EXTENDED PROGRAM

CKC 2024

Canada-Korea Conference on Science & Technology

"Accelerate international collaboration by unlocking the power of science and technology"

June 16-20, 2024

Banff Centre for Arts and Creativity, Banff, Alberta

CKC 2024

CANADA-KOREA CONFERENCE ON SCIENCE & TECHNOLOGY


내일을 바꾸는 기술
산업의 내일을 읽고
기업의 오늘을 이끕니다
KEIT는 알고 있습니다
하나의 기술을 완성하기까지
얼마나 많은 땀을 흘리고 있는 지를 -
KEIT도 뛰겠습니다
하나하나 최선을 다해 키워온 기술을
세상에 마음껏 펼쳐보일 수 있도록 -
모든 기업이 더 많은 기회를 얻고
R&D 영역을 넓힐 수 있도록
KEIT가 든든한 디딤돌이 되겠습니다
Changing Tomorrow
KEIT 한국산업기술기획평가원
Korea Planning & Evaluation Institute of Industrial Technology


KERI
The Electrified World's Hub
As the only government-funded electrotechnology research institute in Korea, KERI has conducted a wide range of activities including R&D, Testing & Certifications related to electricity.
In a new era founded on a cutting-edge electrotechnology, KERI is the core.
Power Grid Smart Grid Research
Industry Applications Research
Electrical Apparatus Research
Electrical Materials Research
Electro-Medical Equipment Research
Power Semiconductor Research
Electric Mobility Research
Testing & Certification Services
KERI KOREA ELECTROTECHNOLOGY RESEARCH INSTITUTE

부산광역시
BUSAN METROPOLITAN CITY

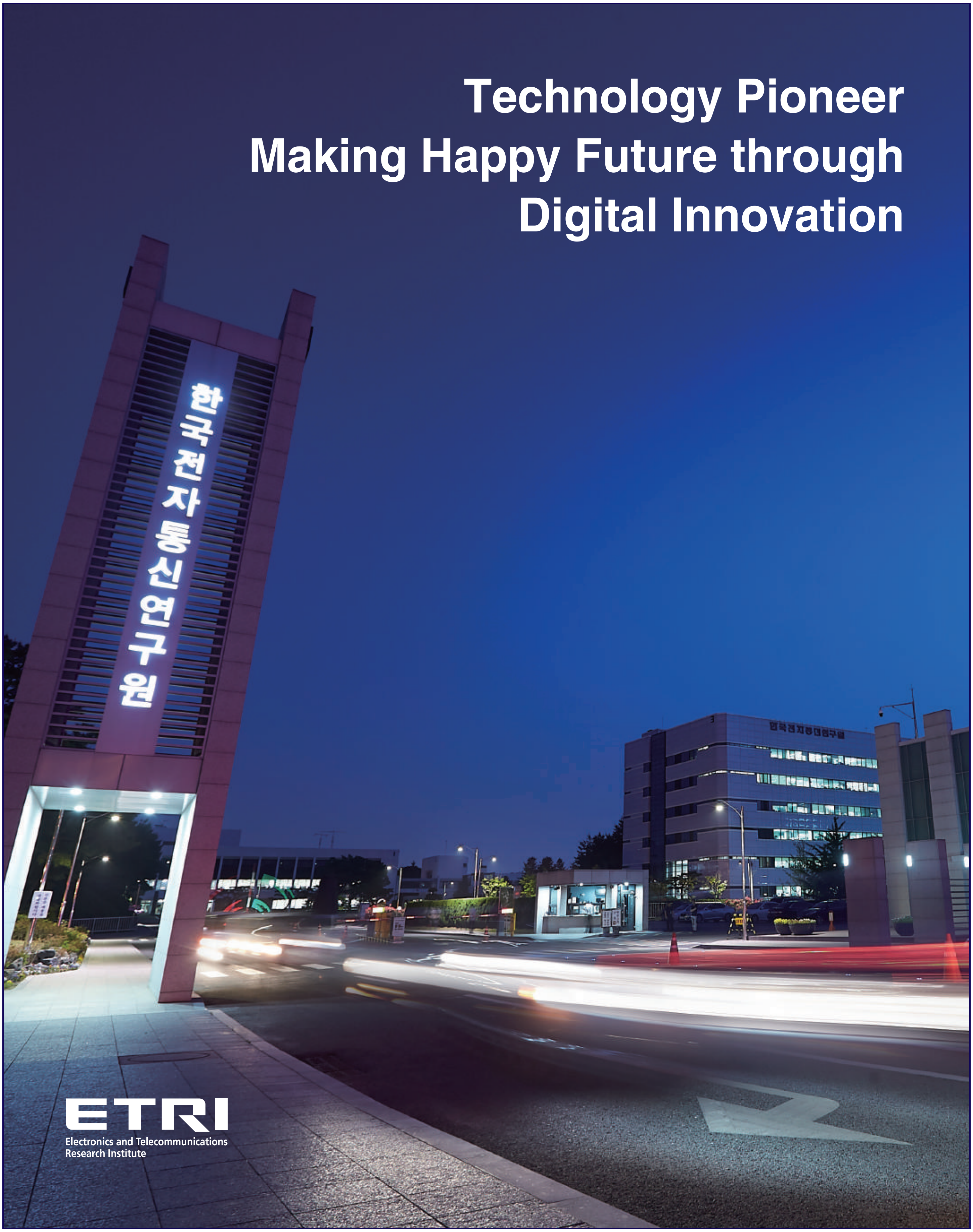
시민행복도시 부산이 글로벌 허브도시로 새롭게 나아갑니다

글로벌 스마트센터 지수
SCI
지옌(Z/Yen, 2023.11.)
세계 15위 아시아 3위

세계 살기 좋은 도시 지수
The Global Liveability Index 2023
이코노미스트 인텔리전스 유닛
(EIU, 2023.6.)
아시아 6위

2023 인기급부상 여행지상
세계 3대 온라인여행사
트립닷컴 주관(2023.10.)
여행 목적지 1,211곳 중
글로벌 TOP 2

2024년 세계 최고의 도시 보고서
World's Best Cities Report
레저넌스 컨설턴시
(Resonance Consultancy, 2023.12.)
글로벌 대도시 270곳 중
67위


Technology Pioneer
Making Happy Future through
Digital Innovation
한국전자통신연구원
ETRI
Electronics and Telecommunications
Research Institute

IITP IS KOREA'S ICT R&D SPECIALIST

ICT R&D

IITP HARNESSES DIGITAL TECHNOLOGY FOR HAPPIER LIVES AND A BETTER SOCIETY

ICT R&D SUPPORT PROGRAMS

ICT is technology
for the people, by the people.

HUMAN RESOURCES DEVELOPMENT PROGRAMS

ICT is completed by people.

INFRASTRUCTURE AND STANDARDIZATION SUPPORT PROGRAMS

We grow as a world-leading
digital powerhouse.

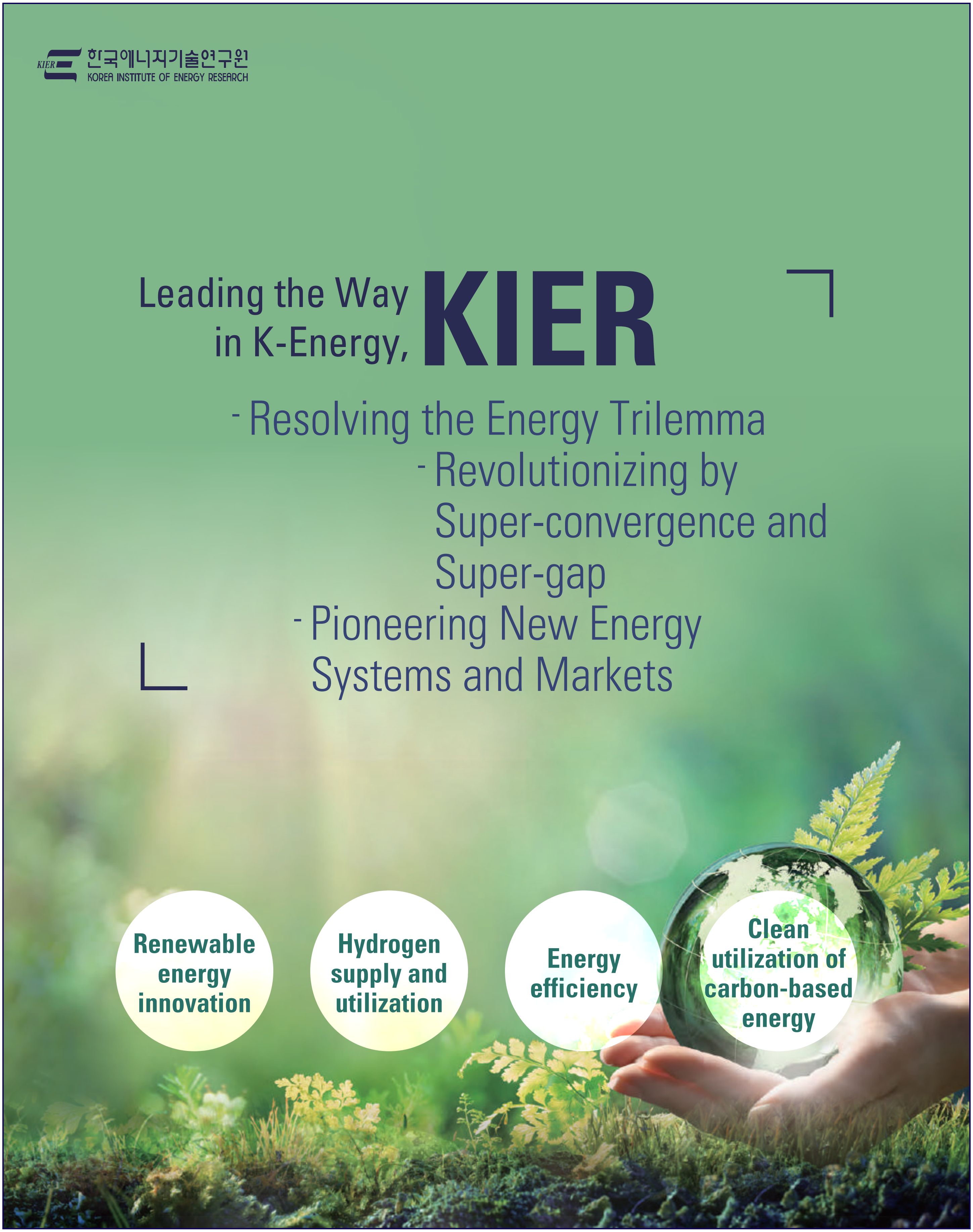
COMMERCIALIZATION SUPPORT PROGRAMS

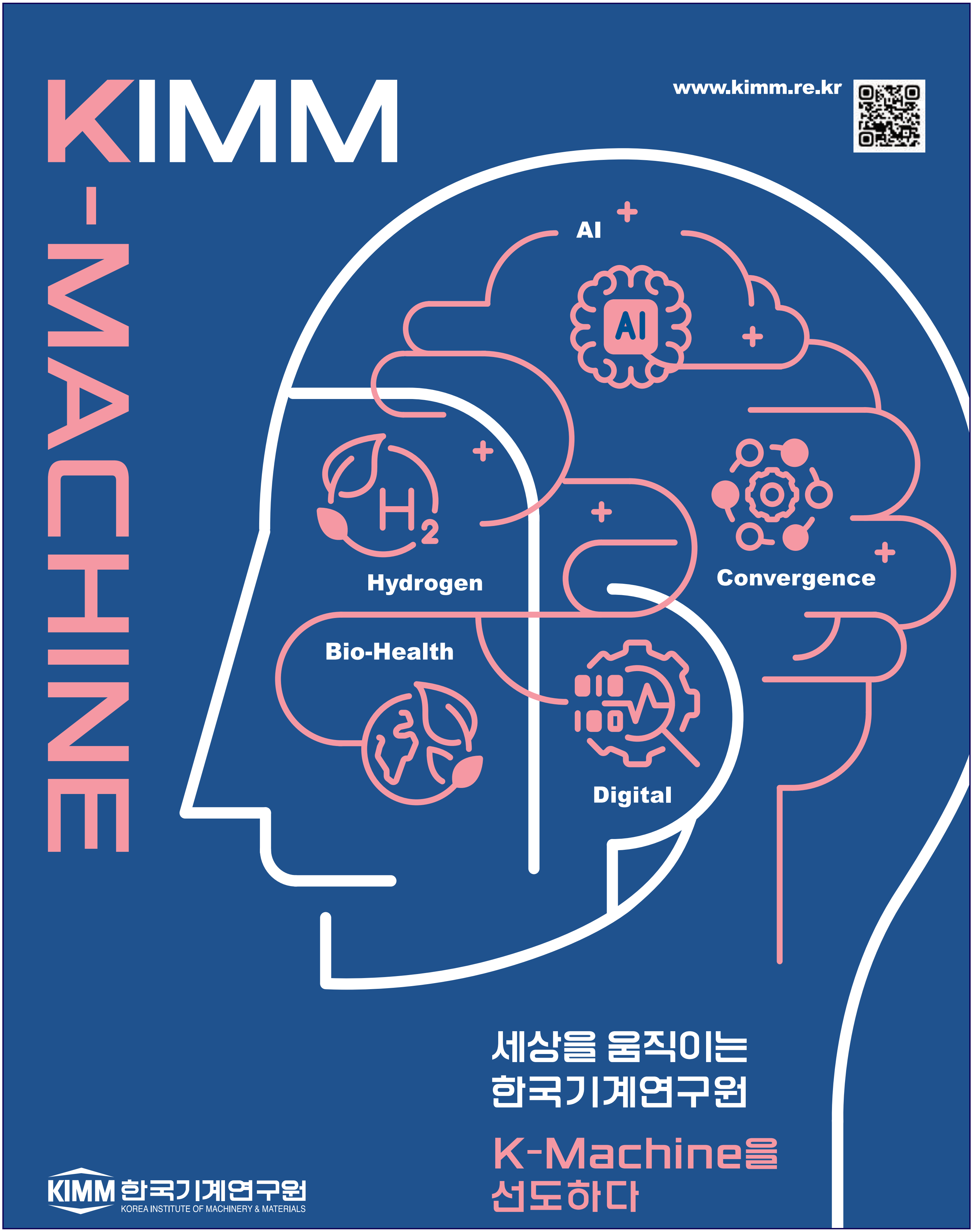
With meaningful experience,
technology becomes sustainable.

(www.iitp.kr)

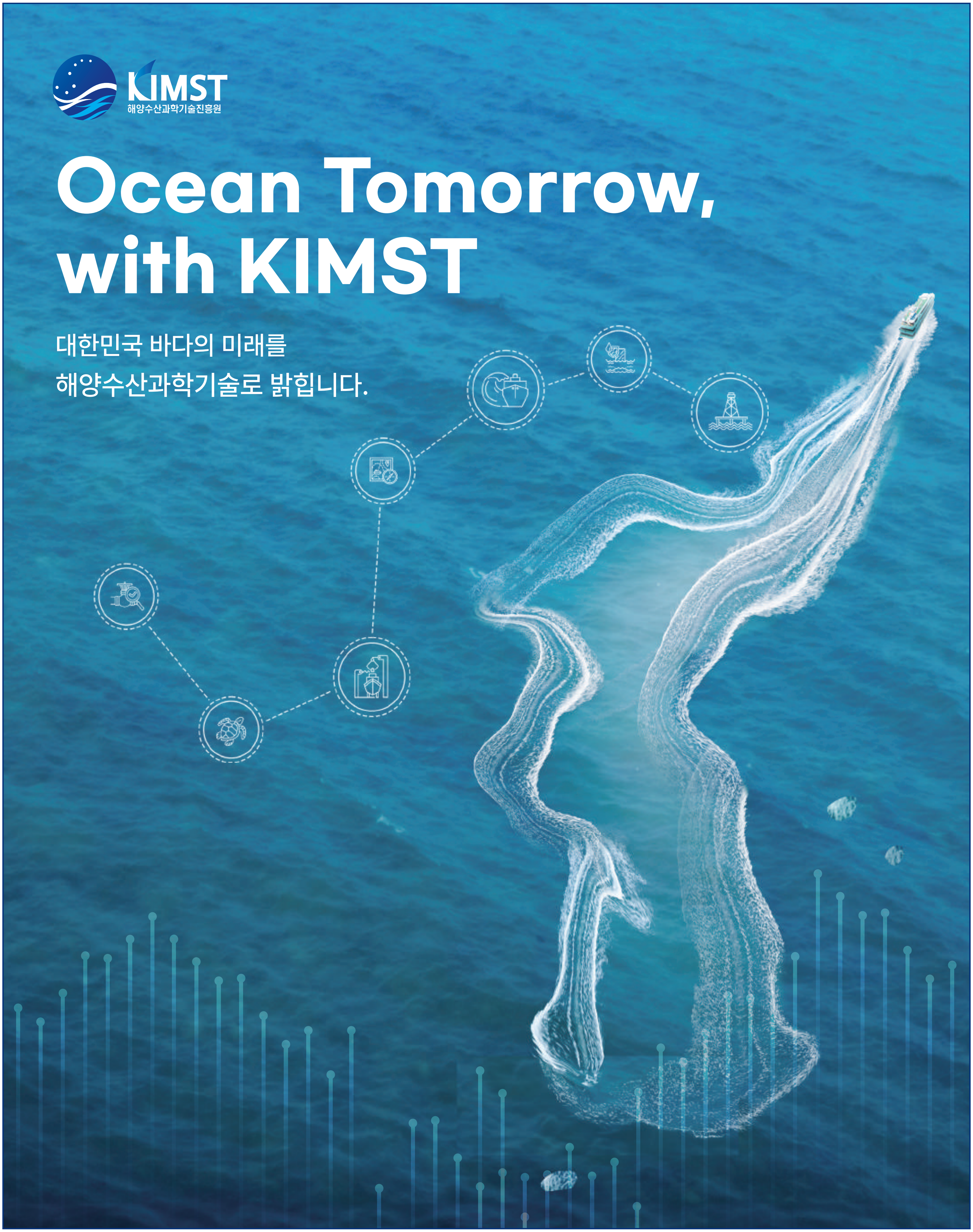
Institute of Information & Communications Technology Planning & Evaluation

IITP


한국에너지기술연구원
KOREA INSTITUTE OF ENERGY RESEARCH
Leading the Way
in K-Energy, KIER
- Resolving the Energy Trilemma
- Revolutionizing by
Super-convergence and
Super-gap
- Pioneering New Energy
Systems and Markets
Renewable energy innovation
Hydrogen supply and utilization
Energy efficiency
Clean utilization of carbon-based energy

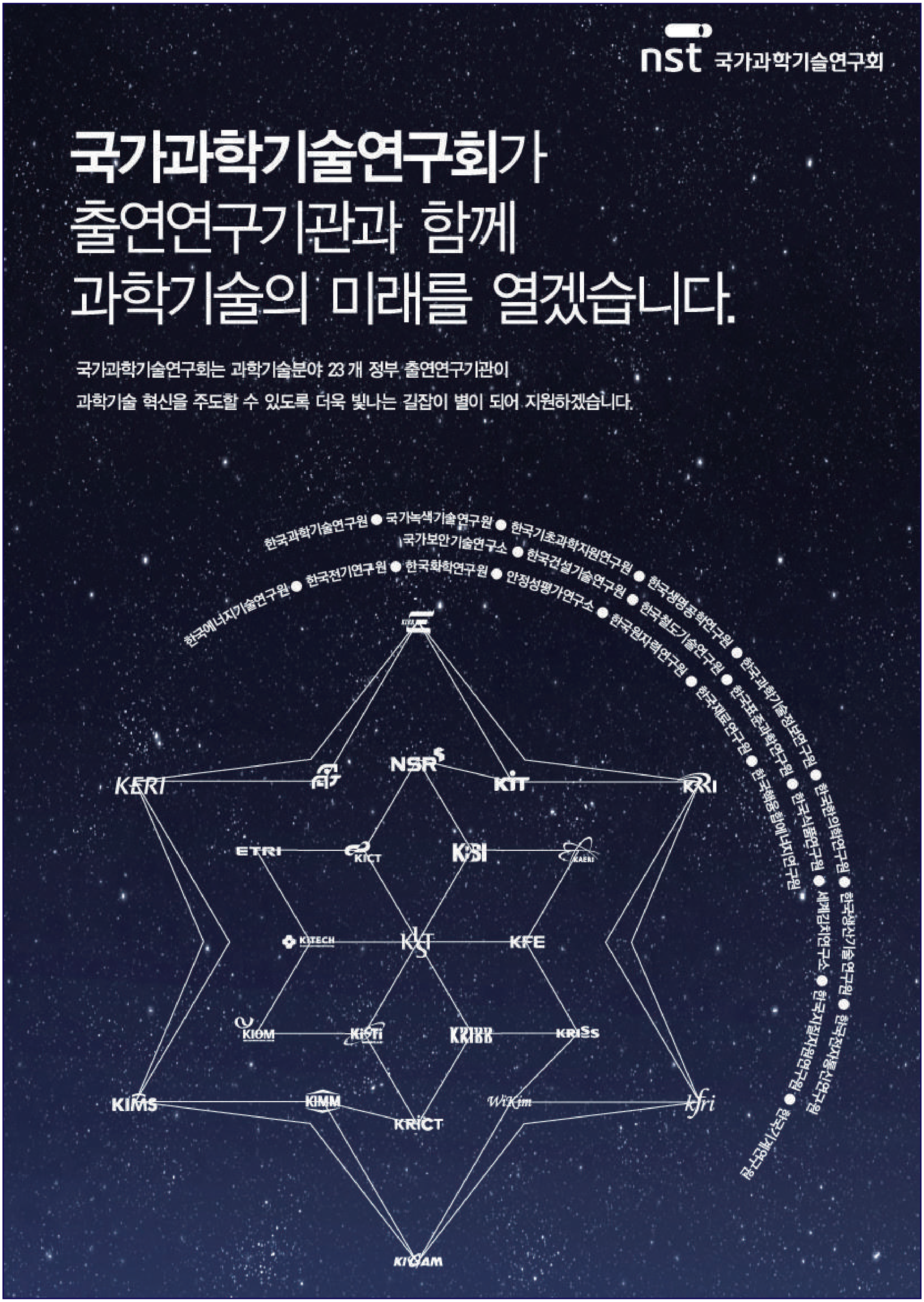

KIMM
K-MACHINE
www.kimm.re.kr
AI
Hydrogen
Convergence
Bio-Health
Digital
세상을 움직이는
한국기계연구원
K-Machine을
선도하다
KIMM 한국기계연구원
KOREA INSTITUTE OF MACHINERY & MATERIALS

KIMS Korea Institute of Materials Science
Global material research institute realizing material powerhouse
Trustworthy technology based on safety as the top priority
World's leading research institution in materials science
KOREA INSTITUTE OF MATERIALS SCIENCE
Increase the value of core technology
KIMSpotlight
EXTREME MATERIALS INSTITUTE
ADVANCED METALS DIVISION
POWDER MATERIALS DIVISION
CERAMIC MATERIALS DIVISION
SURFACE & NANO MATERIALS DIVISION
COMPOSITES RESEARCH DIVISION
MATERIALS DIGITAL PLATFORM DIVISION
MATERIALS TESTING & RELIABILITY DIVISION
RESEARCH PLANNING COORDINATION DIVISION


KIMST
해양수산과학기술진흥원
Ocean Tomorrow,
with KIMST
대한민국 바다의 미래를
해양수산과학기술로 밝힙니다.

KRICT 한국화학연구원 Korea Research Institute of Chemical Technology

www.krict.re.kr / international@krict.re.kr


nst 국가과학기술연구회
국가과학기술연구회가
출연연구기관과 함께
과학기술의 미래를 열겠습니다.
국가과학기술연구회는 과학기술분야 23개 정부 출연연구기관이
과학기술 혁신을 주도할 수 있도록 더욱 빛나는 길잡이 별이 되어 지원하겠습니다.
한국과학기술연구원 ● 국가녹색기술연구원 ● 한국기초과학지원연구원 ● 한국생명공학연구원 ● 한국과학기술정보연구원 ● 한국한의학연구원 ● 한국생산기술연구원 ● 한국전자통신연구원
국가보안기술연구소 ● 한국건설기술연구원 ● 한국철도기술연구원 ● 한국표준과학연구원 ● 한국식품연구원 ● 세계김치연구소 ● 한국지질자원연구원 ● 한국기계연구원
한국에너지기술연구원 ● 한국전기연구원 ● 한국화학연구원 ● 안전성평가연구소 ● 한국원자력연구원 ● 한국재료연구원 ● 한국핵융합에너지연구원
KERI
NSR
KIT
KRRI
ETRI
KICT
KBSI
KAERI
KITECH
KIST
KFE
KIOM
KISTI
KRIBB
KRISS
KIMS
KIMM
KRICT
WiKim
kfri
KIGAM

AKCSE 캐나다한인과학기술자협회
The Association of Korean-Canadian Scientists and Engineers

The Association of Korean-Canadian Scientists and Engineers (AKCSE) was established in 1986 as a non-profit professional organization and has grown to over 3,000 registered members with 11 Local Chapters, 17 School Chapters, 8 Young Professional Societies, Science & Engineering/Industrial Specialty Groups, and 4 Professional Societies across Canada. The association is young with roughly half of its members in their 20s and growing today faster than ever. We have been active in promoting young Koreans to develop their professional career by holding annual competition in math and science from grade 4 to 11, sending young engineers and scientists to Young Generation Forum in Korea, awarding scholarship to undergraduate and graduate students, and supporting regional groups of young professionals.
Our organization fosters friendship among members, encourages and supports more young Koreans and Korean-Canadians to advance in science and technology field of mainstream society, and contributes to development of science, technology and industrial economy in Republic of Korea and Canada.

KOFST Korean Federation of Science & Technology Societies
한국과학기술단체총연합회

The increasing importance of science and technology calls upon the Korean Federation of Science and Technology Societies (KOFST), an organization of scientific and technological societies in various disciplines, to assume increased responsibilities for the advancement of our society. KOFST will double its efforts to foster and support scientific and technological societies, who are the key actors in knowledge creation and diffusion, and also to expand the participation of scientists and engineers in social developments. KOFST seeks "Represent the science and theology community sharing the future of science". To fulfill our mission, KOFST has set the broad goals:

- Foster and support the science and technology societies
- Encourage scientists to engage with society
- Enhance the rights and interests of scientists
- Increase public understanding of scientific discoveries and theories
- Support the national growth by undertaking study, planning, research, and advice on science and technology policy

과학기술정보통신부
Ministry of Science and ICT

Dear CKC 2024 Participants, Colleagues and the AKCSE Members:

On behalf of the Organizing Committee members, I am delighted to welcome all the delegates and participants to Banff, the essence of Canadian Rockies, for the 14th Canada-Korea Conference on Science and Technology (CKC2024) organized by the Association of Korean-Canadian Scientists and Engineers (AKCSE) and the Korean Federation of Science and Technology Societies (KOFST). With 4th Canada-Korea Joint Committee Meeting together with CKC2024, I expect a large number of special guests, delegates, and participants from Canada and South Korea and beyond, representing a wide variety of fields in science, engineering, and technology.

The CKC is a multidisciplinary annual conference that aims to bring together experts and leaders from research institutes, industry, academia, and the governments of Canada and Korea to discuss emerging issues and future challenges in science, technology, and innovation (ST&I). We want to address these issues and challenges by working together. Since the first conference in 2011, CKCs have served as a major platform for innovation, cutting-edge technologies, scientific research, and multidisciplinary collaborations and professional networking between Canada and Korea.

This year's conference theme, "Accelerate international collaboration by unlocking the power of science and technology," highlights a goal shared by both Canada and Korea, and demonstrates new steps taken toward bilateral R&D collaboration between the two countries. This year, we have several special flagship programs, including the Sustainable International R&D Collaboration Summit, Clean Energy and Technologies Forum, and Artificial Intelligence/Quantum Technologies Forum. In addition, we have prepared a rich and diverse conference program with Plenary Sessions, STI Forum, Research Showcase, Korean Government Research Institutes (KGRI) R&D programs, Korean Funding Agency Program, Young Generation & Young Professional Sessions, Women in Science and Engineering (WiSE) Program, KGRI Recruitment Session, and four technical sessions.

In July 2023, we successfully hosted the 13th CKC in Ottawa, Ontario in-person with nearly 310 participants. Without a doubt, the success of this conference ultimately depends on the participation of scientists and engineers, young minds, passionate organizers, and the partner research institutions and industry collaborators. As conference chair of the CKC2024, I would like to thank all participating organizations for their generous support for the conference, and all members of the organizing committee, the local committee, and volunteers for their tireless dedication and efforts.

This year's CKC is celebrating successful collaborations between Canada and Korea and discussing our future direction. I am grateful to have all of you joining us at this conference, and I wish you all a pleasant and fruitful time at CKC2024 by meeting friends and colleagues, as well as forging new collaborations.

Seonghwan (Sam) Kim
President of AKCSE
Conference Co-Chair, CKC2024
Professor, University of Calgary

Welcome, esteemed scientists, engineers and distinguished guests!
It is my great pleasure to greet you all at the '2024 Canada-Korea Conference on Science and Technology'(CKC 2024).
Most of all, I am grateful to Vice Minister Chang Yune Lee of the Ministry of Science and ICT for joining us on the occasion of the Science and Technology Joint Committee Meeting. My deepest appreciation also goes to President Seonghwan Kim of the Association of Korean-Canadian Scientists and Engineers (AKCSE) and all its dedicated members for orchestrating this wonderful event.

It is a privilege to discuss scientific and technological cooperation and development between Korea and Canada with you here in Banff, Canada, a place that captivates us with its natural splendor. The CKC has previously convened here in 2015 and 2019, and it is indeed heartening to witness how this conference has evolved into a steadfast bridge that connects scientists and engineers from both our nations.

At a time when the world confronts a variety of global challenges, including abnormal weather conditions and the depletion of resources, the advancement of science and technology stands as our most formidable tool. Addressing these complex global issues also requires strong international cooperation and unity.
Reflecting on this, the theme of this year's conference is "Accelerate International Collaboration by Unlocking the Power of Science and Technology." Since celebrating the 60th anniversary of our diplomatic relations last year, Korea and Canada have deepened cooperation across various scientific and technological fields, including artificial intelligence, minerals, and hydrogen. It is my hope that this CKC will further enhance exchanges between our two countries and foster broader global cooperation in science and technology.

Recently, with the dawn of the space economy era, the Korean government launched the Korea AeroSpace Administration in May. Modeled after NASA in the United States, this new administration is set to comprehensively implement Korea's space initiatives. With Canada's rich legacy in aerospace and satellite technology, I anticipate substantial cooperation between our nations. In this regard, KOFST has organized a special space session to explore areas of cooperation and development in the aerospace field with experts from both countries.

Moreover, Korea is honored to host the Space Studies Program (SSP25) of the International Space University in June 2025, becoming the third Asian nation to undertake this role. I am delighted that Korea is committed to pioneering in space science research. Your active participation will be highly appreciated.

During the five-day conference, I encourage each of you to engage deeply in robust discussions across various areas, further strengthening the bonds between Korean and Canadian scientists and engineers.
In closing, let me express my gratitude once again to the members of the AKCSE for organizing this event, and to all of you for gracing us with your presence. Please remember that your home country, Korea and KOFST are always with you, and I sincerely ask Korean-Canadian scientists and engineers to serve as ambassadors of public diplomacy.

I wish all of you good health and happiness.

Tai Sik Lee
President of the Korean Federation of Science and Technology

I would like to congratulate the Association of Korean Canadian Scientists and Engineers (AKCSE) for organizing the 14th Canada Korea Conference (CKC) in Banff, Alberta. The location of this year's conference, deep in the heart of the Canadian Rockies, is among the most popular destinations for Korean travelers as it truly embodies the natural beauty of Canada.

Following the successful conclusion of the 13th CKC in Ottawa last year, AKCSE is today better positioned than ever to advance future collaboration between Korea and Canada in the fields of newly emerging and traditional technologies, such as AI, electrical vehicles, nuclear energy, telecommunications and quantum computing, among others.

Last year, I was delighted to see the high turnout of so many leading scientists, engineers and researchers from our two countries at the c onference. The high caliber of the participants was indeed one of many testaments to the achievements made in the field of science and technology over the 60 years of Korea Canada diplomatic relations.

Now, as Korea and Canada embark on greater scientific cooperation for the next 60 years and beyond, the knowledge shared and the relationships formed at this year's conference will provide a strong foundation for greater cooperation in science, technology and innovation (ST& I).

In fact, meeting the challenges of the future requires that developments in ST&I be guided by our shared values, mutual interests, and joint capabilities. For this reason, during their reciprocal summit visits, President Yoon Suk Yeol and Prime Minister Justin Trudeau designated greater scientific cooperation as a priority for deepening our relationship. AKCSE has previously played and continues to play a significant role in this regard and I wish to express m y appreciation for their invaluable contributions.

This year's conference comes at a very timely moment. Last month, Prime Minister Trudeau and other global leaders joined President Yoon at the AI Seoul Summit to discuss AI governance centered on the prio rities of safety, innovation and inclusivity. This week, the 4 th Canada Korea Joint Committee Meeting on ST& I is also taking place in Banff to further facilitate discussions between our leading scientists, engineers and researchers. I am confident that the on going discussions at both multilateral and bilateral levels will generate synergy as we seek to further "accelerate collaboration by unlocking the power of science and technology."

I am also pleased to share that this year marks a new leap forward for Korea in the field of research and development as the Korean government nearly triple s its R&D innovation bu dget from CAD 500 million to CAD 1.2 billion. This commitment to innovation and technological development will further bolster our joint efforts towards greater global R&D investments and cooperation.

As we pursue even stronger relations between Korea and Canada over the next 60 years science, technology and innovation will be the driving force of our partnership . I wish all participants a successful 14th Canada Korea Conference.

H.E. Woongsoon Lim
Ambassador of the Republic of Korea to Canada

PRIME MINISTER · PREMIER MINISTRE

June 16–20, 2024

Dear Friends:

I am pleased to extend my warmest greetings to everyone attending the 2024 Canada-Korea Conference on Science and Technology, being held in Banff, Alberta.

This event brings together students, academics, researchers, entrepreneurs, industry professionals and government policy makers from Canada and Korea to network, exchange ideas and share information on the latest advances in science, technology and innovation. I am certain that participants will come away inspired to take on new challenges and opportunities.

I would like to thank the Association of Korean-Canadian Scientists and Engineers and the Korean Federation of Science and Technology Societies for putting together an informative and rewarding program for delegates and for their commitment to advancing knowledge and collaboration in the fields of science and technology.

Please accept my best wishes for a productive and enlightening conference.

Sincerely,

The Rt. Hon. Justin P. J. Trudeau, P.C., M.P.
Prime Minister of Canada

SENATE
The Honourable Yonah Martin

SÉNAT
L'honorable Yonah Martin

CANADA

April 2024

A MESSAGE FROM THE HONOURABLE YONAH MARTIN

On behalf of the Senate of Canada, I am honoured to extend my sincere greetings to all those participating in the 2024 Canada Korea Conference on Science and Technology.

For 38 years, the Association of Korean-Canadian Scientists and Engineers (AKCSE) has been providing invaluable support and opportunities for Korean-Canadian scientists and engineers. AKCSE has estsblished itself as an outstanding network, and has engaged many experienced and aspiring scientists, engineers and thought leaders from both Canada and Korea.

To all of the participants at this year's conference, may your sessions be thought-provoking, enlightening and meaningful. Special thanks to the presenters for taking the time to share your insights and knowledge, and contributing to the success of this year's conference.

I would like to commend the leadership of AKCSE and all its hardworking members. I would also like to acknowledge the Korean Federation of Science and Technology Societies (KOFST) for their dedication and contributions to the conference.

Best wishes for another productive conference and continued success in the years ahead!

Sincerely,

The Honourable Yonah Martin
Deputy Leader of the Opposition in the Senate

Senate of Canada Building, Parliament Hill, Ottawa, Ontario K1A 0A4 | martin@sen.parl.gc.ca

MESSAGE FROM THE PREMIER OF ALBERTA

On behalf of the Government of Alberta, it is my pleasure to welcome everyone to Alberta for the 2024 Canada-Korea Conference on Science and Technology.

Science and technology continue to provide us with exciting new possibilities as we work to address the challenges our world faces. From safe, reliable, sustainable and affordable energy to artificial intelligence and machine learning, I am proud that our province is a hub for innovation and research. It is a privilege for us to once again host scientists and engineers, industry experts, and Korean and Canadian government representatives as you gather to network and foster collaboration between our two countries. I hope this conference is a productive and rewarding opportunity to build relationships, explore new ideas and exchange knowledge.

Thank you to the Association of Korean-Canadian Scientists and Engineers for your commitment to scientific co-operation, and for your hard work to make this annual event a success for nearly 40 years.

Enjoy your stay in Alberta, and best wishes for a great conference!

Honourable Danielle Smith, Premier of Alberta

110 Bear Street
Box 1260 Banff, Alberta Canada T1L 1A1
T 403.762.1207 F 403.762.1260

OFFICE OF THE MAYOR

Welcome from the Town of Banff!

On behalf of Banff Town Council and our community, I want to welcome everyone participating in the 2024 Canada-Korea Conference on Science and Technology to the Town of Banff, inside beautiful Banff National Park. This is an incredibly important conference and we're thrilled you've chosen Banff for this year's event.

For Indigenous Peoples, Banff has been a home, a place to hunt and forage, and a place to meet and trade for millennia. Today, Banff is a small municipality of approximately 9,000 residents, but we welcome 4 million visitors from around the world each year to explore its natural wonders and pristine landscapes. Banff is Canada's first national park and a UNESCO World Heritage Site. Our mountain vistas have been sources of inspiration and intrigue for scientists, artists and adventurers for generations.

I hope the backdrop helps with this year's conference theme: Accelerate international collaboration by unlocking the power of science and technology.

Scientific and technological advancements are of great value to our community, especially in support of environmental leadership, as we are always looking for new and better ways to be stewards of this ecosystem and our global environment. We need advancements and collaboration to continue to protect this special place so it remains as you see it for the next generations.

It is my distinct pleasure to welcome The Association of Korean-Canadian Scientist and Engineers to our community, and I hope you're able to take time out of your busy schedules to explore our town and find inspiration from the mountains.
Best wishes on a successful conference,

Yours truly,

C. DiManno

Corrie DiManno
Mayor

TOWN OF Banff

www.banff.ca

Dear President Seonghwan Kim, President Taisik Lee and all the members of The Association of Korean-Canadian Scientists and Engineers (AKCSE).

On behalf of Association des Scientifiques Coréens en France (ASCoF), I'd like to give my sincere congratulations for the opening of the CKC 2024. I wish to extend my deep appreciation to President Seonghwan Kim and all the staff of AKCSE for their valuable commitment to this conference.

For many years, AKCSE and ASCoF have maintained friendly cooperation through personal exchanges. I would like to thank the AKCSE President and Vice President for graciously accepting my invitation to visit France for ASCoF 48th Annual Conference in Bordeaux. President Kim gave congratulatory remarks and suggested future research collaboration with France for the Horizon Europe program, as Canada has recently joined as an associate member.

Korea has also become an associate member of Horizon Europe, which will provide more opportunities to form joint research and development consortiums. In this regard, it is necessary to exchange cooperative programs between Canada and France.

I hope all the CKC2024 programs will be successful, and I wish you all a healthy and enjoyable summer.

Sincerely,

Jong-Wook Lee
President of ASCoF

Chers président Seonghwan Kim, président Taisik Lee et membres de l'Association de Korean-Canadian Scientists et Engineers (AKCSE).

Au nom de l'Association des Scientifiques Coréens en France (ASCoF), je tiens à vous adresser mes sincères félicitations pour l'ouverture de la CKC 2024. Je tiens à exprimer ma profonde gratitude au président Seonghwan Kim et à l'ensemble du personnel de l'AKCSE pour leur engagement sans faille à l'égard de cette conférence.

Depuis de nombreuses années, l'AKCSE et l'ASCoF entretiennent une coopération amicale par le biais d'échanges personnels. Je tiens à remercier le président et le vice-président de l'AKCSE d'avoir gracieusement accepté notre invitation à venir en France pour la 48e conférence annuelle de l'ASCoF à Bordeaux. Le président Kim a prononcé un discours de félicitations et a suggéré une future collaboration de recherche avec la France dans le cadre du programme Horizon Europe, le Canada ayant récemment adhéré à ce programme en tant que membre associé.

La Corée est également devenue un membre associé d'Horizon Europe, ce qui offrira davantage de possibilités vers des consortiums communs de recherche et de développement. À cet égard, il est nécessaire d'échanger des programmes de coopération entre le Canada et la France.

J'espère que tous les programmes CKC2024 seront couronnés de succès et je vous souhaite à tous un bel et agréable été.

Cordialement,

Jong-Wook Lee
President of ASCoF

프랑스 한인 과학기술 협회 ASCoF
Association des Scientifiques Coréens en France (1976)

Dear President Seonghwan Kim and esteemed members of the Association of Korean-Canadian Scientists and Engineers (AKCSE),
Warm greetings from the Association of Korean Scientists and Engineers in Austria (KOSEAA)!

We would like to extend our sincere congratulations to Dr. Seonghwan Kim, AKCSE President, and all AKCSE officers and members for hosting the 2024 Canada - Korea Conference on Science and Technology (CKC2024) in the beautiful city Banff.

The conference theme, "Accelerate international collaboration unlocking the power of science and technology" emphasize the importance of international cooperation in advancing research and development in Science and Technology. As evidenced by the numerous achievements international collaboration in Science and Technology has played an important role in the realm of science and technology. Personally, I have been trying to promote R&D cooperation between Korea, Canada, and European countries. Furthermore, as Korea and Canada are members of the EUREKA network, a strong framework exists to support and promote international cooperation between these countries.

The CKC 2024 conference provides an excellent platform for Korean scientists and engineers from Canada and Europe to come together, share their expertise, build partnership among researchers and industry professionals and explore opportunities for collaboration. They can indeed build a robust R&D consortium that fosters innovation and accelerates progress in science and technology.

Based on my experience attending past CKC events, I am confident that CKC 2024 will be another great success and leave a lasting impression on all participants. I wish all attendees a productive and inspiring CKC2024.

Man-Wook Han

Dr. Man Wook Han
President of the Korean Association of Scientists and Engineers in Austria (KOSEAA)

Dear Esteemed Colleagues and Distinguished Guests:

On behalf of KSEA members, I, as the President of Korean-American Scientists and Engineers Association, extend our warmest congratulations to all delegates and participants of the 2024 Canada-Korea Conference on Science and Technology (CKC2024), jointly organized by the Association of Korean-Canadian Scientists and Engineers (AKCSE) and the Korean Federation of Science and Technology Societies (KOFST).

The CKC has long been heralded as a beacon of collaboration and innovation, uniting experts and leaders from diverse backgrounds to address emerging challenges in science, technology, and innovation. Since its inception in 2011, CKCs have played a pivotal role in fostering multidisciplinary collaborations and professional networking between Canada, Korea, and beyond, propelling cutting-edge research and advancements.

This year's conference theme, "Accelerating international collaboration by unlocking the power of science and technology," underscores the significance of cultivating global R&D partnerships. With flagship summits and forums such as the "Sustainable International R&D Collaboration Summit," "Clean Energy and Technologies Forum," and "Artificial Intelligence and Quantum Technologies Forum," CKC2024 pledges to facilitate transformative dialogues and lay the groundwork for groundbreaking advancements.

On behalf of KSEA members, I commend the tireless efforts of the organizing committee, the local committee, and volunteers in bringing CKC2024 to fruition. Your unwavering dedication and commitment to excellence are truly commendable and underscore the success of this esteemed conference, reflecting the shared narrative among scientists and engineers with Korean heritage worldwide.

I extend heartfelt gratitude to all participating organizations for their generous support and collaboration for the success of CKC2024. Together, CKC2024 will exemplify the spirit of global partnership and innovation.

Yours sincerely,

Yongho Sohn, Ph.D., FASM
52nd President of Korean-American Scientists and Engineers Association

IN ALPHABETICAL ORDER FOR THE SAME RANK IN THE INSTITUTE

Dr. Bok Chul Kim

Chairperson / National Research Council of Science and Technology (NST)

Dr. Bok Chul Kim is currently serving as Chairperson of National Research Council of Science and Technology (NST), a position he has held since July 2021. He holds a doctorate in geology from Yonsei University, and had spent his career as geologist at Korea Institute of Geoscience & Mineral Resources (KIGAM) over three decades, actively participating in numerous outstanding R&D projects. Dr. Kim has extensive administrative experience, serving as Director of Planning and Coordination Division at KIGAM and as Director General of Office of Policy at NST. From 2018 to 2021, he also served as President of KIGAM, until joining NST. He is a member of the Korea Society of Economic and Environmental Geology and Korea Society of Petroleum and Sedimentary Geology.

Dr. Byung-Suk Kim

President / Korea Institute of Civil Engineering and Building Technology (KICT)

Dr. Byung-Suk Kim is currently the President of the Korea Institute of Civil Engineering and Building Technology (KICT). He received a Ph.D. degree in Civil Engineering from Seoul National University in 1992. His primary research field is structural engineering. Through the development of the world's best 200-year lifespan super concrete technology, numerous world records have been achieved. These include the construction of the world's first ultra-high-performance concrete road cable-stayed bridge, the world's first reinforcing steel-free concrete structure, and the world's largest span length concrete bridge. In recognition of his contributions, he was awarded the 'National Merit for Innovation' in 2023. He currently serves as the president of the Korean Peninsula Infrastructure Forum and has previously chaired the Alliance of Environmental Research Institutes and Organizations. He is also an active member of the National Academy Engineering of Korea. Additionally, he has served as a committee member in Working Group of the National Standard Commission and has contributed as a writing staff to the publication of national construction standards and guidelines, the establishment of international standards, and the enactment of international design standards and guidelines.

Dr. Chul-Jin Choi

President / Korea Institute of Materials Science (KIMS)

Dr. Choi is currently the President of the Korea Institute of Materials Science (KIMS). He graduated from Seoul National University in 1984 majoring in Metallurgical Engineering and earned his M.S. and Ph.D. in Materials Science and Engineering at the Korea Advanced Institute of Science and Technology (KAIST) in 1986 and 1997 respectively. He has been serving as Chairman of the Machinery and Materials Specialized Subcommittee of the National Science and Technology Advisory Committee since 2023 and served as a director of the Korean Federation of Science and Technology Societies (KOFST) for three years from 2020 to 2023. He has worked as Vice President for the Korean Institute of Metals and Materials and until recently, he worked with Hanyang University as a conjunctive professor. He joined KIMS in 1986 and led the Powder and Ceramic Materials Division as director from 2012 to 2015. He has received numerous honors and awards in his career, including the Order of Science and Technology Merit (2024), Grand Prize in the materials field of the 2020 National Research and Development Top 100 (2020), Korean Prime Minister Award (2016), Minister of Science, ICT and Future Planning Award (2014), and the Award of Chairman of Research Council of Industrial Research Institute (2010).

IN ALPHABETICAL ORDER FOR THE SAME RANK IN THE INSTITUTE

Dr. Hyewhon Rhim
President / Association of Korean Woman Scientists and Engineers (KWSE)
Director-General of Future Convergence Strategy Center, Korea Institute of Science and Technology

Dr. Hyewhon Rhim earned her M.S. in Chemistry from Seoul National University and her Ph.D. in Neurophysiology from the University of Chicago. She began her professional career as a research associate at the University of Chicago in 1995 before transitioning to a researcher at the Korea Institute of Science and Technology (KIST) in 1997. Leveraging her expertise in brain research, Dr. Rhim assumed the role of Director at the Center for Neuroscience, Brain Science Institute of KIST in 2016. The following year, she was appointed the Director-General of the International Cooperation Division. Since then, she has held key leadership positions at KIST. Her significant contributions to convergence research and her advocacy for women in science have notably influenced policies within the field. Dr. Rhim served as the Director of the National Research Foundation (NRF), Korea from 2014 to 2016, and was elected President of the Korea Society of Brain and Neural Science in 2018. Currently, she is the President of the Association of Korean Women Scientists and Engineers (KWSE). Her contributions have been recognized with several prestigious awards, including the Presidential Citation in 2007 and the Science and Technology Merit Medal in 2016, highlighting her significant impact on science and society. E-mail: hrhim@kist.re.kr

Dr. Oh Nam Kwon
President / Korean Federation of Women's Science and Technology Associations (KOFWST)

Dr. Oh Nam Kwon is the President of the Korean Federation of Women's Science and Technology Associations and a Professor of Mathematics Education at Seoul National University. She joined Seoul National University in 2003 after teaching at Ewha Womans University for ten years. She has led over 30 grants as the Principal Investigator and has authored approximately 150 articles in the fields of mathematics education and mathematics. She serves on the editorial boards of top-tier journals such as Education Studies in Mathematics, Journal for Research in Mathematics Education, and Advances in Mathematics Education published by Springer. Additionally, she has been a member of the National Committee of the Korean Institute of Curriculum and Evaluation and the OECD/PISA Mathematics Expert Group. She received the Best Teaching Award from Seoul National University in 2009 and has served as a jury member for the Mathematics of Planet Earth 2013 UNESCO Virtual Modules Competition and as a committee member for the Leelavati Prize 2014. In 2021, she received the Svend Pedersen Lecture Award from Stockholm University, becoming the first Asian recipient of this honor. She has served as the President of the Korean Society of Mathematics Education and is the Chair of the 2025 East-Asian Regional Conference on Mathematics Education. Email: onkwon@snu.ac.kr

Dr. Seung Chan Bang
President / Electronics and Telecommunications Research Institute (ETRI)

Dr. Bang, Seung Chan is a current president of the Electronics and Telecommunications Research Institute (ETRI), Korea. He obtained Ph.D., Master, and B.S. degrees from Seoul National University all in electronic engineering. He started his career as a senior researcher at Digicom in 1987 and joined ETRI in 1994, where he has been at the forefront of the telecommunications field serving in numerous R&D managing positions including, Wireless Transmission, Future Technology, Communication Media, etc. over the last 30 years. Dr. Bang has been actively participated various professional academic society activities and public consultations as well. He is a general member of National Academy Engineering of Korea(NAEK) since 2021 and served as a Vice Chairman of the Korea Institute of Communications and Information Science(KICS) from 2019 to 2021. Dr. Bang also share his expertise as a member of the Private Committee for Enhancing Competitiveness in Materials, Parts, and Equipment. Additionally, since 2024, Dr. Bang has been serving as the 19th chairman of the Daedeok Innopolis Association.

IN ALPHABETICAL ORDER FOR THE SAME RANK IN THE INSTITUTE

Dr. Tae Yeol Kim
President & CEO / Busan IT Industry Promotion Agency (BIPA)

Dr. Tae Yeol Kim is the 10th President of the Busan IT Industry Promotion Agency (BIPA). BIPA is an affiliated organization of the Busan Metropolitan city that promotes the IT and CT industries. It operates various policy businesses in fields such as cloud computing, quantum technology, artificial intelligence (AI). He majored in public administration at Kwangwoon University, earning a master's degree in economics in 1999 and a Ph.D. in economics at Hanyang University in 2008. He previously held positions at the National IT Industry Promotion Agency (NIPA) as the head of the SW industry department (2015), the global growth department (2019), and the head of the information and communication industry department (2022). E-mail: tykim@busanit.or.kr

Dr. Young Kuk Lee
President / Korea Research Institute of Chemical Technology (KRICT)

Dr. Young Kuk Lee currently serves as the President of Korea Research Institute of Chemical Technology(KRICT) in Daejeon, Korea. He earned his BS, MS and Ph.D. of Materials Science & Engineering from Seoul National University in 1985, 1987, and 1997, respectively. Dr. Lee joined KRICT in 1989 and has since worked as a principal researcher in the Advanced Material Division, until his appointment as President in March 2023. Between 2020 and 2022, he was seconded to the National Research Foundation of Korea (NRF) as the Project Manager for Materials & Device at the National Strategic R&D Program Directorate. Additionally, he has been an Advisory Member of the Presidential Advisory Council on Science & Technology since 2023 and has held the position of Industrial Vice President of the Korean Ceramic Society since 2020. In recognition of his contributions, he was awarded the Science and Technology Medal by the Minister of Science and ICT (MSIT) in 2020.

Dr. Bong-Ki Kim
Vice President / Korea Institute of Machinery & Materials (KIMM)

Dr. Kim is the Vice President of Korea Institute of Machinery and Materials (KIMM). He received his Ph.D. in Mechanical Engineering from the Korea Advanced Institute of Science and Technology (KAIST) in 1997. He has worked as a senior/principal researcher at KIMM since 2000, and has led the Department of System Dynamics until 2020. Before he became the Vice President, he served as the Director of the Mechanical Systems Safety Research Division, overseeing the researches on the large and complex mechanical systems using safety and reliability technologies at KIMM. Prior to joining KIMM, he has worked as a section chief at the Samsung Motors, Inc., as well as a project engineer at the Arvin-Meritor Industries Inc., USA. As a respected voice in the field of mechanical engineering, he has been recognized throughout his career for his contributions. In 2021, he received a Presidential Commendation for his contributions to Science and Technology Promotion within Korea, and in 2013, a Ministerial Commendation from the Ministry of Trade, Industry and Energy. E-mail: bkkim@kimm.re.kr

IN ALPHABETICAL ORDER FOR THE SAME RANK IN THE INSTITUTE

Dr. Joonyeon Chang
Vice-President / Korea Institute of Science and Technology (KIST)

Dr. Chang is currently Vice-President at KIST. He received a Ph.D. in the Department of Materials Science & Engineering from Yonsei University, Seoul, in 1998, preceded by an M.S. in Metallurgical Engineering in 1989 and a B.S. in the same field in 1987, both from Yonsei University as well. Since joining KIST in 1990, he has served as Director-General of the KIST Gangneung Institute of Natural Products (2020-2024), Director-General of the Post-Silicon Semiconductor Institute (PSI) (2015-2020), Head of the Spin Convergence Research Center (2011-2014), and Head of the KIST-MIT on-site lab, MIT, USA (2008-2011). He also performed post-doctoral research at UCLA from 2000 to 2002. His research interests lie primarily in the areas of spintronics, Nanoelectronic Devices, Nanomaterials. E-mail: presto@kist.re.kr

Dr. Seogjoo Kim
Vice President (Research) / Korea Electrotechnology Research Institute (KERI)

Dr. Seogjoo Kim received his B.S., (Electrical Engineering in 1984), M.A (Electrical Engineering in 1986), and Ph.D. (Electrical & Electronic Engineering in 2007) degrees from Yonsei University, Seoul, Korea respectively. Since 1987, he has been with Korea Electrotechnology Research Institute(KERI), Changwon, Korea, where he is currently Vice President (Research) of KERI since 2023 January. From 2014 to 2017, he was Executive Director of Advanced Power Grid Research Division. In 2018, he was Executive Director of Electric Propulsion Research Division. From 2019 to 2021, he was Executive Director of Industry Applications Research Division. From 2021 to 2023, he also played the role as Executive Director of Electro-Medical Equipment Research Division. Dr. Kim also serves as Vice President of the Korean Institute of Electrical Engineers (KIEE).

Dr. Seong Ok Han
Vice President / Korea Institute of Energy Research (KIER)

Dr. Seong Ok Han, Vice President at the Korea Institute of Energy Research (KIER), received her Bachelor's, Master's, and Doctoral degrees in Chemistry from Ewha Womans University. A leading figure in energy material field, Dr. Han has dedicated nearly four decades to advancing energy technology. Her career includes significant leadership roles, such as President of the Korea Women Scientists and Engineers from 2014 to 2015 and serving as a non-executive director of the Institute for Basic Science(IBS) from 2021. Her commitment extends to her involvement in vital governmental committees, such as the Researcher Rights Protection Committee, etc at the Ministry of Science and ICT, and her regular membership in the National Academy of Engineering of Korea(NAEK) reflects her significant contributions to science, technology and policy.

IN ALPHABETICAL ORDER FOR THE SAME RANK IN THE INSTITUTE

Dr. Seung Youb Han
Vice President / Industrial Innovation, Korea Planning & Evaluation Industrial Technology (KEIT)

Dr. Seung Youb Han is currently the Vice President of Industrial Innovation of the Korea Planning & Evaluation Industrial Technology (KEIT). He obtained Ph.D., Master, and Bachelor's degrees in Chemical Engineering from Korea Advanced Institute of Science and Technology (KAIST). He started his career as a Senior Consultant at SAMSUNG SDS in 2001 and joined KEIT in 2005. He served as the Team Leader of RCMS Operation Team & System Integration Team, Director General of Digital Innovation Department, Vice President of Strategic Industry Division. He is leading Industrial Technology R&D in Korea with the network and experience in the various industry field over the past 20 years.

Dr. Taek Soo Kim
Vice President / Korean Institute of Industrial Technology (KITECH)

Dr. Taek Soo Kim is currently the Vice President of Korean Institute of Industrial Technology(KITECH). He has a Ph.D. in Metal Engineering from Chung Nam National University, South Korea, and Material Science and Engineering from Tohoku University, Japan. He was a Managing Director of Korea Institute for Rare Metals from 2010 to 2016, and Executive Managing Director of Research Institute of Advanced Manufacturing & Materials Technology in 2020. In 2022, he became the Vice President of KITECH, and Senior Vice President of The Korean Powder Metallurgy & Materials Institute. He is also contributing as a policy advisory committee member of the Ministry of National Defense since 2023.

Jin-Gook Lim
Director General / Future Policy Division
Institute of Information & Communications Technology Planning & Evaluation (IITP)

Jin-Gook Lim, Director General of IITP, graduated from Kyung Hee University and has been working at IITP, formerly known as IITA, since 1997. He has contributed to the advancement of digital field R&D policies for about 27 years. He is currently in charge of policy formulation, information analysis, and promoting international joint research at the IITP Future Policy Division. He has played a major role in the growth of IITP, which has become the representative agency for implementing the government's digital policies. In addition, he is active as a speaker forecasting the top 10 issues of the following year at the ICT Industry Outlook Conference, the best academic exchange meeting in the digital field in South Korea, boasting more than 20 years of history and tradition.

IN ALPHABETICAL ORDER FOR THE SAME RANK IN THE INSTITUTE

Dr. Jong Seong Khim
Professor / Seoul National University & Blue Carbon Research Center

Dr. Jong Seong Khim is Professor in the School of Earth and Environmental Sciences at Seoul National University. His research interests encompass a broad spectrum of ecological and environmental topics with research keywords of biodiversity, biological assay, ecological quality, marine pollution, sediment assessment, and ecosystem services. He published about 300 peer-reviewed SCI journal articles, with citations of >11,000 and Hirsch (h)-index of 54 at present. He is a recipient several research awards including 2014 International Cooperation Award for Young Scientist awarded by the Chinese Academy of Sciences, China. He was selected as a World Expert in Environmental Monitoring, Top 0.01% in 2021, and awarded the Medal of Honor in 2023 by the Government of the Republic of Korea in recognition of his contributions to the advancement of marine science. He is currently co-Editor-in-Chief of the Regional Studies in Marine Science.

Na-young Chung
Director / AISW Division in Busan Metropolitan City

Na-young Chung is the director of the AISW Division in Busan Metropolitan City. Her role is to help develop digital enterprises, universities and research institutes through R&D in various high-tech fields suchas AI, Quantum, Cloud, Metaverse, Information Security, Smartcity, etc. She majored in computer science from Yonsei University inSouth Korea in 2001. She held a Master's degree in Public Administration from York University in the UK in 2017 and She completed a Ph.D. course in technology administration from Yonsei University in South Korea in 2021. E-mail: hsmile73@korea.kr / happysmile2y@naver.com

Seok Ho Son
Director-General / Office of Strategic Technology Planning, Korea Institute of S&T Evaluation and Planning (KISTEP)

Seok Ho Son is currently the Director-General of the Office of Strategic Technology Planning at the Korea Institute of S&T Evaluation and Planning(KISTEP). He received his M.S. degree in Construction Management from Inha University in 2001 and completed his Ph.D. courseworks in Management of Technology from Yonsei University in 2007. Son has been an integral part of KISTEP since 2003, where he has been actively involved in national S&T planning, R&D budget allocation and cordination, national R&D innovation systems. He spearheaded the establishment of Korea's STI policies, including the Identification of 12 National Strategic Technologies and the Government R&D Innovation Strategy. He was a visiting scholar at the School of Economics at Georgia Institutue of Technology(Georgia Tech) from 2020 to 2021. E-mail : shson@kistep.re.kr

Dr. Sungmi Lee
General Manager / Policy Development Office, Korea Institute of Marine Science & Technology promotion (KIMST)

Dr. Sungmi Lee currently serves as the General Manager of the Korea Institute of Marine Science & Technology Promotion (KIMST). She earned her M.S. and Ph.D. degree in marine environmental sciences from Hanyang University in 2004 and 2008, respectively. During her doctoral studies, she was honored with the UNESCO MAB Young Scientist Award in 2006. Since joining KIMST in 2009, she has been actively involved in policy development and planning within the marine and fisheries sector. Recently, she led the project to create the 2nd Basic Plan for Promotion of Marine and Fisheries Science and Technology. In recognition of her significant contributions to marine and fisheries R&D, she was awarded the 2023 Minister of Oceans and Fisheries Award.

Changwoo Kim
Deputy director / National Geographic Information Institute (NGII)

Mr. Changwoo Kim is a deputy director of National Geographic Information Institute, and now responsible for the revision and production of the Korean national base map. Mr. Kim has experience in collaborating with the Korea Meteorological Administration and the National Emergency Management Agency to establish a flood damage prediction system based on a three-dimensional digital elevation model. Mr.Kim also has experience in mapping national key statistical information in a grid format. Currently, Mr. Kim is in charge of constructing a nationwide 1:5,000 scale map and 1:1,000 scale map for major urban areas, and strives to change the mapping process from the tradioanl method based on aerial photogrametry to the new method based on integrating administrative information for providing users with faster and more accurate information.

	Day 1: Sunday, June 16, 2024								
Room	KC 105	KC 201	KC 205	KC 202	KC 204	KC 206	KC 208	KC 210	PDC 103
07:00 - 08:00	Registration (14:00 - 18:00) *[KC Galleria, Kinnear Center 1st floor]*								
08:00 - 08:30									
08:30 - 09:00									
09:00 - 09:15									
09:15 - 09:30									
09:30 - 09:45									
09:45 - 10:00									
10:00 - 10:15									
10:15 - 10:30									
10:30 - 10:45									
10:45 - 11:00									
11:00 - 11:15									
11:15 - 11:30									
11:30 - 11:45									
11:45 - 12:00									
12:00 - 12:30									
12:30 - 13:00									
13:00 - 13:15									Volunteer Orientation (13:00 - 14:30) [PDC 103]
13:15 - 13:30									
13:30 - 13:45									
13:45 - 14:00	OPENING OF CKC 2024								
14:00 - 14:15									
14:15 - 14:30									
14:30 - 14:45									
14:45 - 15:00									
15:00 - 15:15	YGP Icebreaker /AGM (15:00 - 17:00) [KC 105]								
15:15 - 15:30									
15:30 - 15:45									
15:45 - 16:00									
16:00 - 16:15									AKCSE Board Meeting (15:00 - 18:00) [PDC 103]
16:15 - 16:30									
16:30 - 16:45									
16:45 - 17:00									
17:00 - 17:15	YGF/YPF Alumni Workshop (17:00 - 18:30) [KC 105]								
17:15 - 17:30									
17:30 - 17:45									
17:45 - 18:00									
18:00 - 18:15									
18:15 - 18:30									
18:30 - 18:45	Welcome Reception (18:30 - 20:30) [KC 203/205]								
18:45 - 19:00									
19:00 - 19:30									
19:30 - 20:00									
20:00 - 20:30									
20:30 - 21:00									
21:00 - 22:00									

AKCSE Session	Sustainable International R&D Collaboration Summit	KGRI	Technical Session	Reception Opening Ceremony Banquet
AI Forum Quantum Technologies Forum	Research Showcase	CKJCM	YGP Program	Clean Energy and Technologies Forum
Funding Agency	WiSE Session	Reserved	Closed (Inviation Only)	Canada-Korea Battery Value Chain R&D Workshop

		Day 2: Monday, June 17, 2024								
Room	KC 101/103 /105	KC 201	KC 205	KC 202	KC 204	KC 206	KC 208	KC 210	PDC 103	KC 203 (Exhibit)
07:00 - 08:00	Breakfast (07:00 - 09:00) *[Vistas Dining Room, Sally Borden Bldg 3rd floor]* Registration (9:00 - 12:00) *[KC Galleria, Kinnear Center 1st floor]*									
08:00 - 08:30										
08:30 - 09:00										
09:00 - 09:15	Opening Ceremony (09:00 - 09:40) [KC 101/103/105]									
09:15 - 09:30										
09:30 - 09:45										
09:45 - 10:00	Photo Time (09:40 - 10:00)									
10:00 - 10:15	Sustainable International R&D Collaboration Summit (Plenary I and STI Forum) (10:00 - 12:00) [KC 101/103/105]									
10:15 - 10:30										
10:30 - 10:45										
10:45 - 11:00										
11:00 - 11:15										
11:15 - 11:30										
11:30 - 11:45										
11:45 - 12:00										
12:00 - 12:30	Lunch (12:00 - 13:00) [Vistas Dining Room, Sally Borden Bldg 3rd floor]									
12:30 - 13:00										
13:00 - 13:15		AI Forum with ETRI (13:00 - 14:45) [KC 201]	Quantum Technologies Forum with BIPA (13:00 - 14:45) [KC 205]					Advanced Bio Forum (13:00 - 14:45) [KC 210]	4th Canada-Korea Joint Committee Meeting (13:00 - 18:00) [PDC 103]	
13:15 - 13:30										
13:30 - 13:45						KITECH (13:30 - 15:00) [KC 206]				
13:45 - 14:00										
14:00 - 14:15					Reserved					
14:15 - 14:30										
14:30 - 14:45										
14:45 - 15:00		Coffee Break (14:45 - 15:15) [KC 200 Galleria]								
15:00 - 15:15										
15:15 - 15:30			YGP Project Showcase (15:15 - 17:45) [KC 205]	IITP (15:15 - 16:45) [KC 202]		KOFST-Space session (15:15 - 16:45) [KC 206]	Reserved	Technical Session VI (15:15 - 16:45) [KC 210]		
15:30 - 15:45										
15:45 - 16:00										
16:00 - 16:15										
16:15 - 16:30										
16:30 - 16:45										
16:45 - 17:00										
17:00 - 17:15				Technical Session I (17:00 - 18:15) [KC 202]	Technical Session II (17:00 - 18:15) [KC 204]	Technical Session III (17:00 - 18:15) [KC 206]	Technical Session IV (17:00 - 18:15) [KC 208]	Technical Session V (17:00 - 18:15) [KC 210]		
17:15 - 17:30										
17:30 - 17:45										
17:45 - 18:00										
18:00 - 18:15										
18:15 - 18:30										
18:30 - 18:45										
18:45 - 19:00										
19:00 - 19:30										
19:30 - 20:00										
20:00 - 20:30										
20:30 - 21:00										
21:00 - 22:00										

AKCSE Session	Sustainable International R&D Collaboration Summit	KGRI	Technical Session	Reception Opening Ceremony Banquet
AI Forum Quantum Technologies Forum	Research Showcase	CKJCM	YGP Program	Clean Energy and Technologies Forum
Funding Agency	WiSE Session	Reserved	Closed (Inviation Only)	Canada-Korea Battery Value Chain R&D Workshop

Room	KC 101/103 /105	KC 201	KC 205	KC 202	KC 204	KC 206	KC 208	KC 210	PDC 103	KC 203 (Exhibit)
	Day 3: Tuesday, June 18, 2024									
07:00 - 08:00	**Breakfast** (07:00 - 09:00) *[Vistas Dining Room, Sally Borden Bldg 3rd floor]* **Registration** (9:00 - 12:00) *[KC Galleria, Kinnear Center 1st floor]*									
08:00 - 08:30										
08:30 - 09:00										
09:00 - 09:15	**Clean Energy and Technologies Forum (Plenary II)** (09:00 - 10:30) [KC 101/103/105]									
09:15 - 09:30										
09:30 - 09:45										
09:45 - 10:00										
10:00 - 10:15										
10:15 - 10:30										
10:30 - 10:45		Canada-Korea Battery Value Chain R&D Workshop (10:30 - 12:00) [KC 201]	Hydrogen/ Fuel Cell/CCUS (10:30 - 12:00) [KC 205]	Reserved	NGII A (10:30 - 12:00) [KC 204]	Clean Energy & Environment (10:30 - 12:00) [KC 206]				
10:45 - 11:00										
11:00 - 11:15										
11:15 - 11:30										
11:30 - 11:45										
11:45 - 12:00										
12:00 - 12:30	**Lunch** (12:00 - 13:00) [Vistas Dining Room, Sally Borden Bldg 3rd floor]									
12:30 - 13:00										
13:00 - 13:15		Canada-Korea Battery Value Chain R&D Workshop (13:00 - 15:00) [KC 201]	YGP Skillshare Workshop (13:00 - 15:00) [KC 205]		NGII B (13:00-15:00) [KC 204]	Reserved			4th Canada-Korea Joint Committee Meeting (13:00 - 18:00) [PDC 103]	
13:15 - 13:30										
13:30 - 13:45				KIMST (13:30 - 15:00) [KC 202]						
13:45 - 14:00										
14:00 - 14:15										
14:15 - 14:30										
14:30 - 14:45										
14:45 - 15:00										
15:00 - 15:15		**Coffee Break** (15:00 - 15:30) [KC 200 Galleria]								
15:15 - 15:30										
15:30 - 15:45		Canada-Korea Battery Value Chain R&D Workshop (15:30 - 18:00) [KC 201]	YGP Leadership Workshop (15:30 - 18:00) [KC 205]	KERI (15:30 - 17:00) [KC 202]				KICT (15:30 - 17:00) [KC 210]		
15:45 - 16:00										
16:00 - 16:15										
16:15 - 16:30										
16:30 - 16:45										
16:45 - 17:00										
17:00 - 17:15										
17:15 - 17:30										
17:30 - 17:45										
17:45 - 18:00										
18:00 - 18:15										
18:15 - 18:30										
18:30 - 18:45										
18:45 - 19:00										
19:00 - 19:30										
19:30 - 20:00										
20:00 - 20:30										
20:30 - 21:00										
21:00 - 22:00										

AKCSE Session	Sustainable International R&D Collaboration Summit	KGRI	Technical Session	Reception Opening Ceremony Banquet
AI Forum Quantum Technologies Forum	Research Showcase	CKJCM	YGP Program	Clean Energy and Technologies Forum
Funding Agency	WiSE Session	Reserved	Closed (Inviation Only)	Canada-Korea Battery Value Chain R&D Workshop

	Day 4: Wednesday, June 19, 2024									
Room	KC 101/103 /105	KC 201	KC 205	KC 202	KC 204	KC 206	KC 208	KC 210	PDC 103	KC 203 (Exhibit)
07:00 - 08:00	Breakfast (07:00 - 09:00) *[Vistas Dining Room, Sally Borden Bldg 3rd floor]* Registration (9:00 - 12:00) *[KC Galleria, Kinnear Center 1st floor]*									
08:00 - 08:30										
08:30 - 09:00										
09:00 - 09:15	Research Showcase (09:00 - 10:30) [KC 101/103/105]									
09:15 - 09:30										
09:30 - 09:45										
09:45 - 10:00										
10:00 - 10:15										
10:15 - 10:30										
10:30 - 10:45			KEIT Global Strategic Forum (10:30 - 12:00) [KC 205]	KIMM (10:30 - 12:00) [KC 202]					Marine S&T Cooperation Session (10:30 - 12:30) [PDC 103]	
10:45 - 11:00										
11:00 - 11:15										
11:15 - 11:30										
11:30 - 11:45										
11:45 - 12:00										
12:00 - 12:30	Lunch (12:00 - 13:00) [Vistas Dining Room, Sally Borden Bldg 3rd floor]									
12:30 - 13:00										
13:00 - 13:15										
13:15 - 13:30			KOFWST (13:15 - 15:15) [KC 205]							
13:30 - 13:45		KEIT Session I (13:30 - 15:00) [KC 201]		KIMS (13:30 - 15:00) [KC 202]	NIMS (13:30 - 15:00) [KC 204]	KRICT (13:30 - 15:00) [KC 206]	KEIT Session II (13:30 - 15:00) [KC 208]	KEIT Session III (13:30 - 15:00) [KC 210]		
13:45 - 14:00										
14:00 - 14:15										
14:15 - 14:30										
14:30 - 14:45										
14:45 - 15:00										
15:00 - 15:15				Coffee Break (15:00 - 15:30) [KC 200 Galleria]						
15:15 - 15:30										
15:30 - 15:45		NST recruitment & information session (15:30 - 17:30) [KC 201]	KWSE (15:30 - 17:30) [KC 205]		Reserved	KIER, KIMM Ammonia-Hydrogen Session (15:30 - 17:30) [KC 206]		NGIIC (15:30-17:30) [KC 210]		
15:45 - 16:00										
16:00 - 16:15										
16:15 - 16:30										
16:30 - 16:45										
16:45 - 17:00										
17:00 - 17:15										
17:15 - 17:30										
17:30 - 17:45										
17:45 - 18:00										
18:00 - 18:15	Farewell Dinner and Award Ceremony (18:00 - 21:00) [KC 101/103/105]									
18:15 - 18:30										
18:30 - 18:45										
18:45 - 19:00										
19:00 - 19:30										
19:30 - 20:00										
20:00 - 20:30										
20:30 - 21:00										
21:00 - 22:00										

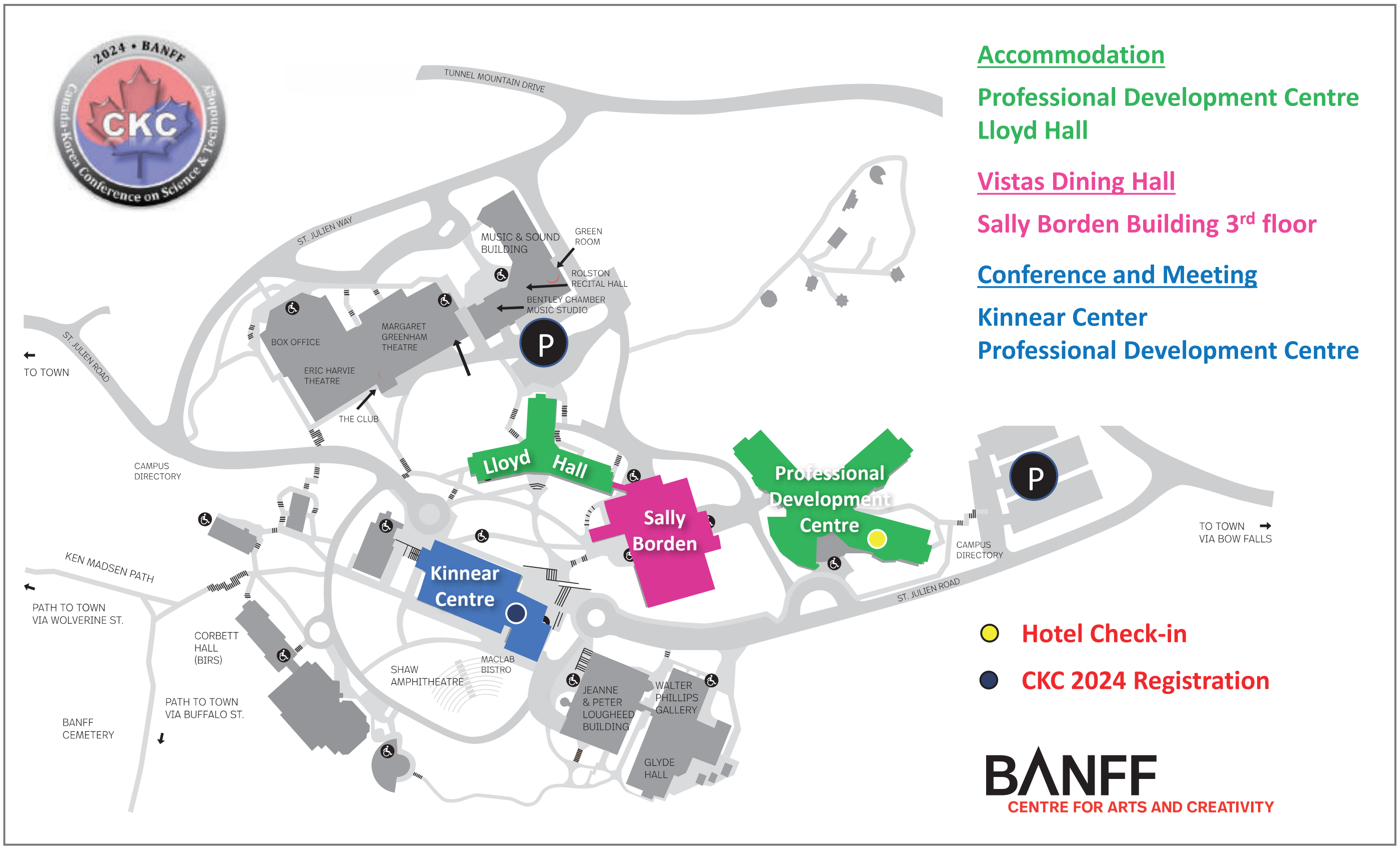
AKCSE Session	Sustainable International R&D Collaboration Summit	KGRI	Technical Session	Reception Opening Ceremony Banquet
AI Forum Quantum Technologies Forum	Research Showcase	CKJCM	YGP Program	Clean Energy and Technologies Forum
Funding Agency	WiSE Session	Reserved	Closed (Inviation Only)	Canada-Korea Battery Value Chain R&D Workshop

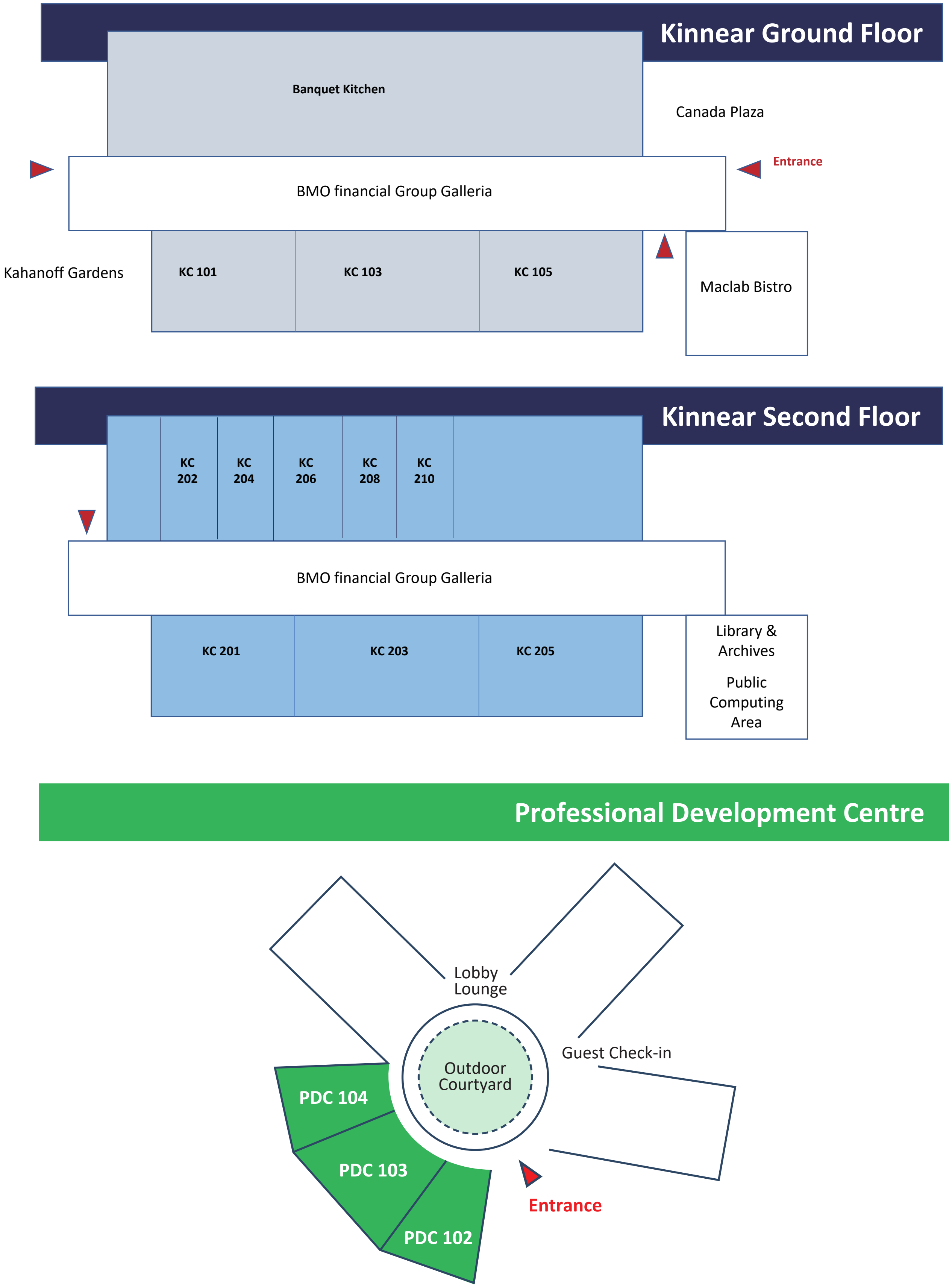
	Day 5: Thursday, June 20, 2024					
Room	KC 202	KC 204	KC 206	KC 208	KC 210	PDC 103
07:00 - 08:00	Breakfast (07:00 - 09:00) *[Vistas Dining Room, Sally Borden Bldg 3rd floor]*					
08:00 - 08:30						
08:30 - 09:00						
09:00 - 09:15	Technical field trip for Korean delegates (09:00 - 13:00)				AKCSE Annual General Meeting (9:00 - 10:30) [PDC 103]	
09:15 - 09:30						
09:30 - 09:45						
09:45 - 10:00						
10:00 - 10:15						
10:15 - 10:30						
10:30 - 10:45						
10:45 - 11:00						
11:00 - 11:15						
11:15 - 11:30						
11:30 - 11:45						
11:45 - 12:00						
12:00 - 12:30						
12:30 - 13:00						
13:00 - 13:15	END OF CKC2024					
13:15 - 13:30						
13:30 - 13:45						
13:45 - 14:00						
14:00 - 14:15						
14:15 - 14:30						
14:30 - 14:45						
14:45 - 15:00						
15:00 - 15:15						
15:15 - 15:30						
15:30 - 15:45						
15:45 - 16:00						
16:00 - 16:15						
16:15 - 16:30						
16:30 - 16:45						
16:45 - 17:00						
17:00 - 17:15						
17:15 - 17:30						
17:30 - 17:45						
17:45 - 18:00						
18:00 - 18:15						
18:15 - 18:30						
18:30 - 18:45						
18:45 - 19:00						
19:00 - 19:30						
19:30 - 20:00						
20:00 - 20:30						
20:30 - 21:00						
21:00 - 22:00						

AKCSE Session	Sustainable International R&D Collaboration Summit	KGRI	Technical Session	Reception Opening Ceremony Banquet
AI Forum Quantum Technologies Forum	Research Showcase	CKJCM	YGP Program	Clean Energy and Technologies Forum
Funding Agency	WiSE Session	Reserved	Closed (Inviation Only)	Canada-Korea Battery Value Chain R&D Workshop

Banff Centre for Arts and Creativity

107 Tunnel Mountain Drive, Banff, AB, T1L 1H5, Canada | 403.762.6100 | www.banffcentre.ca




Kinnear Ground Floor
Banquet Kitchen
Canada Plaza
Entrance
BMO financial Group Galleria
Kahanoff Gardens
KC 101
KC 103
KC 105
Maclab Bistro
Kinnear Second Floor
KC 202
KC 204
KC 206
KC 208
KC 210
BMO financial Group Galleria
KC 201
KC 203
KC 205
Library & Archives
Public Computing Area
Professional Development Centre
Lobby Lounge
Outdoor Courtyard
Guest Check-in
PDC 104
PDC 103
PDC 102
Entrance

10:00–10:25, June 17 (Monday) MDT

KC 101/103/105

Speaker: Chang Yune Lee

Vice Minister, the Ministry of Science and ICT (MSIT)

Chang Yune Lee was appointed as the Vice Minister of the Ministry of Science and ICT in 2024. He oversees various critical sectors within the ministry, focusing on enhancing national science and technology initiatives.

Mr. Lee has an extensive career in science and technology policy. He earned his B.A. in Chemical Engineering from Yonsei University and an M.A. in Patent Law from the Graduate School for Law at Yonsei University, Korea.

Throughout his career, Mr. Lee has held several pivotal positions, including Secretary-General of the Support Group for the Presidential Advisory Council on Science and Technology in 2023, Deputy Minister of the Office of R&D Policy at the Ministry of Science and ICT in 2022, and Expert Committee Member in the Science and Technology Education Division of the Presidential Transition Committee in the same year. He also served as the Director General of the R&D Policy Bureau, Space, Nuclear, and Big Science Policy Bureau, and S&T Commercialization and Job Creation Policy Bureau at the Ministry of Science and ICT from 2018 to 2021. His early roles included being the Director of R&D Policy Division (2016) and the Science, ICT, and Future HR Policy Division (2014) at the Ministry of Science, ICT, and Future Planning.

Mr. Lee's career began as a Deputy Director in the Science and Technology Strategy Division at the Ministry of Education, Science, and Technology in 1995. His leadership and strategic vision have significantly contributed to advancing Korea's science and technology landscape.

Strengthening of Global R&D in Korea- Focusing on Advanced Bio, Quantum, and AI

10:25–10:45, June 17 (Monday) MDT

KC 101/103/105

Speaker: Dr. Lakshmi Krishnan

Vice-President of Life Sciences at the National Research Council of Canada (NRC)

Dr. Lakshmi Krishnan was appointed as the Vice President of Life Sciences on April 1, 2022 after recently acting in the position. In this capacity, she oversees the Human Health Therapeutics, Aquatic and Crop Resource Development and Medical Devices research centres.

As a globally recognized Life Sciences researcher, Dr. Krishnan has been a leader for driving innovation in the area of vaccine technologies and novel biologics for the improvement of human health. Throughout her career, she has represented NRC and government of Canada at various national and international joint committees and has been invited as guest speaker on many occasions. She is committed to health innovation and sustainable bio-economy.

Dr. Krishnan joined the NRC in 1997 and, as a scientist, built expertise in immunology research at the Institute for Biological Sciences (IBS), in the areas of vaccine adjuvants and host pathogen interactions. She was the Director General (DG) of the Human Health Therapeutics (HHT) Research Centre (2018-2022), Program Lead for Vaccines and Immunotherapy (2015-2018), Director of R&D for Immunobiology at HHT (2016-2018), and a research officer (1997-2014) at IBS and HHT. Over the course of her career, Dr. Krishnan has been the recipient of numerous competitive research grants from various agencies including the Ontario Institute for Cancer Research (OICR), the Canadian Institutes of Health Research (CIHR) and the National Institutes of Health (NIH – USA). She has published over 75 primary research articles in peer-reviewed journals in the field of vaccine technologies, host-pathogen and cancer immunity, and is listed as an inventor on several patents. She has significant experience in technology transfer to industrial clients and at the same time has a strong academic background, having mentored several graduate students who have all gone on to have successful research careers. She is member of the board of the Canadian Cancer Research Alliance, National Synthetic Biology Steering Committee and also chaired the Federal Vaccine Research Innovation and Development DG committee, which consists of membership from 13 different federal departments across the Government of Canada.

Dr. Krishnan received her Master's degree in Bio-medical Genetics from the University of Madras (India) and Ph.D. in Immunology from the National Institute of Immunology in India, following which, she completed post-doctoral studies at the University of Alberta through an Alberta Heritage Foundation scholarship.

Dr. Krishan represents the government of Canada as the Canadian Co-Chair of the Canada-Korea Joint Committee Meeting under the Canada-Korea Science and Technology Agreement.

Sustainability in S&T Collaboration between Canada and Korea to Drive Resilient Societies

Abstract:

The Government of Canada is strengthening and expanding its science, technology and innovation relationships with key markets in the Indo-Pacific region to enhance collaboration between Canadian researchers, innovators, companies and potential foreign partners. Korea is an important strategic partner and ally for Canada with a long and successful history of bilateral research and development partnerships on which to build upon. The Government of Canada is actively working with key Korean science-based organizations to leverage existing cooperation mechanisms, like the Canada-Korea Science, Technology and Innovation Agreement and exploring other programs aimed at supporting more progress in emerging technology fields that hold the potential to address common global challenges. As the Canadian Co-Chair of the Canada-Korea Joint Science and Technology Cooperation Committee, Dr. Krishnan will provide a high-level overview of the evolution and future trajectory of the Canada-Korea science, technology and innovation relationship to drive resilient societies.

9:00–9:30, June 18 (Tuesday) MDT

KC 101/103/105

Speaker: Dr. David B Layzell

Emeritus Professor and Energy Systems Architect, The Transition Accelerator

David Layzell is an Emeritus Professor from the University of Calgary and an Energy Systems Architect for the Transition Accelerator, a non-profit focused on the net-zero energy system transition in Canada. His research uses techno-economic and environmental modeling tools to identify credible, compelling, and capable pathways for transitioning Canada's energy systems to net-zero greenhouse gas (GHG) emissions by mid-century. Before assisting in the launch of the Transition Accelerator in 2019, David established the Canadian Energy System Analysis Research (CESAR) Initiative at the U of C in 2013 and was Executive Director of the Institute for Sustainable Energy, Environment and Economy (ISEEE) at the U of C (2008-12). As a Professor at Queen's University (Kingston, ON), he set up and ran the BIOCAP Canada Foundation (1998-2008), founded a scientific instrumentation company called Qubit Systems Inc. and was elected 'Fellow of the Royal Society of Canada' (FRSC) for his research contributions.

Towards Net-Zero Emission Energy Systems in Canada

Abstract:

Achieving net-zero greenhouse gas (GHG) emissions by mid-century requires transformative changes in the energy systems of Canada, the world's 6th largest energy producer and a country that currently exports more than half of its primary energy production. Demand for fossil carbon-based energy carriers (i.e. gasoline, diesel, natural gas) must shift to zero emission carriers (e.g. electricity, biofuels, hydrogen) that are produced with minimal or no GHG emissions and are used with technologies that meet the needs of the demand sectors. To gain a window on a 'Made-in-Canada' net-zero future, we built a Net-Zero Energy System Transition (NZEST) model that uses techno-economic analyses to identify credible, compelling, and capable carrier-technology solutions for demand sectors and regions across Canada. As a nation with only 0.5% of the world's population but 7% of the global land area, the model also explores Canada's potential role in the export of zero-emission energy carriers to other, more densely populated regions.

In this presentation, I will describe how the NZEST model works, and summarize results of an NZEST scenario that projects a tripling in electricity generation/use, a 6-fold increase in biofuel production/use, and a new role for oil and gas in the production of hydrogen and ammonia as energy carriers to meet domestic and export demand. The figure provided here shows the current and possible future transition of Canada's energy carriers in a net-zero future.

*Contact Email: dlayzell@ucalgary.ca

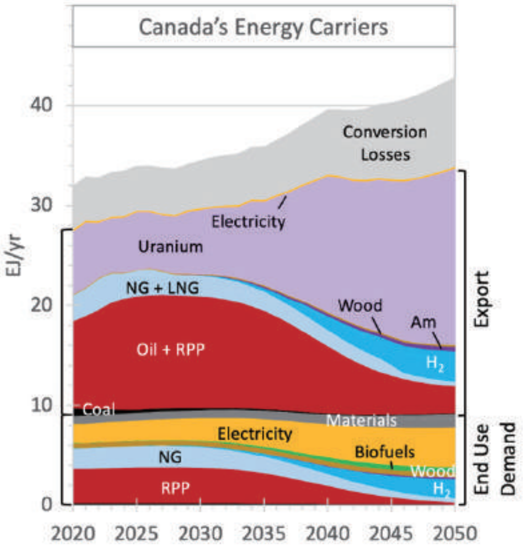


Figure. Historical and net-zero projection of Canada's energy carriers to serve either domestic, end-use demand or energy export from 2020 to 2050. Am, ammonia; EJ, Exajoules; NG, natural gas.

9:30–10:00, June 18 (Tuesday) MDT

KC 101/103/105

Speaker: Dr. Hee-Tak Kim

Professor of Korea Advanced Institute of Science and Technology

Dr. Hee-Tak Kim serves on the faculties of Chemical and Biomolecular Engineering at KAIST. He obtained his Ph.D. in Chemical Engineering at KAIST in 1999. Dr. Kim's current work focuses on design of electrochemical energy devices including secondary batteries, fuel cells and water electrolysis. Dr. Kim's group explore new battery solutions which extend cruise range of electric vehicle and provide better performances and economics for energy storage system. The research includes electrode and electrolyte development for lithium metal and lithium sulfur batteries. His research features the combination of multi-scale structural engineering, simulation, and electrochemical engineering to address the key issues in this field. He is currently the head of Frontier Research Lab. which is a research center for the collaboration of KAIST and LG energy solution. He also leads KAIST-Samsung SDI battery education program. E-mail heetak.kim@kaist.ac.kr

Lean Electrolyte Lithium Metal Batteries

Abstract:

Liquid electrolyte-based lithium metal battery (LMB) presents a promising alternative to overcome the limitations of lithium-ion batteries in enhancing energy density. In recent years, a deeper understanding of the degradation of Li metal electrodes in liquid electrolytes has been achieved, with a particular emphasis on the impact of the solid electrolyte interphase (SEI) on Li electrode morphology and corrosion. Consequently, there is a growing need for effective methodologies to understand the ideal SEI structure on lithium metal anodes and control its formation. Despite these advances, current LMB technology still falls short of achieving the targeted 500 Wh kg-1 and struggles with insufficient charging rate, demanding further improvement. In this talk, insights gained from the previous LMB researches are summarized and discussed. Building upon the insights, we propose solutions to achieve energy-dense LMBs, introducing a composite interlayer or a borate-pyran electrolyte. The composite interlayer leveraging ceramic solid electrolyte and gel electrolyte effectively suppresses Li corrosion by altering electrolyte solvation structure, enabling the successful operation of LMB with carbonate electrolytes. The borate-pyran electrolyte transforms large LiF crystallites in the SEI into fine crystalline or glassy LIF, which suppress Li corrosion. LMBs assembled with the borate-pyran electrolyte delivered a high full-cell-level energy density of > 400 Wh/kg and operated for 400 cycles. The case studies provide fresh insights into addressing the two critical problems of LMB: inhomogeneous Li morphology and Li corrosion. *Corresponding author; E-mail heetak.kim@kaist.ac.kr

10:45–11:00, June 17 (Monday) MDT

KC 101/103/105

Speaker: Dr. Tai Sik Lee

President of Korean Federation of Science and Technology Societies (KOFST)

Dr. Tai Sik Lee was inaugurated as the 21st President of the Korean Federation of Science and Technology Societies(KOFST) in March 2023. Since his inauguration, he has contributed to supporting scientists and engineers from home and abroad and fostering global science and technology cooperation. Key achievements during his tenure include the official opening of the Science and Technology Convention Center (ST-Center) and hosting the 1st World Congress of Korean Scientists & Engineers (2,460 participants from 18 countries), and the announcement of a joint declaration.

Dr. Lee earned a Bachelor's degree in Civil Engineering from Seoul National University and both a Master's and a Ph.D. in Construction Management from the University of Wisconsin-Madison, USA. He has served as a Professor in the Department of Civil and Environmental Engineering at Hanyang University and has held positions such as chairman of the R&D Committee of the National Research Council of Science & Technology Korea, President of the Korea Institute of Civil Engineering and Building Technology(KICT), President of the Korean Society of Civil Engineers, and President of the Korean Society for Railway.

In addition to his current role as President of KOFST, he also serves as a Director of the Climate Change Center, an Honorary Professor at Hanyang University, a Director of the International Moonbase Alliance(IMA), and the CEO of the International Space Exploration Research Institute(ISERI), where he leads space exploration and research initiatives.

In 2017, Dr.Tai Sik Lee ranked 1st among total 77 teams in a NASA Centennial Challenges program competition to build a 3D-printed habitat under Mars Phase 2 Level 2, and has been recognized for his contributions to science and technology with awards such as the 2010 Doyak Medal-Order of Science and Technology Merit, Ministry Science and Technology, the Presidential Award, Ministry Science and Technology, and the Special Award(Young Engineer of the year), National Academy of Engineering of Korea.

Beyond the field of science and technology, Dr. Lee is actively involved in cultural and artistic endeavors. He is a representative of the 50–year-old theater company, 'Silgeuk(실극)', a member of the choir ‘Diamante Blu’, and a co-producer of the play ‘King Lear’, taking the lead in spreading scientific culture by exploring various ways to combine science and art.

Pioneering the Final Frontier

10:00–10:20, June 18 (Tuesday) MDT

KC 101/103/105

Speaker: Victor Lee

Alberta Government Representative in Korea
Counsellor (Commercial), Canadian Embassy in Korea

Victor has 15 years of international business development and foreign affairs experience – with expertise in the global energy-security and the food-security subjects.
Previously, Victor served as a Managing Director – Saskatchewan India Office/Counsellor (Commercial), High Commission of Canada in New Delhi; Trade and Investment Director - Asia Pacific, Alberta Ministry of Economic Development, Trade and Tourism (EDTT); and a Trading Manager (Mineral and Energy Resources), Mitsui & Co. Victor also has relevant international business development experience from E*TRADE, and the University of Toronto's Centre for International Experience.
Victor, a Certified International Trade Professional (CITP®|FIBP®), is a graduate from the University of Toronto, Trinity College, holds an MBA from the University Toronto, and Global Executive MBA from SDA Bocconi School of Business (Milan, Italy).

Alberta, Canada: South Korea's Strong Economic Partner in The Hydrogen & Critical Minerals

Abstract:

Alberta, Canada, is becoming a key economic partner for South Korea, particularly in the fields of clean hydrogen and critical minerals. This presentation will review the growing economic relationship between Alberta and South Korea, and introduce the strategic roles and responsibilities of the Alberta Government Office in Korea (which is co-located within the Canadian Embassy in Seoul). It will focus on outlining the commercial and R&D opportunities between Alberta and Korea, and discuss the potential for collaborative projects involving Alberta's sustainably sourced and cost-effective blue hydrogen, as well as the extraction and processing of critical minerals such as nickel, cobalt, magnesium, and lithium. The presentation aims to provide a clear plan for enhancing bilateral economic ties and promote sustainable economic collaboration between Korea-Alberta-Canada.

Sustainable International R&D Collaboration Summit

Plenary Speech I and STI Forum

Open Session

Time: 10:00–12:00, June 17 (Monday) Canada, Mountain Daylight Time (MDT)

Place: KC 101/103/105

Sponsor: Association of Korean-Canadian Scientists and Engineers (AKCSE) & Korean Federation of Science and Technology Societies (KOFST)

Organizer: AKCSE & KOFST

Contact: Dr. Yong Hoon Kim, University of Windsor (kim523@uwindsor.ca)

Description: This session is introducing the organization's unique tasks and missions under the theme of 'Accelerate international collaboration by unlocking the power of science and technology'. The session aims to achieve two main goals: providing everyone with widespread access to international collaboration in science and technology, and effectively tackling global challenges. The STI forum will center its attention on the topic of " International collaboration in science and technology in Canada and Korea." It will serve as a dynamic platform for participants to engage in discussions regarding the influence of science and technology on international collaboration in both countries, the strategic direction of national research institutes, and international research networks for joint research between Canada and Korea.

Program:

Time	Place	Topic	Speaker	Affiliation
10:00	KC 101/ 103/105	Opening	Chair: Dr. Regina Lee	York University
10:00–10:25		Plenary Speech 1	Vice Minister: Chang Yune Lee	Ministry of Science and ICT
10:25–10:45		Plenary Speech 2	Dr. Lakshmi Krishnan	National Research Council of Canada
10:45–11:00		Plenary Speech 3	Dr. Tai Sik Lee	The Korean Federation of Science and Technology
11:00–11:10		Break		
11:10–12:00		STI Forum	Moderator: Dr. Yong Hoon Kim	University of Windsor

*NRC: National Research Council Canada, *NST: National Research Council of Science and Technology (Korea), *NRCan: Natural Resources Canada

List of Participants:

Name	Position	Affiliation
Dr. Bok Chul Kim	Chairperson	National Research Council of Science & Technology (NST)
Dr. Byung-Suk Kim	President	Korea Institute of Civil Engineering and Building Technology (KICT)
Dr. Seung Youb Han	Vice President	Korea Evaluation Institute of Industrial Technology (KEIT)
Dr. Taek Soo Kim	Vice President	Korea Institute of Industry Technology (KITECH)
Dr. Seogjoo Kim	Vice President	Korea Institute of Energy Research (KERI)
Dr. Tae Yeol Kim	President	Busan IT Industry Promotion Agency (BIPA)

Name	Position	Affiliation
Dr. Seung Chan Bang	President	Electronics and Telecommunications Research Institute (ETRI)
Dr. Young Kuk Lee	President	Korea Research Institute of Chemical Technology (KRICT)
Dr. Joonyeon Chang	Vice President	Korea Institute of Science and Technology (KIST)
Dr. Bong-Ki Kim	Vice President	Korea Institute of Machinery & Materials (KIMM)
Dr. Seong Ok Han	Vice President	Korea Institute of Energy Research (KIER)

Note: Speech with slides for 3 min, followed by panel discussion and Q & A session (in Korean).

Sustainable International R&D Collaboration Summit

Chair: Dr. Regina Lee

Professor, York University, Canada

Regina Lee, PhD, PEng is Professor at the Department of Earth and Space Science and Engineering, York University, Toronto, Canada. Prof. Lee received her Ph.D. from the University of Toronto in 2000. It has been a focus of Prof. Lee's research to develop a series of satellite technologies that will lead to scientific nanosatellite missions. Currently, she's investigating several areas including MEMS based attitude sensors and actuators to incorporate their low-grade characteristics; and optical payloads including a star tracker for Resident Space Object (RSO) detection, identification and characterization with light curve analysis. To date, Dr. Lee has raised over $10M in independent funding, working with over 13 industry partners and trained over 100 HQPs. Currently, Dr. Lee serves as the director of York Microfabrication Facility (YMF). E-mail: reginal@yorku.ca

Sustainable International R&D Collaboration Summit

Moderator: Dr. Yong Hoon Kim

Associate Professor, University of Windsor

Dr. Yong Hoon Kim is an Associate Professor of Civil and Environmental Engineering at the University of Windsor. Dr. Kim has received the B.S. and M.S. degrees in transportation from the University of Seoul, Seoul, Korea, in 2003 and 2006, respectively, and Ph.D. degree in Civil Engineering from Purdue University, West Lafayette, IN, USA, in 2017. He worked for two and a half years at the Seoul Institute in Korea as a research engineer. He also worked a Research Associate with the NEXTRANS Center, Purdue University. His research interests include Intelligent Transportation System, connected and autonomous vehicle technology, data analytics for connected transportation system, artificial intelligence for connected and autonomous vehicle applications, and traffic safety.

Sustainable International R&D Collaboration Summit

Speaker: Dr. Bok Chul Kim

Chairperson / National Research Council of Science and Technology (NST)

Dr. Bok Chul Kim is currently serving as Chairperson of National Research Council of Science and Technology (NST), a position he has held since July 2021. He holds a doctorate in geology from Yonsei University, and had spent his career as geologist at Korea Institute of Geoscience & Mineral Resources (KIGAM) over three decades, actively participating in numerous outstanding R&D projects. Dr. Kim has extensive administrative experience, serving as Director of Planning and Coordination Division at KIGAM and as Director General of Office of Policy at NST. From 2018 to 2021, he also served as President of KIGAM, until joining NST. He is a member of the Korea Society of Economic and Environmental Geology and Korea Society of Petroleum and Sedimentary Geology.

Abstract:

The mission of NST (National Research Council of Science and Technology) is to support, foster and systematically manage 23 GRIs (Government-funded Research Institutes) to contribute to national R&D policy and development of knowledge industry.

Recently NST has developed the programs to support the international cooperation of GRIs. ‘Global Challenge, Global Response’ opened a call in 2022 and it supports the international collaboration of NST GRIs to solve a global agenda. We use one of our branches, KIST-Europe to mediate the cooperation between Korea and Europe. And ‘Korea-US-Japan National Laboratories Collaboration Program’ will open this year. It is a follow-up to the trilateral summit at Camp David last year. We are going to support more than 10 small collaboration projects among NST GRIs, US NNSA National Laboratories and Japanese National R&D Agencies.

Four NST GRIs have 12 international branches all over the world, including the branches of ETRI and KITECH in California. We are also developing more measures to expand their roles and utilization. NST encourages and supports its GRIs’ international projects to use the branches. On May 30 Korean government announced the policy to strengthen the network among the public science and technology related international branches. NST will support its GRIs’ branches to be international cooperation platforms of Korea with their expertise.

Sustainable International R&D Collaboration Summit

Speaker: Dr. Byung-Suk Kim

President, Korea Institute of Civil Engineering and Building Technology (KICT)

Dr. Byung-Suk Kim is currently the President of the Korea Institute of Civil Engineering and Building Technology (KICT). He received a Ph.D. degree in Civil Engineering from Seoul National University in 1992. His primary research field is structural engineering. Through the development of the world's best 200- year lifespan super concrete technology, numerous world records have been achieved. These include the construction of the world's first ultra-high-performance concrete road cable-stayed bridge, the world's first reinforcing steel-free concrete structure, and the world's largest span length concrete bridge. In recognition of his contributions, he was awarded the 'National Merit for Innovation' in 2023. He currently serves as the president of the Korean Peninsula Infrastructure Forum and has previously chaired the Alliance of Environmental Research Institutes and Organizations. He is also an active member of the National Academy Engineering of Korea. Additionally, he has served as a committee member in Working Group of the National Standard Commission and has contributed as a writing staff to the publication of national construction standards and guidelines, the establishment of international standards, and the enactment of international design standards and guidelines.

Abstract:
Founded in 1983, the Korean Institute of Civil Engineering and Building Technology (KICT) is a leader in civil engineering technology innovation, focusing on national infrastructure advancement, sustainable construction technologies, and comprehensive testing and certification services. KICT is also responsible for establishing and managing national design and construction standards for the national government. KICT currently conducts R&D programs to solve national-level issues related to public safety and disaster response, in alignment with National Strategic Technologies.
KICT addresses dynamic social and environmental issues through the KICT-Digital Cluster(K-DC) system, which was designed to conduct interdisciplinary and convergent R&D projects on various topics such as disaster management, smart cities, and hydrogen infrastructure. The K-DC system promotes innovation by eliminating barriers between departments within the research institute, expanding domestic Industry-Academia-Research convergence, and further enhancing international R&D cooperation. Embracing the concept of consilience, KICT integrates culture and art to bridge gaps between disciplines and countries, aiming for the world-class and sustainable international R&D cooperation.
Committed to global collaboration, KICT engages in international partnerships to tackle worldwide challenges and promote sustainable development. KICT is establishing a cooperative network with prominent earthquake research institutes in Korea, the United States, and Japan, including the Pacific Earthquake Engineering Research Center (PEER). These collaborations aim to develop pioneering earthquake-related technologies and enhance global disaster resilience. Additionally, KICT is pursuing joint research with Lawrence Berkeley National Lab on carbon-neutral smart cities.
Looking ahead, KICT is proactively addressing challenges posed by AI, digital transformation, low economic growth, and carbon neutrality through innovative projects such as smart cities, hydrogen infrastructure, and digital twin technology. KICT looks forward to sharing insights and fostering further international partnerships to enhance its pioneering research and visionary projects, which are shaping the future of civil engineering technology.

Sustainable International R&D Collaboration Summit

Speaker: Dr. Seung Youb Han

Vice President, Korea Planning & Evaluation Industrial Technology (KEIT)

Dr. Seung Youb Han is currently the Vice President of Industrial Innovation of the Korea Planning & Evaluation Industrial Technology (KEIT). He obtained Ph.D., Master, and Bachelor's degrees in Chemical Engineering from Korea Advanced Institute of Science and Technology (KAIST). He started his career as a Senior Consultant at SAMSUNG SDS in 2001 and joined KEIT in 2005. He served as the Team Leader of RCMS Operation Team & System Integration Team, Director General of Digital Innovation Department, Vice President of Strategic Industry Division. He is leading Industrial Technology R&D in Korea with the network and experience in the various industry field over the past 20 years.

Abstract:
KEIT is committed to becoming the facilitator of technology-led innovative growth and technology -based industrial powerhouse.
◎ Introduction
- KEIT specializes in the planning, evaluation and management of national R&D projects in industrial technology under the Ministry of Trade, Industry and Energy (MOTIE).
- KEIT supports various projects to enhance the nation's industrial competitiveness and discover new growth engines.

◎ Mission
- KEIT contributes to promoting the nation's industrial competitiveness and innovative capacity by planning, evaluating and managing industrial technology R&D projects to stimulate technology innovation.

◎ Vision
- KEIT is committed to becoming the facilitator of technology-led innovative growth and technology-based industrial powerhouse.

◎ Responsibilities
○ Planning R&D projects
- Performing R&D analysis on promising industries (by program directors)
- Investigating the demand, current status, and prospect of industrial technologies
- Planning R&D projects following government policies and strategies
- Conducting technical & economic feasibility studies on R&D projects

○ Evaluation and management of R&D projects
- Selecting R&D project contractors, sign contracts, and provide funds
- Managing progress in R&D projects

○ Dissemination of R&D project outcomes
- Investigating, analyzing and evaluating the utilization of R&D outcomes
- Holding「Korea Tech Show Fair」that features R&D outcomes
- Publishing an industrial technology journal, 「Tech Focus」

Sustainable International R&D Collaboration Summit

Speaker: Dr. Taek Soo Kim

Vice President, Korea Institute of Industrial Technology (KITECH)

Dr. Taek Soo Kim is currently the Vice President of Korean Institute of Industrial Technology (KITECH). He has a Ph.D. in Metal Engineering from Chung Nam National University, South Korea, and Material Science and Engineering from Tohoku University, Japan. He was a Managing Director of Korea Institute for Rare Metals from 2010 to 2016, and Executive Managing Director of Research Institute of Advanced Manufacturing & Materials Technology in 2020. In 2022, he became the Vice President of KITECH, and Senior Vice President of The Korean Powder Metallurgy & Materials Institute. He is also contributing as a policy advisory committee member of the Ministry of National Defense since 2023.

Abstract:
Korea Institute of Industrial Technology (KITECH) is a distinctive government-funded research institute, operating under the Ministry of Science and ICT of the Republic of Korea. Since its establishment in 1989, KITECH has been unwavering in its commitment to driving national industrial growth by developing and applying manufacturing technologies and providing technological support for small and medium-sized enterprises.
As the manufacturing industry undergoes significant changes, KITECH has taken the lead in setting a new goal: to enhance the value of the manufacturing industry by spearheading the manufacturing paradigm shift. Our research and technology will guide manufacturing across the entire production chain, from customer-centric ideation to servitization. This will open the door for mass personalization of products, thereby maximizing the value of manufacturing.
At the forefront of the manufacturing paradigm shift, KITECH has outlined three key research directions on manufacturing technology:

1) Intelligence: by intelligentizing root technology, we will strategically respond to current and future industrial transformations
2) Human-centricity: Our R&D will reflect human needs and preferences for a better quality of life for all
3) Sustainability: Our research and technology will help utilize sustainable energy and overcome climate change through the digital production process

Our extensive history of collaboration with global partners makes us confident in our journey. KITECH has collaborated on more than 500 global R&D projects over the past decade with partners worldwide. KITECH has also built a team of global cooperation experts dedicated to strengthening our partnerships worldwide. KITECH operates four international offices in the US, China, Vietnam, and Indonesia.
Thanks to our global competence and proven track record, KITECH was designated as a 'National Collaboration Center' by the Ministry of Trade, Industry and Energy, and the one and only 'Global Convergence R&D Collaboration Center' by the Ministry of Science and ICT. These designations reflect the government's recognition of our capabilities and the pivotal role we play in the development of new joint projects with leading research institutes all over the world. KITECH now stands at the heart of global R&D for Korea as the control tower for joint R&D project development, a position that we are proud to hold and are committed to maintaining.

Sustainable International R&D Collaboration Summit

Speaker: Dr. Seogjoo Kim

Vice President, Korea Electrotechnology Research Institute (KERI)

Dr. Seogjoo Kim received his B.S., (Electrical Engineering in 1984), M.A (Electrical Engineering in 1986), and Ph.D. (Electrical & Electronic Engineering in 2007) degrees from Yonsei University, Seoul, Korea respectively. Since 1987, he has been with Korea Electrotechnology Research Institute(KERI), Changwon, Korea, where he is currently Vice President (Research) of KERI since 2023 January. From 2014 to 2017, he was Executive Director of Advanced Power Grid Research Division. In 2018, he was Executive Director of Electric Propulsion Research Division. From 2019 to 2021, he was Executive Director of Industry Applications Research Division. From 2021 to 2023, he also played the role as Executive Director of Electro-Medical Equipment Research Division. Dr. Kim also serves as Vice President of the Korean Institute of Electrical Engineers (KIEE).

Abstract:
Regarding the collaboration between the two countries, KERI has already shown the best practices for international partnerships since 2019. Most attendees probably heard of the AI project "Development and dissemination of models for generative manufacturing AI", which supports SMEs in Busan and Changwon in applying AI; it had begun before AI was allotted as one of the 12 National Strategic Technologies Roadmap. The project can be noted as a desirable example of sustainable cooperation that had begun as the joint research centre in the AI field at the very first stage, and now it has grown to its current state. Not only the project above, but KERI has also been cooperating with Canada (AKCSE) on the 12 National Strategic Technologies Roadmap, such as next-generation batteries and electric mobilities, by inviting competent researchers or professors from Canadian Universities utilising KERI's international research networks.

In addition, KERI holds the title of an NCC (National Collaboration Center / a project by the MOTIE to revitalise international cooperation in industrial technologies and systematic support for open innovation) project member. KERI has a powerful capability in some Korean National Strategic Technologies, especially in electrification areas and has participated in the project to make it even better. KERI aims to lead international joint R&D project planning and innovative technology R&D support to discover the demand for global cooperation and partner matching in next-generation batteries, electric mobilities, power semiconductors, electro-medical, etc. In the realm of the NCC, KERI has been formulating projects to cooperate with U.S. universities, for example, Purdue University and the University of North Texas (UNT)).

Furthermore, according to the recent policy direction to break down barriers between government-funded research institutes and universities, KERI is actively conceptualising cooperative models and projects with universities. Once these models are established, KERI is eager to extend our collaborative efforts to include universities in Canada. The potential for sustainable international cooperation between KERI and Canada is vast, extending beyond the pre-established collaboration areas. KERI is open and ready to explore and integrate additional fields that align with national policy and strategic objectives. To sum up, KERI is set to expand the scope of our partnership and value our potential partners in Canada.

Sustainable International R&D Collaboration Summit

Speaker: Dr. Tae-Yeol Kim

President & CEO, Busan IT Industry Promotion Agency (BIPA)

Dr. Tae Yeol Kim is the 10th President of the Busan IT Industry Promotion Agency (BIPA). BIPA is an affiliated organization of the Busan Metropolitan city that promotes the IT and CT industries. It operates various policy businesses in fields such as cloud computing, quantum technology, artificial intelligence (AI). He majored in public administration at Kwangwoon University, earning a master's degree in economics in 1999 and a Ph.D. in economics at Hanyang University in 2008. He previously held positions at the National IT Industry Promotion Agency (NIPA) as the head of the SW industry department (2015), the global growth department (2019), and the head of the information and communication industry department (2022). E-mail: tykim@busanit.or.kr

Abstract:

BIPA is the organization responsible for promoting the information and communications technology (ICT) and content industries in Busan Metropolitan City.

Currently, Busan is progressing towards becoming a “Global Hub City” based on openness and innovation. The city's traditional industries also need to pursue digital-based global industrialization. Starting this year, BIPA aims to lead the establishment of "Global Digital Attractive City Busan," where digital technology, human resources, and enterprises converge, contributing to the realization of Busan's vision as a global hub city. To achieve this, BIPA is strategically fostering Busan's digital industry through the following initiatives.

First, we are building and continuously expanding the infrastructure to attract global technology, human resources, and companies to Busan. We are operating 28 support facilities across Busan, including Digital innovation hub, Information protection cluster, Green data center complex, and Smart city lab, etc.

Second, we are focusing on promoting Busan’s digital new technologies and leading companies. Digital transformation using IT technologies is now essential not only for enhancing corporate competitiveness but also for survival. We are identifying key new technologies such as AI, Cloud computing, Metaverse, Information security, and Quantum technology. Additionally, we support technology development, validation, commercialization, consulting, and certification to integrate these technologies with traditional industries centered on services and manufacturing.

Through these efforts, regional industries will gain global competitiveness, which requires continuous global cooperation. By establishing global partnerships and strengthening investment, we aim to enable local and national enterprises to enter global markets. BIPA will work diligently alongside Busan City to achieve these goals and ask for your interest and cooperation. Thank you.

Sustainable International R&D Collaboration Summit

Speaker: Dr. Seung Chan Bang

President, Electronics and Telecommunications Research Institute (ETRI)

Dr. Bang, Seung Chan is a current president of the Electronics and Telecommunications Research Institute (ETRI), Korea. He obtained Ph.D., Master, and B.S. degrees from Seoul National University all in electronic engineering. He started his career as a senior researcher at Digicom in 1987 and joined ETRI in 1994, where he has been at the forefront of the telecommunications field serving in numerous R&D managing positions including, Wireless Transmission, Future Technology, Communication Media, etc. over the last 30 years. Dr. Bang has been actively participated various professional academic society activities and public consultations as well. He is a general member of National Academy Engineering of Korea (NAEK) since 2021 and served as a Vice Chairman of the Korea Institute of Communications and Information Science(KICS) from 2019 to 2021. Dr. Bang also share his expertise as a member of the Private Committee for Enhancing Competitiveness in Materials, Parts, and Equipment. Additionally, since 2024, Dr. Bang has been serving as the 19th chairman of the Daedeok Innopolis Association.

Abstract:

ETRI currently maintains an international collaboration network with 156 institutions across 42 countries, including Canada. As of now, 28 active MOUs have been established with foreign institutions. Each year, ETRI engages in an average of 5 multilateral and bilateral international cooperation projects, including initiatives such as Horizon Europe and Eureka. Furthermore, ETRI is involved in approximately 49 international R&D projects annually, encompassing joint research and outsourced research collaborations with foreign institutions.

To promote international R&D cooperation, ETRI operates a funding program and a cooperation promotion program utilizing its own resources. The funding program includes top-tier international collaboration research projects and matching fund support projects aimed at securing cutting-edge technologies and laying the foundation for global R&D alliances. The cooperation promotion program, known as the Internationalization Index Program, aims to enhance global competitiveness by establishing ETRI's internationalization indicators, diagnosing the current state of international cooperation, and promoting active international partnerships.

ETRI's strategic plans for sustainable international cooperation are as follows:

Expansion of Research Collaboration Centers: By redefining the roles of the America Research Cooperation Center and the Asia Research Cooperation Center, ETRI aims to expand their scope of work and restructure their duties to support essential international collaborations, thereby building an innovative R&D cooperation infrastructure.

Strengthening Global Network Capabilities: ETRI plans to co-host international conferences with prestigious foreign institutions and organize international events that invite foreign ambassadors in Korea and representatives from overseas institutions to ETRI, thus fostering its global network capabilities.

Sustainable International R&D Collaboration Summit

Speaker: Dr. Young Kuk Lee

President, Korea Research Institute of Chemical Technology (KRICT)

Dr. Young Kuk Lee currently serves as the President of Korea Research Institute of Chemical Technology (KRICT) in Daejeon, Korea. He earned his BS, MS and Ph.D. of Materials Science & Engineering from Seoul National University in 1985, 1987, and 1997, respectively. Dr. Lee joined KRICT in 1989 and has since worked as a principal researcher in the Advanced Material Division, until his appointment as President in March 2023. Between 2020 and 2022, he was seconded to the National Research Foundation of Korea (NRF) as the Project Manager for Materials & Device at the National Strategic R&D Program Directorate. Additionally, he has been an Advisory Member of the Presidential Advisory Council on Science & Technology since 2023 and has held the position of Industrial Vice President of the Korean Ceramic Society since 2020. In recognition of his contributions, he was awarded the Science and Technology Medal by the Minister of Science and ICT (MSIT) in 2020.

Abstract:
Korea Research Institute of Chemical Technology (KRICT), established in 1976, is a national research institute committed to advancing research and development in chemistry and related convergence technologies. Our mission is to increase competitiveness of chemical industry and contribute to solving national and societal challenges in Korea by providing state-of-the-art public infrastructure services.

KRICT focuses on five key research areas: environmentally friendly chemical process technology, high value-added chemical materials, innovative drug discovery and biotechnology, bio-based and green fine chemical materials, and chemical platform infrastructure. These areas are strategically chosen to align with both industry needs and societal demands.

Our institute consistently delivers significant research outcomes, with several technologies recognized annually as part of the Nation’s Top 100 R&D Achievements. Notable recent achievements include advancements in perovskite, secondary battery materials, carbon capture and utilization (CCU) technology, and COVID-19 vaccines.

In alignment with the national strategic technologies identified by the Korean government, KRICT prioritizes research in secondary batteries, CCU, and data-driven material research. While including these areas, we are also seeking to explore new global cooperation opportunities with talented researchers across all our research areas.

KRICT is committed to global collaboration, leveraging our exceptional expertise and technological capabilities. As a National Collaboration Center (NCC), designated by the Korean government, we partner with leading research institutes, academic institutions, and industries worldwide. Our objective is to expand our global network, foster technological partnerships, and undertake international R&D project.

Additionally, KRICT operates its own global R&D cooperation program, K-GRC, tailored to various levels of collaboration. This program aims to facilitate and enhance joint research initiatives with global partners. By utilizing K-GRC and engaging in global cooperation projects of other funding agencies, KRICT will support and encourage our researchers in international cooperation.

Sustainable International R&D Collaboration Summit

Speaker: Dr. Joonyeon Chang

Vice President, Korea Institute of Science and Technology (KIST)

Dr. Chang is currently Vice-President at KIST. He received a Ph.D. in the Department of Materials Science & Engineering from Yonsei University, Seoul, in 1998, preceded by an M.S. in Metallurgical Engineering in 1989 and a B.S. in the same field in 1987, both from Yonsei University as well. Since joining KIST in 1990, he has served as Director-General of the KIST Gangneung Institute of Natural Products (2020-2024), Director-General of the Post-Silicon Semiconductor Institute (PSI) (2015-2020), Head of the Spin Convergence Research Center (2011-2014), and Head of the KIST-MIT on-site lab, MIT, USA (2008-2011). He also performed post-doctoral research at UCLA from 2000 to 2002. His research interests lie primarily in the areas of spintronics, Nanoelectronic Devices, Nanomaterials. E-mail: presto@kist.re.kr

Abstract:

International R&D collaboration is currently increasing worldwide, as it is essential for finding effective solutions to global issues such as climate change. Simultaneously, the world is establishing a new order for international R&D collaboration by strengthening technological alliances centered on friendly nations that share common values. Recognizing the importance of international cooperative R&D, South Korea is prioritizing various initiatives to promote international joint R&D, such as improving related systems and significantly expanding budgets.

The Korea Institute of Science and Technology (KIST), as a representative research institute of South Korea, has conducted various international cooperative activities to achieve national mid- to long-term goals, such as securing strategic technologies and solving national and social challenges. Currently, KIST maintains research collaborations with over 80 foreign institutions and operates global units in countries like Germany, India, and the United States. Additionally, KIST has been operating a science and technology ODA project in Vietnam to support its growth by disseminating the institution's accumulated knowledge.

To maintain its position as an attractive partner for international cooperation, KIST is pursuing the following three strategies: (1) Implementing a mission-oriented R&D system, primarily operated by Program Managers (PMs), to focus on achieving national missions. (2) Enhancing cooperation systems with leading domestic and foreign institutions (e.g., universities, firms, and GRIs) to secure global frontier technologies in national strategic technology fields. (3) Clarifying the roles and visions of each global unit to strengthen its strategic international cooperation. KIST continues to strive to become a world-class research institute that contributes to the prosperity of human society and the nation's economic development.

Sustainable International R&D Collaboration Summit

Speaker: Dr. Bong-Ki Kim

Vice President, Korea Institute of Machinery and Materials (KIMM)

Dr. Kim is the Vice President of Korea Institute of Machinery and Materials (KIMM). He received his Ph.D. in Mechanical Engineering from the Korea Advanced Institute of Science and Technology (KAIST) in 1997. He has worked as a senior/principal researcher at KIMM since 2000, and has led the Department of System Dynamics until 2020. Before he became the Vice President, he served as the Director of the Mechanical Systems Safety Research Division, overseeing the researches on the large and complex mechanical systems using safety and reliability technologies at KIMM. Prior to joining KIMM, he has worked as a section chief at the Samsung Motors, Inc., as well as a project engineer at the Arvin- Meritor Industries Inc., USA. As a respected voice in the field of mechanical engineering, he has been recognized throughout his career for his contributions. In 2021, he received a Presidential Commendation for his contributions to Science and Technology Promotion within Korea, and in 2013, a Ministerial Commendation from the Ministry of Trade, Industry and Energy. E-mail: bkkim@kimm.re.kr

Abstract:

The Korea Institute of Machinery and Materials (KIMM) is a government-funded research institute under the Ministry of Science and ICT, specializes in Mechanical engineering. We were founded in 1976 as the Korea Test Institute of Machinery and Metals, and since then, KIMM has contributed in the growth of the Korean manufacturing industries as our chief mission is to make contributions to Korea and its industries by performing R&D on core technologies, commercialization, reliability test and evaluation in machinery and materials, leading the “K-Machine”.

Mainly we conduct R&D in these six major areas of mechanical engineering: autonomous manufacturing, nano-convergence manufacturing, carbon-neutral/eco-friendly energy and environment, AI robotics, and the virtual engineering platform. The field researchers have active collaborative work with world renowned institutes, companies and universities, and even with the governments, as part of the effort to achieve “With KIMM, to the World”.

Furthermore, KIMM has signed MoUs with the partners all over the globe, forming a comprehensive mechanical engineering global alliance network. KIMM also conducts average 5.8 international joint research projects per year, including the Canadian organizations such as NRC.

In order to sustain the ongoing international R&D cooperation, KIMM is pursuing three agendas: 1. sharing strategy/resources among partners, 2. forming and participating in the cooperation networks, and 3. making a one-team R&D response.

First, we are trying to establish the common ground between the cooperation partners. Finding the common interest and common goals between cooperation partners and forming a shared strategy ensures that the parties participating in the cooperation can both benefit in the long run. Then we could strengthen the bond with the sharing of parties’ resources throughout the cooperation, further enhancing the sustainability of the cooperation. Second, we are trying to form the cooperation networks around the globe. By building and participating in these cooperation networks, the participants can get the access to the new resources, fresh ideas, and the increased opportunities. The more we expand our network, more we can gain from the network around the globe. Lastly, we are trying to make a one-team R&D response. We can collaborate with different partners around the world; since we established the shared objectives and cooperation networks, we can deliver a one-team R&D outputs through joint research projects.

Sustainable International R&D Collaboration Summit

Speaker: Dr. Seong Ok Han

Vice President, Korea Institute of Energy Research (KIER)

Dr. Seong Ok Han, Vice President at the Korea Institute of Energy Research (KIER), received her Bachelor's, Master's, and Doctoral degrees in Chemistry from Ewha Womans University. A leading figure in energy material field, Dr. Han has dedicated nearly four decades to advancing energy technology. Her career includes significant leadership roles, such as President of the Korea Women Scientists and Engineers from 2014 to 2015 and serving as a non-executive director of the Institute for Basic Science (IBS) from 2021. Her commitment extends to her involvement in vital governmental committees, such as the Researcher Rights Protection Committee, etc. at the Ministry of Science and ICT, and her regular membership in the National Academy of Engineering of Korea (NAEK) reflects her significant contributions to science, technology and policy.

Abstract:

In response to the growing importance of economic and energy security alliances in science and technology, countries are increasingly achieving significant innovations through global collaborative research. Recognizing this trend, major nations are strengthening international collaboration in science and technology. The Korean government is actively promoting policies based on global open innovation to achieve ground-breaking results through close technological collaboration with key international partners. As a leading government-funded institution in the energy sector, the Korea Institute of Energy Research (KIER) leads clean energy research to address national energy security and carbon neutrality challenges. In alignment with the Korean government's policy to enhance international cooperation in science and technology, KIER has established strong networks with prominent energy organizations worldwide to foster trust and promote collaborative research.

One of the strong networks has been developed from the Korea-Canada Battery Supply Chain Workshop hosted by KIER, NRC and NRCan, which has been held annually since 2022. The strong network among the researchers has led to preparing a few proposals to develop advanced world-class battery technologies. Additionally, KIER collaborates with technologically advanced countries such as the United States, Germany, the United Kingdom, Denmark, and Japan on projects involving green hydrogen production, high-efficiency water electrolysis, energy storage solutions, and other carbon-neutral technologies.

KIER aims to develop innovative clean energy technologies and overcome global energy problems and the climate crisis by working closely with major countries worldwide through active international cooperation.

AI Forum with ETRI

Open Session

Time: 13:00–14:45, June 17 (Monday) Canada, Mountain Daylight Time (MDT)

Place: KC 201

Sponsor: Electronics and Telecommunications Research Institute (ETRI)

Organizer: Association of Korean-Canadian Scientists and Engineers (AKCSE)

Contact: Dr. Yong Hoon Kim, University of Windsor (kim523@uwindsor.ca)

Description: This technology forum co-hosted by ETRI and AKCSE aims to bring together experts from Korea and Canada to discuss about advancement in Artificial Intelligence and explore potential collaboration opportunities.

Program:

Time	Place	Topic	Speaker	Affiliation
13:00–13:05	KC 201	Opening remark	Dr. Seung Chan Bang	ETRI
13:05–13:35		Keynote speech	Dr. Randy Goebel	University of Alberta
13:35–13:49		The effect of wildfire suppression resources: targeting fire groups with enhanced treatment effect using machine learning	Dr. Ilbin Lee	University of Alberta
13:49–14:03		Applications of Artificial Intelligence in Enhancing Urban Infrastructure Intelligence	Dr. Kwang-ju Kim	ETRI
14:03–14:17		Privacy guarantee in AI through efficient differential privacy with hardware generated noise	Dr. Seokbum Ko	Univ. of Saskatchewan
14:17–14:31		An Introduction of Southwest Research Institute and Its R&D Activity in Robotics and Artificial Intelligence	Dr. Shinhyuk Michael Joo	Southwest Research Institute
14:31–14:45		Deep Learning-based Dynamic Covariance Prediction in Pose Graph for Ultra-Wideband-Aided UAV Positioning	Dr. Gunho Shon	York University

List of Participants:

Name	Position	Affiliation
Dr. Yong Hoon Kim	Professor	University of Windsor
Dr. Seung Chan Bang	President	Electronics and Telecommunications Research Institute (ETRI)
Dr. Randy Goebel	Professor/Fellow	University of Alberta/Alberta Machine Intelligence Institute (Amii)
Dr. Ilbin Lee	Professor	University of Alberta
Dr. Kwang-ju Kim	Senior Researcher	ETRI
Dr. Seokbum Ko	Professor	University of Saskatchewan
Dr. Shinhyuk Michael Joo	Senior program manager	Southwest Research Institute
Dr. Gunho Shon	Professor	York University

AI Forum with ETRI

Chair: Dr. Yong Hoon Kim

Associate Professor, University of Windsor

Dr. Yong Hoon Kim is an Associate Professor of Civil and Environmental Engineering at the University of Windsor. Dr. Kim has received the B.S. and M.S. degrees in transportation from the University of Seoul, Seoul, Korea, in 2003 and 2006, respectively, and Ph.D. degree in Civil Engineering from Purdue University, West Lafayette, IN, USA, in 2017. He worked for two and a half years at the Seoul Institute in Korea as a research engineer. He also worked a Research Associate with the NEXTRANS Center, Purdue University. His research interests include Intelligent Transportation System, connected and autonomous vehicle technology, data analytics for connected transportation system, artificial intelligence for connected and autonomous vehicle applications, and traffic safety.

AI Forum with ETRI

Speaker: Dr. Randy Goebel

Professor of Computing Science, Fellow and Co-Founder, Alberta Machine Intelligence Institute (Amii), University of Alberta

R.G. (Randy) Goebel is currently professor of Computing Science in the Department of Computing Science, adjunct Professor in the Department of Medicine in the Faculty of Medicine and Dentistry, at the University of Alberta. He is also Fellow and co-founder of the Alberta Machine Intelligence Institute (Amii).
Professor Goebel's theoretical work on abductive and hypothetical reasoning and belief revision is well known, as is his work on explainable artificial intelligence (XAI), especially for applications in autonomous driving, legal reasoning, and precision health. He has worked on optimization, algorithm complexity, systems biology, natural language processing, and automated reasoning.
Randy has previously held faculty appointments at the University of Waterloo, University of Tokyo, Multimedia University (Kuala Lumpur), Hokkaido University (Sapporo), visiting researcher engagements at National Institute of Informatics (Tokyo), DFKI (Germany), and NICTA (Australia); he is actively involved in collaborative research projects in Canada, Japan, Germany, France, the UK, and China.

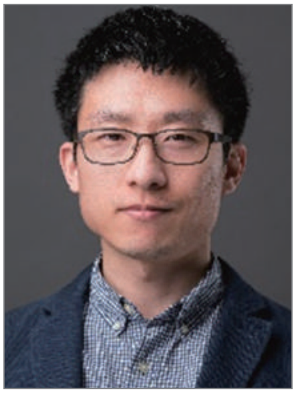
Why Artificial Intelligence needs an integrative framework for neurosymbolic foundational representations

Randy Goebel

Professor, Department of Computing Science, Fellow and co-Founder, Alberta Machine Intelligence Institute, University of Alberta, rgoebel@ualberta.ca

The rapidly evolving landscape of artificial intelligence (AI) activities is in a phase where scientific principles and related challenges are disguised within almost daily technical missives about everything from predictions on near immediate artificial general intelligence (AGI), massive skepticism about accelerating generation and dissemination of misinformation, and urgency of public regulatory constraints to control dual use AI.
Within this context, the definition and role of so-called "foundation models" seems important, but the emergent scientific challenges are often ignored. One such challenge is the emergent need for understanding foundation representation components within a not yet fully defined framework of neurosymbolic methods.
We provide one sketch of a neurosymbolic framework, and consider what scientific challenges emerge for an integration of methods within that framework. This involves not only becoming more agnostic about competing representation methods (e.g., varieties of machine learning), but the consideration of foundational challenges in moving toward an integrative science of AI.
We argue that there are some necessary components of this integration, including the requirement that all such methods explicitly address the need to develop representation theories that support evaluable methods of explainability

AI Forum with ETRI



Speaker: Dr. Ilbin Lee
Assistant Professor, University of Alberta

Dr. Ilbin Lee is an Assistant Professor at the University of Alberta in Accounting and Business Analytics, where he conducts research and teaches courses on operations management and business analytics. He applies machine learning and statistical techniques to derive useful implications from data in wildfire and health applications. His research interests also include decision-making under uncertainty based on data and prediction. He obtained his PhD in Industrial and Operations Engineering at the University of Michigan. Before his PhD, he worked as a software researcher developing speech recognition and machine learning applications.

The effect of wildfire suppression resources: Targeting fire groups with enhanced treatment effect using machine learning

Mostafa Rezaei[1], Ilbin Lee[2,*], Jen Beverly[3]

[1]*Information and Operations Management, ESCP Business School, Paris, France*
[2]*Accounting and Business Analytics, University of Alberta, AB, Canada*
[3]*Faculty of Agricultural, Life and Environmental Sciences, University of Alberta, AB, Canada*

Wildfires can cause profound economic and social costs, as evidenced by recent destructive fires in the United States, Australia, and Canada. The initial response to a newly reported fire is critical for ensuring that fires are limited to small sizes. However, the impact of the initial response decisions on suppression success has been largely unstudied. We estimate the causal effect of dispatched resources on initial attack (IA) success. We identify heterogeneous treatment effects in different fire groups to improve resource allocation. We first categorize historical fires into groups with varying levels of difficulty. For each group, we estimate the treatment effect of suppression resources by estimating a dose response function. Our results show that the IA success rate can be improved by using more resources for fires with “mid-level” difficulty. In contrast, the effects of resources on the two extremes (the easiest and the hardest group) are inconclusive. Moreover, we provide a machine learning model predicting whether a new fire belongs to the “mid-level” group. By a simulation experiment, we demonstrate that our results and the prediction model can be used to improve IA operations. Our results provide insight into conditions under which a certain resource is most effective, which can be used to inform dispatching decisions, strategic assessments of target resource levels, and how to allocate limited fire management budgets. To our knowledge, this is the first study to estimate the effect of dispatched resources on wildfire suppression success using treatment effect estimation techniques.
*Corresponding author; E-mail ilbin@ualberta.ca

AI Forum with ETRI

Speaker: Dr. Kwang-Ju Kim

Director/Senior Researcher, Electronics and Telecommunications Research Institute

Kwang-Ju Kim (Member, IEEE) received the B.S. degree in electronics engineering from Kyungpook National University (KNU), Daegu, South Korea, in 2010, the M.S. degree in electrical engineering from the Pohang Institute of Science and Technology (POSTECH), Pohang, South Korea, in 2013, and the Ph.D. degree in electronics engineering from KNU in 2020. From 2013 to 2015, he was a Researcher with General Electric Ultrasound Korea (GEUK). Since 2015, he has been with the Electronics and Telecommunications Research Institute (ETRI). His major research interests include computer vision, pattern recognition, and video surveillance. E-mail: kwangju@etri.re.kr

Applications of Artificial Intelligence in Enhancing Urban Infrastructure Intelligence

Kwang-Ju Kim, Woo-Jin Byun

Daegu-Gyeongbuk Research Division, Electronics and Telecommunications Research Institute (ETRI), Daegu 42994, South Korea

The integration of artificial intelligence (AI) into urban infrastructure has immense potential for revolutionizing city management, enhancing efficiency, and improving the quality of life for urban residents. This paper explores the application of AI in urban infrastructure intelligence, focusing on two primary areas: video-based traffic infrastructure intelligence and digital twin-based water supply network management. The first focus area is the development of video-based traffic infrastructure intelligence technologies. These technologies include smart parking systems, anomaly detection on roadways, and License Plate Recognition (LPR) systems. Smart parking systems utilize AI to monitor and manage parking availability in real-time, reducing congestion and improving parking efficiency. Anomaly detection systems employ video analytics to identify and respond to abnormal or hazardous conditions on roads, thereby enhancing safety and traffic flow. LPR systems leverage AI to automate vehicle identification and management, facilitating traffic enforcement and access control. The second focus area is the implementation of digital twin-based water supply network management technologies. Digital twin technology creates a virtual replica of the physical water supply network, enabling real-time monitoring and predictive maintenance. AI algorithms are applied to detect leaks, monitor water quality, and identify water hammer events, ensuring the integrity and reliability of the water supply system. This proactive approach minimizes water loss, enhances public health safety, and optimizes resource management. Thus, this presentation highlights the transformative impact of AI on urban infrastructure, demonstrating benefits such as increased operational efficiency, improved safety, and sustainable resource management. These findings underscore the necessity of continued research and investment in AI technologies to address the evolving challenges of urbanization and to foster the development of smarter, more resilient cities.

*Corresponding author; E-mail: kwnagju@etri.re.kr

AI Forum with ETRI

Speaker: Dr. Seok-Bum Ko

Professor, Department of Electrical and Computer Engineering, University of Saskatchewan
Professor, Division of Biomedical Engineering, University of Saskatchewan

Seokbum Ko is currently a Professor at the Department of Electrical and Computer Engineering and the Division of Biomedical Engineering, University of Saskatchewan, Canada. He received his PhD from the University of Rhode Island, USA in 2002. His areas of research interest include computer architecture/arithmetic, efficient hardware implementation of compute-intensive applications, deep learning processor architecture and biomedical engineering. He is an IEEE Cicuits and Systems Society Distinguished Lecturer (2024-2025), a senior member of IEEE circuits and systems society and an associate editor for IEEE TVLSI, IEEE TCAS-II, IEEE Access and IET Computers & Digital Techniques. He is an active member of IEEE CAS Technical Committee, IEEE P3109, IEEE754-2029, IEEE Domain-Specific Accelerators Standarads Committee and IEEE Emerging Processor Systems Standards Committee. He was an associate editor for IEEE TCASI (2019-2021). E-mail: seokbum.ko@usask.ca

Privacy guarantee in AI through efficient Differential Privacy with hardware generated noise

Muhammad Hamis Haider[1], and Seokbum Ko[1]

[1]*Department Electrical and Computer Engineering, Univ. of Saskatchewan, SK, Canada*

Differential Privacy (DP) has emerged as a pivotal concept in addressing modern privacy concerns, notably in sensitive domains like healthcare and finance. However, the adoption of DP in federated learning and reinforcement learning scenarios faces hurdles due to the computational complexities associated with noise insertion during training phase in the optimizer of the neural network. Thus, DP significantly extends the training times, rendering DP-based models less practical for real-world applications. To mitigate these challenges, this research explores the potential of approximate computing as a bridging mechanism between DP and federated/reinforcement learning paradigms. Approximate computing techniques offer a trade-off between computational accuracy and efficiency, aligning well with the demands of privacy-preserving machine learning as an alternative to the traditional noise functions such as Gaussian or Laplacian noise. By leveraging approximate computing hardware capable of seamlessly integrating HW-based noise insertion into DP networks, the computational overhead of DP-enabled training can potentially be notably reduced. This approach streamlines the training process, making DP more feasible and scalable for widespread adoption. The study aims to demonstrate a substantial reduction in computation overhead, thereby enhancing the efficiency and accessibility of DP-enabled learning frameworks. Ultimately, these advancements contribute to bolstering consumer privacy in artificial intelligence applications across diverse sectors, paving the way for more secure and trustworthy data-driven decision-making processes.
*Corresponding author; E-mail seokbum.ko@ usask.ca

AI Forum with ETRI

Speaker: Dr. Shinhyuk Michael Joo

Senior Program Manager, Southwest Research Institute

Dr. Joo's formal training is in the general area of Mechanical Engineering, with specialization in Engine Research, Combustion Systems, Laser Diagnosis through his education at Yonsei University from BS to Ph.D. Dr. Joo joined Southwest Research Institute in July 2005, in the Advanced Combustion Research Group, Department of Engine Research. He has been actively involved in the high efficiency combustion engine R&D projects including dual fuel, alternative fuel, hydrogen fuel combustion engines. Dr. Joo took a responsibility of representing SwRI in Korean market in 2008. Dr. Joo is responsible of business development and customer relationship in Korea, Japan and Chinese market since 2015. E-mail: shin.joo@swri.org

An Introduction of Southwest Research Institute and Its R&D Activity in Robotics and Artificial Intelligence

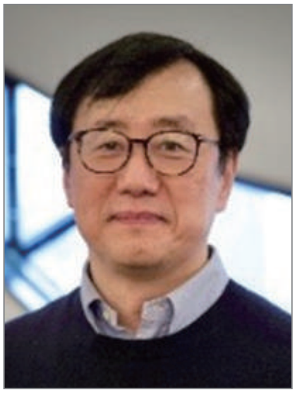
Shinhyuk Michael Joo[1], Douglas Brooks[2]

[1]*Advanced Propulsion System Department, Southwest Research Institute, San Antonio, Tx, USA*
[2]*Artificial Intelligence Department, Southwest Research Institute, San Antonio, Tx, USA*

Southwest Research Institute (SwRI), headquartered in San Antonio, Texas, USA. It is an independent and nonprofit applied research and development (R&D) organization founded in 1947. It provides contract research and development services to government and industrial clients. For more than 75 years, Southwest Research Institute has addressed challenges from deep sea to deep space and everywhere in between.

The institute's headquarters occupy more than 214,000 m2 of office and laboratory space on more than 6,070,000 m2 in San Antonio. SwRI has technical offices and laboratories in Boulder, Colorado; Ann Arbor, Michigan; Warner-Robins, Georgia; Ogden, Utah; Oklahoma City, Oklahoma; Rockville, Maryland; Minneapolis, Minnesota; Beijing, China; and other locations. More than 4,000 projects are active at the institute at any given time. These projects are funded between the government and commercial sectors. At the close of fiscal year 2023, the staff numbered approximately 3,200 employees and research volume was nearly $726 million. SwRI's research expertise are broad including 'Automotive & Transportation', 'Biomedical & Health', 'Chemistry & Materials', 'Defense & Security', 'Earth & Space', 'Electronics & Automation', 'Energy &Environment', 'Manufacturing& Construction'. Among the R&D areas, Robotics and Artificial Intelligence R&D activities are briefed in this presentation. Robotics and Artificial Intelligence R&D at SwRI is focused around 9 distinct Program Areas. These program areas define groups of customers, or markets, where our novel technology offerings are in use worldwide. 1. Connected-Automated Vehicles (CAV) 2. Defense Ground Vehicle Robotics (DGVR) 3. Fabrication Robotics (FR) 4. Food and Agriculture Automation (FAA) 5. Inspection/Service Robotics (ISR) 6. Maritime/Naval Robotics (MNR) 7. Medical AI (MAI) 8. Predictive Tracking and Performance Optimization (PTPO) 9. Space Robotics (SR)

AI Forum with ETRI



Speaker: Dr. Gunho Sohn

Professor, York University

Professor Gunho Sohn, Associate Professor of Geomatics engineering and Chair, Department of Earth and Space Science and Engineering at York University, stands at the forefront of smart mobility research, blending administrative acumen with pioneering scientific inquiry. As the inaugural director of the Mobility Innovation Centre (MOVE) and a leader in computer vision and photogrammetry, he is lauded for his contributions to urban digital twinning and smart mobility solutions. Professor Gunho Sohn distinguishes himself in smart mobility with a h-index of 30 and 5,255 citations across over 150 publications. His impactful work in autonomous vehicles and digital twinning, strengthened by strategic collaborations with entities like CFI, ORF and NSERC CREATE, has been recognized with the York University Research Leader Award twice and the PEO York Chapter Engineering Project of the Year Award, underscoring his innovation in urban mobility solutions. Leading a team with 10 co-applicants and collaborators, Professor Sohn aims to leverage his extensive experience in mobility research to design a research training program centered on the advanced applications of smart mobility.

OrbitNet: Advanced 2D Keypoint-Based Detection and Tracking of LEO Resident Space Objects Using Deep Convolutional Neural Network

Gunho Sohn[1,*], Yeonjeon Jeong, Mishal Vellani, Randa Qashoa, Regina Lee[1]

[1]Department of Earth and Space Science and Engineering, Lassonde School of Engineering, York University, 4700 Keele Street, Toronto, ON M3J 1P3, Canada

Maintaining situational awareness in Low Earth Orbit (LEO) amidst burgeoning space exploration and satellite deployment demands advanced tracking solutions. OrbitNet, a novel algorithm, employs deep convolutional neural networks (DCNNs) for Resident Space Object (RSO) monitoring, enhancing accuracy and efficiency. Inspired by CenterPointNet, OrbitNet utilizes 2D imagery for dynamic RSO tracking, offering a streamlined alternative to traditional methods. OrbitNet employs DCNN to predict RSO velocities, enabling precise tracking through temporal sequence analysis. By merging image features from previous frames, it estimates velocity with high accuracy, supervised by L1 loss. During inference, negative velocity projection connects current detections with past ones, ensuring robust object tracking over time. A failsafe retains unmatched tracks for a set period, enhancing continuity.

Notably, OrbitNet incorporates a lightweight point-feature extractor, outperforming center-feature-based methods and enabling detailed feature extraction even when object centers are obscured. This refinement mechanism ensures accurate localization and tracking, overcoming challenges of 2D imagery in space object detection. OrbitNet's methodology showcases DCNN's potential in space situational awareness advancement. With advanced keypoint detection and tracking refinements, it exceeds prior standards, offering an efficient solution for managing complex space traffic. This research contributes significantly to space safety and sustainability, underlining the pivotal role of technological innovation in securing the future of space exploration and satellite operations.

*Corresponding author; E-mail gsohn@yorku.ca

Quantum Technologies Forum

Open Session

Time: 13:00–14:45, June 17 (Monday) Canada, Mountain Daylight Time (MDT)

Place: KC 205

Sponsor: Busan Metropolitan City

Organizer: Busan Metropolitan City and Association of Korean-Canadian Scientists and Engineers (AKCSE)

Contact: Dr. Keun Su Kim, National Research Council Canada (KeunSu.Kim@nrc-cnrc.gc.ca)

Description: This technology forum co-hosted by the Busan Metropolitan City and AKCSE aims to bring together experts from Korea and Canada to discuss advancement in quantum technology and explore potential collaboration opportunities.

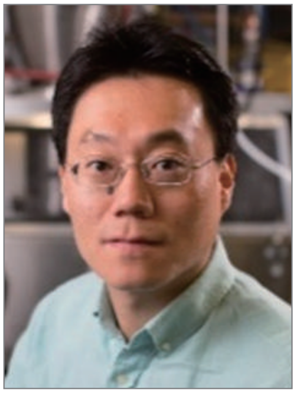
Program:

Time	Place	Topic	Speaker	Affiliation
13:00–13:05	KC 205	Opening Remarks	Dr. Keun Su Kim	National Research Council Canada (NRC)
13:05–13:30		Quantum Technology Policy in Korea	Na-young Chung	Busan Metropolitan City
13:30–13:55		Canadian Strengths and Interests in Quantum S&T	Dr. Peter Mason	NRC
13:55–14:20		Diamond Photonics: Sculpting Resonators for Light and Sound	Dr. Paul Barclay	University of Calgary
14:20–14:45		Quantum Approach to Industrial Problems: Protein Prediction and Operations of the Busan Port Terminal	Dr. Joonwoo Bae	Korea Advanced Institute of Science and Technology (KAIST)

List of Participants:

Name	Position	Affiliation
Dr. Keun Su Kim	Senior Research Officer	Quantum and Nanotechnologies Research Centre, NRC
Na-young Chung	Director of the AISW Division	Busan Metropolitan City
Dr. Peter Mason	Director General	Quantum and Nanotechnologies Research Centre, NRC
Dr. Paul Barclay	Professor	Department of Physics and Astronomy, University of Calgary
Dr. Joonwoo Bae	Professor	School of Electrical Engineering & Graduate School of Quantum Science and Technology, KAIST

Quantum Technologies Forum



Chair: Dr. Keun Su Kim

Senior Research Officer, Quantum and Nanotechnologies Research Centre, National Research Council of Canada

Dr. Kim is a Senior Research Officer at the National Research Council Canada and an Adjunct Professor at the Department of Mechanical Engineering, University of Toronto. He received his Ph.D. degree in Nuclear Engineering from Seoul National University in 2005. With growing interest in energy, materials, and the environment, his research interest has focused on the development of new plasma technologies for renewable energy production, advanced nanomaterial synthesis, and thermo-chemical conversion of low-valued materials into value-added materials. In 2009, he joined in NRC and has been working on the synthesis of low-dimensional nanomaterials including carbon and boron nitride nanotubes. Recently his research has been expanded to synthesis of multi-element nanoparticles (e.g., high-entropy alloy nanoparticles) as well as low-temperature plasma processing for surface treatment. Email: KeunSu.Kim@nrc-cnrc.gc.ca

Quantum Technologies Forum

Speaker: Na-young Chung
Director, Busan Metropolitan City

Chung Na-young is the director of the AISW Division in Busan Metropolitan City. Her role is to help develop digital enterprises, universities and research institutes through R&D in various high-tech fields such as AI, Quantum, Cloud, Metaverse, Information protection, Smart City, etc. She majored in computer science from Yonsei University in South Korea in 2001. She held a Master's degree in Public Administration from York University in the UK in 2017 and she completed a Ph.D. course in technology administration from Yonsei University in South Korea in 2021. E-mail: hsmile73@korea.kr / happysmile2y@naver.com

Quantum Technology Policy in Korea

Na-young Chung

Director of the AISW Division in Busan Metropolitan City, Busan, Korea

In Korea, various policies are being pursued at the government level with a lot of interest in quantum technology, and the Ministry of Science and ICT has enacted the Quantum Technology Industry Act and recently announced a quantum initiative containing nine key technologies and four strategies. Many local governments, including Busan, Seoul, and Daejeon, are making great efforts to incorporate quantum technology into local industries, such as enacting ordinances and forming dedicated teams. Busan is providing a lot of support to create an ecosystem for the quantum information technology industry through various methods such as forming an advisory committee, holding a forum, fostering bilateral human resources, fostering companies, and carrying out state-funded tasks.
E-mail: hsmile73@korea.kr / happysmile2y@naver.com

Quantum Technologies Forum

Speaker: Dr. Peter Mason

Director General, Quantum and Nanotechnologies Research Centre, National Research Council of Canada

Dr. Peter C. Mason is the Director General of the Quantum and Nanotechnologies Research Centre. He joined the NRC in 2020 to develop and lead the Quantum Sensors Challenge program. Under his leadership, the program has become highly visible and valued within the Canadian quantum science and technology community. Peter began his career as an assistant professor at Mount Allison University, where he taught introductory physics and senior-level quantum mechanics. He then worked as a product research scientist in photonics at JDS Uniphase Corporation, in Ottawa. Peter spent 17 years with Defence Research and Development Canada (DRDC), where he established himself as a leading defence research scientist and scientific leader. In 2014, he transitioned to science management and held several positions before being appointed DRDC's Chief Scientist. During his tenure, he published over 50 peer-reviewed papers and led award-winning international collaborative scientific projects. While at DRDC, Peter was also an adjunct professor at the University of Ottawa and the University of Ontario Institute of Technology. Peter has been recognized with awards for outstanding scientific achievement, strong leadership and creative management, and for promoting a healthy workplace environment. He holds a Joint Honours Bachelor of Science degree in mathematics and physics from Mount Allison University, and an M.Sc. and PhD in physics from McMaster University. He also completed a postdoctoral fellowship at the National Research Council of Canada's Steacie Institute for Molecular Sciences. Beyond his professional accomplishments, he is known for his community leadership, particularly for his advocacy of cycling as an alternative means of transportation, for which he received the Bruce Timmermans Cycling Award. He also coaches the Ottawa Bicycle Club's mountain biking Youth Racing Team. E-mail Peter.Mason@nrc-cnrc.gc.ca

Canadian Strengths and Interests in Quantum S&T

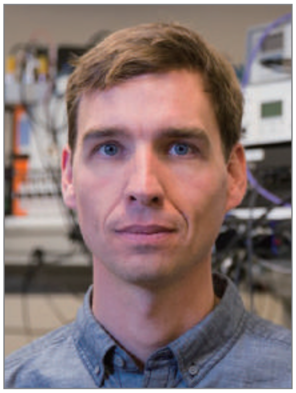
Peter Mason

Quantum and Nanotechnologies Research Centre, National Research Council of Canada

There are revolutionary technologies based on harnessing targeted, microscopic properties and interactions of light and matter, which can only be described and understood by the laws of quantum physics. This talk will review some familiar examples, highlight some of the results of Canadian investment in Quantum S&T, situate current Canadian policies, and discuss some of the capabilities of the National Research Council of Canada. Some ideas for potential future directions will be put forward.

*Corresponding author; E-mail Peter.Mason@nrc-cnrc.gc.ca

Quantum Technologies Forum



Speaker: Dr. Paul Barclay

University of Calgary Research Excellence Chair in Quantum Nanophotonics

Paul Barclay completed his Ph.D. in Applied Physics at the California Institute of Technology in 2007, where he performed early experiments in nonlinear optics with high-Q silicon photonic crystal cavities. In 2008 he joined Hewlett Packard Labs, in Palo Alto, California, where he helped establish the emerging field of diamond quantum nanophotonics. Since starting his lab as a member of the Institute for Quantum Science and Technology (IQST) at the University of Calgary 2011, he has performed pioneering research in the field of diamond photonics and optomechanics, and in nanophotonic sensor development. Techniques developed by his lab have been adopted by many of the world's leading quantum photonics research groups. His research impact was recognized in 2019 by the Herzberg Medal for early career researchers from the Canadian Association of Physicists, and in 2017 by an NSERC Discovery Accelerator award. He is a University of Calgary Research Excellence Chair in Quantum Nanophotonics, is an Optica Fellow, is the Scientific Lead of the qLab nanofabrication facility under development as part of the University of Calgary Quantum City initiative and is currently the Director of IQST. E-mail pbarclay@ucalgary.ca

Diamond Photonics: Sculpting Resonators for Light and Sound

Paul E. Barclay[1]

[1]*Department of Physics and Astronomy, University of Calgary, AB, Canada*

The exceptional physical properties of diamond make it an ideal material for creating optomechanical devices that combine optical and mechanical resonators. These devices allow light to be strongly coupled to mechanical resonator motion, and vice versa, opening the door to new technologies for information processing and sensing. These opportunities are particularly rich for diamond based optomechanical devices: this material is the foundation for many quantum technologies enabled by impurities in the diamond crystal lattice that can behave like artificial atoms or qubits. My group has developed the ability to not only create diamond optomechanical devices, but also to use them to control the quantum properties of diamond defects. In my presentation I will review the challenges that needed to be overcome to fabricate nanoscale photonic and nanomechanical structures from diamond, and present recent progress in using diamond optomechanical devices to control ultrahigh frequency (12 GHz) mechanical resonators.

*Corresponding author; E-mail pbarclay@ucalgary.ca

Quantum Technologies Forum

Speaker: Dr. Joonwoo Bae

Professor, KAIST

Dr. Bae received his Ph.D. from Universitat de Barcelona in 2007 while preparing his thesis titled 'Entanglement and Quantum Cryptography' at the ICFO-the Institute of Photonic Sciences. He is currently an Associate Professor at the Korea Institute of Science and Technology (KAIST). He is also a member of the Korea Academy of Science and Technology (KAST). The field of specialization is Quantum Information Theory which investigates information processing at the most fundamental level and finds its practical applications to information technologies. He has authored more than 60 publications in international journals of Physics, Mathematics, and Electrical Engineering and, in particular, is known as a solver of the 22nd open problem in quantum information theory. He is a recipient of the Marie-Sklodowska-Curie fellowship in 2014, and a FRIAS alumni fellowship in 2017. He has earned Outstanding Reviewer Award and Trusted Reviewer Award from the Institute of Physics in 2022. He serves as an Editorial Board Member of the New Journal of Physics. E-mail joonwoo.bae@kaist.ac.kr

Quantum Approach to Industrial Problems: Protein Prediction and Operations of the Busan Port Terminal

Joonwoo Bae[1,2]*

[1]School of Electrical Engineering, and [2]Graduate School of Quantum Science and Technology, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea

Quantum information processing may show more efficient computation and achieve higher security in cryptographic protocols beyond the limitations of present-day technologies. However, the currently available quantum systems, dubbed noisy-intermediate-scale-quantum (NISQ) technologies, still need to meet the criteria for the above-mentioned quantum advantages since errors that may occur in the execution of quantum information processing are not entirely under control. I present and discuss quantum software approaches to deal with NISQ systems to achieve quantum advantages in a realistic scenario. I then present the ongoing efforts with NISQ technologies, firstly, on the protein structure prediction toward the quantum-based approach to develop designing novel anticancer drugs, and secondly, on the logistics optimization problem in operations of the Busan Port Terminal. Both problems share it common to exploit quadratic binary optimization. I also show the state-of-the-art techniques for dealing with quantum noise in the NISQ era.

*Corresponding author; E-mail joonwoo.bae@kaist.ac.kr

KITECH-AKCSE International Joint Research Proposal Presentation

Invitation Only

Time: 13:30–15:00, June 17 (Monday) Canada, Mountain Daylight Time (MDT)

Place: KC 206

Sponsor: Korea Institute of Industrial Technology (KITECH)

Organizer: KITECH and Association of Korean-Canadian Scientists and Engineers (AKCSE)

Contact: Dr. Simon Park, University of Calgary (simon.park@ucalgary.ca) / Chair: Gun Yeol Bae, KITECH

Description: This session is to discuss joint research proposals between KITECH and AKSCE members

Program:

Time	Place	Topic	Speaker	Affiliation
13:30–13:45	KC 206	Opening Remarks	Gun Yeol Bae Dr. Taksu Kim Dr. Seonghwan Kim	KITECH (Chair) KITECH VP AKCSE President
13:45–13:55		Photo Time		
13:55–14:10		Development of Dry Electrode Manufacturing Equipment for All-Solid-State Batteries	Dr. Jaehak Lee Dr. Simon Park	KITECH University of Calgary
14:10–14:15		Revolutionizing Aluminum Die-Casting with Advanced AI: from Vision Based Deburring to Optimal Tool Paths	Dr. Hongin Won	KITECH
14:15–14:20		Synthesis and Characterization of model nanoscale material systems for electrocatalysis application	Dr. Yongwook Choi	KITECH
14:20–14:25		Development of Robotic System for Automatic Material Removal of Metal Parts	Dr. Jihyun Lee	University of Calgary
14:25–14:30		Active Visuo-Tactile Integration for Robotic Assembly and Inspection	Dr. Soo Jeon	University of Waterloo
14:30–14:35		Lightweighting of next-generation mobility systems using CFRP (carbon fiber reinforced polymer)	Dr. Il Yong Kim	Queens University
14:35–14:40		Electrochemical Recycling of Precious Group Metal Catalysts from Spent Fuel Cells	Dr. ChungHyuk Lee	Toronto Metro University
14:40–14:45		A Comprehensive Framework for Fabricating Porous Materials in Water Electrolyzers	Dr. Jason Keonhag Lee	University of Victoria
14:45–14:50		Development of basic technology for improving properties and functionality of recycled polymers by laser-induced graphene	Dr. Patrick Lee	University of Toronto
14:50–14:55		Development and Application of Low-cost Colorimetric Gas Sensors	Dr. Hyojick Choi	University of Alberta
14:55–15:00		Development of additive manufacturing (AM) technology and assessment of gas turbine components for hydrogen turbine applications	Dr. Dongyi Seo	NRC
15:00–15:05		Closing	Dr. Taksu Kim	KITECH VP

KITECH-AKCSE International Joint Research Proposal Presentation

Chair: Gun Yeol Bae

Chief Officer, Korea Institute of Industrial Technology, Korea

Gunyeol Bae joined Korea Institute of Industrial Technology in 2003, and has been serving as the Chief Officer of Global Innovation Office since 2023. He holds a master's degree in technology management from Koreatech and is a certified management consultant and technology transfer agent. He served as the head of the Indonesia Office of KITECH from 2020 to 2023, where he led KITECH's international cooperation in South East Asia, facilitating more than 20 international technology exchanges and developing more than 40 international joint projects. Currently, he manages several international projects of the Ministry of Science and ICT and the Ministry of Trade, Industry and Energy of Korea, serving as the control tower for global science and technology cooperation of KITECH.

KITECH-AKCSE International Joint Research Proposal Presentation

Speaker: Dr. Jaehak Lee

Senior Researcher, Korea Institute of Industrial Technology, Korea

Dr. Jaehak Lee is a Senior Researcher at the Korea Institute of Industrial Technology since 2019. He earned both his Bachelor's and Ph.D. degrees from KAIST (Korea Advanced Institute of Science and Technology), in 2012 and 2018, respectively. From 2018 to 2019, he served as a senior researcher at Samsung Electronics' Semiconductor R&D Center, where he was involved in the development of dry etchers for flash memory production. His primary research areas include semiconductor and battery equipment design, battery electrode structure design and manufacturing process development, as well as the simulation and automation of machine tools and collaborative robotic processes. He has published 7 international papers and registered over 10 patents. Additionally, Dr. Lee currently serves as a board member of the Machine Tool Division at the Korean Society of Precision Engineering. He has also received the Young Engineer Award and Best Paper Presentation Award from the Korean Society of Precision Engineering (KSPE) and the Korean Society of Manufacturing Technology (KSMTE). E-mail ljh1125@kitech.re.kr

Development of Electrode Structures and Manufacturing Technologies for Eco-Friendly Battery Production

Jaehak Lee[1], *, Jae Young Seok[2]

[1]*Autonomous Manufacturing & Process R&D Department, Korea Institute of Industrial Technology*
[2]*Department of Mechanical System Design Engineering, Seoul National University of Science and Technology*

Due to the rapid global increase in the adoption of smart devices and electric vehicles, the demand for batteries required for these technologies is also growing significantly. Currently, batteries are manufactured by creating a slurry of electrode materials in NMP (N-Methyl-2-Pyrrolidone) solvent, which is then coated onto copper or aluminum current collector and dried. NMP has been widely used not only in the battery sector but also in various industries such as petrochemicals, semiconductors, dyes, and paints due to its high solvency for diverse materials. However, recent studies have shown that NMP can be absorbed through human skin and irritate the lungs and respiratory system. It is particularly harmful to children as it can interfere with their growth and development. The U.S. Environmental Protection Agency (EPA) has classified NMP as a developmental toxicant, and the Occupational Safety and Health Administration (OSHA) in the United States limits exposure to NMP to 1 ppm over a 10-hour workday. Therefore, many battery manufacturing companies have implemented systems to recover and purify NMP. However, a more fundamental solution involves eliminating the use of NMP in the battery manufacturing process altogether. This study approaches the creation of an NMP-free battery manufacturing process in two ways. Firstly, instead of the traditional electrode coating method, electrodes are manufactured using an electroplating technique. By electroplating high-capacity transition metal oxides onto copper nanostructures, such as copper nanopillar or nanopalm sturcture, on the anode's current collector (copper foil), the high electrical conductivity and increased surface area of the copper nanostructures can be utilized, enabling the production of high-performance battery anodes. Secondly, this study introduces the development of equipment for a dry electrode process, which is an alternative to the wet process. One of the greatest challenges in dry process development is the creation of mixing equipment that applies a stronger external force compared to traditional wet mixing processes. The research covers the conceptual design of this equipment and the results of preliminary tests.

KITECH-AKCSE International Joint Research Proposal Presentation

Speaker: Dr. Simon S. Park

Professor, Mechanical Engineering, University of Calgary

Dr. Park is a professor at the Schulich School of Engineering, Dept. of Mechanical and Manufacturing Engineering, University of Calgary, Canada. He is a Schulich School of Engineering Industrial Research Chair in sensing and monitoring. He is a professional engineer in Alberta and is an associate member of CIRP (Int. Academy of Production Engineers) from Canada. Dr. Park received bachelor and master's degrees from the University of Toronto, Canada. He then continued his PhD at the University of British Columbia, Canada. He has worked in several companies including IBM manufacturing where he was a procurement engineer for printed circuit boards and Mass Prototyping Inc. dealing with 3D printing. His research interests include nanocomposites, printed electronics, sensors, IoTs, batteries and advanced manufacturing. He has also founded several start-up companies in sensing, batteries, and advanced manufacturing. He has received several awards including Young Innovator's Award, Schulich School of Engineering Teaching Award, Schulich School Research Excellence Award, CFI New Faculty Grant, Alberta Innovates New Faculty award, NSERC scholarships, etc. He is also serving as associate editors of several journals. Currently, he is directly supervising over 30 students and scholars at Multifunctional Engineering, Dynamics and Automation Lab (MEDAL, www.ucalgary.ca/medal). E-mail simon.park@ucalgary.ca

KITECH-AKCSE International Joint Research Proposal Presentation

Speaker: Dr. Hong-In Won

Chief of Manufacturing AI Cooperation Team at Korea Institute of Industrial Technology, Korea

Dr. Won is a senior researcher at the Research Center for Manufacturing AI within the Korea Institute of Industrial Technology, Republic of Korea. He earned his doctorate in 2017 from the Department of Mechanical Design Engineering at Hanyang University, Republic of Korea. Between 2017 and 2019, he served as a research assistant at the Chair of Acoustics and Haptics, Technische Universität Dresden, Germany. His research interests include industrial AI, data mining, digital twin technology, and automated control in manufacturing. He focuses on both theoretical frameworks and practical design to enhance manufacturing processes. Currently, he is also the Chief of the Manufacturing AI Cooperation Team.

Revolutionizing Aluminum Die-Casting with Advanced AI: From Vision-Based Deburring to Optimal Tool Paths

Hong-In Won[1], Sanga Lee[1], Daehan Kim[2], and JaeHwang Kim[2,3,*]

[1]*Manufacturing AI Research Center, Korea Institute of Industrial Technology, Republic of Korea*
[2]*Carbon & Light Materials Group, Korea Institute of Industrial Technology, Republic of Korea*
[3]*Convergence Manufacturing System Engineering, Korea National University of Science and Technology (UST)*

To enhance the die-casting process of aluminum alloys, we propose the integration of advanced vision and AI technologies to improve material properties and manufacturing precision. Vision-based deburring location extraction will utilize state-of-the-art AI algorithms, such as Transformer models and Convolutional Neural Networks (CNNs), to accurately identify the position and shape of materials to be removed. This approach enables precise targeting and efficient removal of excess material, ensuring high-quality surface finish and dimensional accuracy. Additionally, AI-based automatic tool path generation will be implemented to optimize the machining process. Advanced AI techniques, including Graph Neural Networks (GNNs) and Diffusion Models, will be employed to generate optimal tool paths for material removal. This ensures precise and efficient machining, reduces errors, and enhances the overall efficiency of the die-casting process. By integrating these AI-driven methodologies, our research aims to revolutionize aluminum die-casting, enabling precise control over microstructural features and significantly improving material properties. This innovative approach will lead to smarter manufacturing processes and high-performance aluminum components, with broad applications in the automotive, aerospace, and energy sectors.

KITECH-AKCSE International Joint Research Proposal Presentation

Speaker: Dr. Yong-Wook Choi

Senior Researcher, Korea Institute of Industrial Technology (KITECH), Korea

Dr. Choi is currently a senior researcher, who has worked sustainable technologies at Korea Institute of Industrial Technology (Busan, S. Korea) in 2020. He began his academic career by completing his BSc and MSc in Chemical Engineering in Inha Univ. (S. Korea) in 2012 and 2014, a PhD in Chemistry in Ruhr-Univ. Bochum (Germany) in 2018. His main research topic is CFE (Carbon-Free Energy) technology including green-hydrogen, CO2 electroreduction, and nuclear decontamination. Dr. Yong-Wook Choi is the author of 17 peer-reviewed publications and 2 patents. His H-factor is 14 (Google Scholar) and his work has received about 2,030 citations. He has worked as a board member of The Korean Electrochemical Society, The Korean Society of Industrial and Engineering Chemistry, and The Korean Society of Surface Science and Engineering. His mail address is: yongwook@kitech.re.kr.

Synthesis and characterization of model nanoscale material systems for electrocatalysis application

Yong-Wook Choi[1]*

[1]*Energy System Group, Korea Institute of Industrial Technology Busan, S. Korea*

The most needs that our society is currently focusing to cope with accelerating global warming and increasing energy demands. Electrocatalysts have been attracted as promising means to give rise to provide clean energy system in a sustainable way without the emission of pollutants. Nanoscale materials have demonstrated remarkable catalytic activity due to their high active surface area including low-coordinated sites, and significantly modified chemical and electronic properties in comparison to bulk materials. However, fundamental insight is still required to find how structural and chemical properties of nano-scaled catalysts influence reactivity and life time in electrocatalysis. This work discusses the role of low-coordinated sites, surface roughness and the presence of metal cationic species in electrocatalytic performance. With these fundamental insights, this research provides valuable information on how to design stable and efficient electrocatalysts.

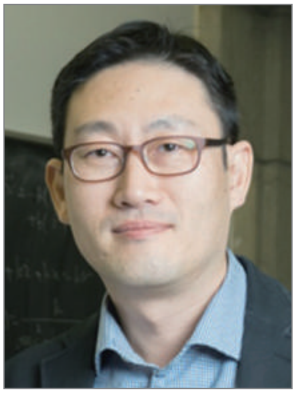
KITECH-AKCSE International Joint Research Proposal Presentation

Speaker: Dr. Jihyun Lee

Assistant Professor, University of Calgary

Dr. Jihyun Lee is an expert in manufacturing, mechatronics, artificial intelligence (AI), robotics, and sensors, and has contributed her expertise to the aerospace, automotive, and oil industries. Her research is directly related to improving manufacturing performance and automation based on robots and sensors. Her research has resulted in two knowledge and technology translations and twenty-five journal papers. Dr. Lee serves as the PI for many domestic and international research projects for robotic systems, manufacturing automation, and sensors. Dr. Lee has collaborated with many industry partners in Canada and Korea. Dr. Lee received a B.S. from Yonsei University and an M.Sc. & Ph.D. from the University of Michigan-Ann Arbor. After graduation, she worked for 2.5 years as a senior researcher in the department of ultra-precision machines and systems at the Korea Institute of Machinery and Materials in Korea, where she contributed to manufacturing and mechatronics. Dr. Lee joined the University of Calgary in 2019 then is leading a research group, the intelligent automation research laboratory (iAR Lab).

KITECH-AKCSE International Joint Research Proposal Presentation



Speaker: Dr. Soo Jeon

Associate Professor, Mechanical and Mechatronics Engineering, University of Waterloo

Soo Jeon received his BS and MS degrees from Mechanical & Aerospace Engineering at Seoul National University, Korea in 1998 and 2001 respectively, and his PhD from Mechanical Engineering at University of California, Berkeley in 2007. After graduation, he worked in Applied Materials Inc. until he moved to Department of Mechanical & Mechatronics Engineering at University of Waterloo in 2009 where he is currently an associate professor. His research interests include dynamic systems and control, mechatronic system design, friction-induced stability and machine learning for control of physical systems. Applications of his research cover robotics, industry automation, medical ultrasound, and transportation systems. He received Rudolf Kalman Best Paper Award from ASME in 2010, Best Robotics Paper Award from The Conference on Robots and Vision in 2022, and The Engineer of The Year Award from KOFST in 2022. He is a member of ASME, IEEE, CSME and PEO (Professional Engineers Ontario). Email: soojeon@uwaterloo.ca

Active Visuo-Tactile Integration for Robotic Assembly and Inspection

KITECH-AKCSE International Joint Research Proposal Presentation

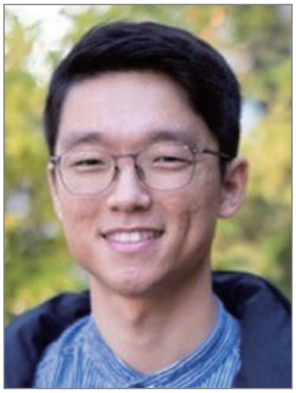
Speaker: Dr. Il Yong Kim

Professor, Queen's University

Dr. Il Yong Kim is a Professor in the Department of Mechanical and Materials Engineering at Queen's University, Kingston, Canada. His research interest is design optimization with applications in automotive and aerospace systems. KIM received his B.S in mechanical engineering from Korea University, and M.S. and Ph.D. degrees in mechanical engineering from the Korea Advanced Institute of Science and Technology (KAIST). He worked as an instructor and postdoctoral researcher in the Department of Aeronautics and Astronautics at M.I.T., where he taught undergraduate design course. KIM received a number of awards, including the Early Researcher Award in Canada, the recognition of the Experienced Humboldt Fellow in Germany, the Research Excellence Award at Queen's, and many paper awards at major scientific conferences. KIM is actively collaborating with global, multi-national companies in the automotive and aerospace industries, including General Motors, Magna, Bombardier Aerospace, Pratt & Whitney, Safran Landing Systems, and General Dynamics.

Lightweighting of next-generation mobility systems using CFRP (carbon fiber reinforced polymer)

KITECH-AKCSE International Joint Research Proposal Presentation



Speaker: Dr. Chunghyuk Lee

Assistant Professor, Toronto Metropolitan University

Dr. Lee received his Ph.D. in mechanical engineering from the University of Toronto. Prior to his professorship, he worked as a postdoctoral fellow at Los Alamos National Laboratory (LANL), and as a research associate at National Research Council Canada. He is currently an Assistant Professor at the department of chemical engineering at Toronto Metropolitan University. His research group (Fluids and Electrochemical Engineering Laboratory) focusses on the area of electrochemical energy systems such as fuel cells and electrolyzers. He received awards including the 2022 Canadian Light Source Young Investigator Excellence Award and the US Department of Energy Hydrogen and Fuel Cell Technologies Office Postdoctoral Recognition Award. He is an editorial board member of Scientific Reports (Nature Publishing Group) and InterPore Journal, and a member of H2CAN2.0 (Canada Strategic Hydrogen R&D Network). He is currently serving as the local chapter president of the Greater Toronto-Lake Ontario Chapter of the Association of Korean-Canadian Scientists and Engineers.

Electrochemical Recycling of Precious Group Metal Catalysts from Spent Fuel Cells

KITECH-AKCSE International Joint Research Proposal Presentation

Speaker: Dr. Jason Keonhag Lee
Assistant Professor, University of Victoria

Dr. Jason Keonhag Lee serves as an Assistant Professor in the Department of Mechanical Engineering at the University of Victoria. His research focuses on advancing clean hydrogen production technologies through electrochemical energy conversion, collaborating closely with Accelerating Community Energy Transformations (ACET) and Institute for Integrated Energy Systems (IESVic) at the University of Victoria. He earned his Ph.D. from the Department of Mechanical and Industrial Engineering at the University of Toronto and obtained his M.A.Sc. and B.Eng. from the Department of Mechanical Engineering at the University of Victoria. Dr. Lee worked as a postdoctoral researcher at Lawrence Berkeley National Laboratory where he contributed to the development of electrolyzers for reducing the cost of clean hydrogen. His efforts were acknowledged with a runner-up recognition for the Department of Energy Hydrogen Fuel Cell Technology Office's Postdoctoral Award. Dr. Lee has an impressive publication record of 40 peer-reviewed publications 19 conference proceedings and abstracts, and a textbook chapter. E-mail: jasonklee@uvic.ca

A Comprehensive Framework for Fabricating Porous Materials in Water Electrolyzers

KITECH-AKCSE International Joint Research Proposal Presentation

Speaker: Dr. Patrick C. Lee

Associate Professor, University of Toronto

Dr. Lee serves as an Associate Professor within the Department of Mechanical and Industrial Engineering at the University of Toronto. He obtained his B.Sc. in Mechanical Engineering from the University of British Columbia, and pursued his M.A.Sc. and Ph.D. in Mechanical Engineering at the University of Toronto. With a wealth of industry experience, Dr. Lee has contributed significantly in the areas of multiphase composites and foams, having previously held positions as a Research Scientist and Project Leader at The Dow Chemical Company. In 2014, he transitioned to academia, assuming the role of Assistant Professor at the University of Vermont. There, he established a pioneering research platform centered on lightweight and hybrid composites and foams via micro-/nano-structuring techniques. Returning to the University of Toronto in 2018, Dr. Lee continues his impactful research, focusing on the processing and characterization of hybrid composites, foams, and micro-/nano-layered structures. Currently, Dr. Lee serves as the director of the Multifunctional Composites Manufacturing Laboratory (MCML), where he leads comprehensive investigations of process-structure-property relationships for advanced multiphase composites & foams . Key technological innovations under Dr. Lee's guidance include novel methods for creating micro-/nano-layered composites and foams, hybrid polymer composites and many more. Notably, collaborative efforts with various private enterprises have facilitated the application of these advanced materials across diverse sectors, including automotive, aerospace, battery technologies, thermal insulation materials, energy storage systems, electronic components, and food packaging industries. Dr. Lee's research output underscores his dedication to academic excellence and innovation, with a record of 98 peer-reviewed publications, more than 140 international conference abstracts/papers, and the filing of 30 patents, highlighting his significant contributions to the field. E-mail patricklee@mie.utoronto.ca

Development of basic technology for improving properties and functionality of recycled polymers by laser-induced graphene

J.U. Lee, S. Farzana, N.D. Sansone, R. Aguiar, A.A. Faysal, J. Zhao, Patrick C. Lee*

Multifunctional Composites Manufacturing Laboratory (MCML), Department of Mechanical, Department of Mechanical and Industrial Engineering, University of Toronto, Toronto M5S 3G8, Canada

Our research team is focused on advancing the development of hierarchically structured hybrid composites and micro-/nano-layered (MNL) architectures to intricately tailor engineering properties through precise micro-/nano-phase structuring methodologies. Our investigation also introduces an innovative approach aimed at mitigating polymer separation from multiphase plastic wastes, with a primary emphasis on environmental sustainability. By utilizing a CO2 laser and low-cost non-metallic catalyst, we achieve high-quality graphene production from waste plastics (i.e., Laser-Induced Graphene (LIG)). In our research endeavor, we are committed to advancing the sustainable resource circulation theme through the development of high-performance structural reinforced composites from waste sources. This is achieved by integrating micro- and nano-sized filler utilizing LIG derived from Post-Consumer Recycled (PCR) plastic materials. We intend to leverage advanced manufacturing techniques, such as MNL coextrusion, to introduce reinforced phases in various dimensional configurations (1D, 2D, and 3D) within plastic matrices. Our primary goal is to produce robust, lightweight composites using recyclable resins and advanced MNL technology. These tailored composites have the potential to meet the demands of high-value applications across diverse sectors including filters, aircraft-aerospace, medical devices, packaging, plastics recycling, and future mobility solutions amidst the realm of sustainability, featuring eco-friendly resource circulation technology.

KITECH-AKCSE International Joint Research Proposal Presentation

Speaker: Dr. Hyo-Jick Choi

Associate Professor, University of Alberta

Dr. Hyo-Jick Choi is an associate professor in the Department of Chemical & Materials Engineering at the University of Alberta, and runs a sustainable engineering and drug delivery design (SEƎD) lab. Dr. Choi has made influential scientific contributions in global health by developing, 1) universal and reusable antimicrobial personal protective measures against pandemic/epidemic diseases, 2) cold-chain free solid oral vaccine technologies, 3) antimicrobial technologies against foodborne/seafood and hospital-acquired infectious diseases, and 4) colorimetric gas sensors for environment applications. His capability in integrative fusion technologies and their commercialization enabled him to establish two start-up companies based on his research findings. Dr. Choi is an Editorial Board Member of Scientific Reports. E-mail hyojick@ualberta.ca

Development and Application of Low-cost Colorimetric Gas Sensors

KITECH-AKCSE International Joint Research Proposal Presentation

Speaker: Dr. Dongyi Seo

Senior Research Officer, Aerospace Research Centre of National Research Council Canada

Dr. Dongyi Seo is a senior research officer at the high temperature materials group, Aerospace Research Centre of National Research Council Canada. He received his Ph.D. degree in Materials Science from Michigan State University in 1998. He manages several significant projects on assessment of high-temperature materials and coatings and repair technology of metallic materials with the gas turbine OEMs and international research organizations. As an Adjunct Professor at Carleton University, he has been working and supervising students on the development of joining technology and evaluation of mechanical and environmental properties of various metallic materials as collaborative projects between NRC, and international research organizations such as Korea Institute of Materials Science, Korea Institute of Industrial Technology-South Korea, Australia's Nuclear Science and Technology Organization-Australia, IHI/Tohoku University-Japan, and Los Alamos National Lab., Michigan State University, and University of Tennessee-USA. He has authored and co-authored 76 peer-reviewed journals, 34 conference proceedings, 55 internal technical reports, and 103 technical presentations at international and national conferences including 22 invited papers and plenary talks. E-mail: dongyi.seo@nrc-cnrc.gc.ca

R&D Funding Agency Session with IITP

Invitation Only

Time: 15:15–16:45, June 17 (Monday) Canada, Mountain Daylight Time (MDT)

Place: KC 202

Sponsor: Institute of Information & Communications Technology Planning & Evaluation (IITP)

Organizer: IITP and The Association of Korean Canadian Scientists and Engineers (AKCSE)

Contact: Dr. Seokbum Ko, University of Saskatchewan (seokbum.ko@usask.ca)

Description: This session serves as a platform to share information and research support status of Canada's major R&D funding agencies, and to discover new research partners.

Program:

Time	Place	Topic	Speaker	Affiliation
15:15–15:20	KC 202	Introduction	Dr. Seokbum Ko	University of Saskatchewan
15:20–15:25		Opening Remarks	Jin Gook Lim	IITP Director General
15:25–15:30		Greeting	Dr. Seonghwan Kim	AKCSE President
15:30–15:50		Major funding agencies in Canada	Dr. Seokbum Ko	University of Saskatchewan
15:50–16:10		Major research institutions in Canada - Discovery of international joint research partners	Dr. Hyojik Choi	University of Alberta
16:10–16:30		About NRC(National Research Council Canada)	Dr. Homin Shin	NRC
16:30–16:45		Q&A	All	
16:45		Closing & Photo time		

List of Participants:

Name	Position	Affiliation
Jin Gook Lim	Director General	IITP
Dr. Juhee Ki	Director	IITP
Dr. Seonghwan Kim	President of AKCSE and Professor, University of Calgary	AKCSE and University of Calgary
Dr. Seokbum Ko	Professor	University of Saskatchewan
Dr. Hyojik Choi	Associate Professor	University of Alberta
Dr. Homin Shin	Senior Research Officer	NRC
Dr. Il Yong Kim	Professor	Queen's University
Dr. Simon Park	Professor	University of Calgary
Dr. Yong hoon Kim	Associate Professor	University of Windsor
Dr. Gap Soo Chang	Professor	University of Saskatchewan
Dr. Jiyun Lee	Associate Professor	University of Calgary
Dr. Eunsik Kim	Assistant Professor	University of Windsor

R&D Funding Agency Session with IITP

Jin-Gook Lim

Director General, Future Policy Division, Institute of Information & Communications Technology Planning & Evaluation (IITP)

Jin-Gook Lim, Director General of IITP, graduated from Kyung Hee University and has been working at IITP, formerly known as IITA, since 1997. He has contributed to the advancement of digital field R&D policies for about 27 years. He is currently in charge of policy formulation, information analysis, and promoting international joint research at the IITP Future Policy Division. He has played a major role in the growth of IITP, which has become the representative agency for implementing the government's digital policies. In addition, he is active as a speaker forecasting the top 10 issues of the following year at the ICT Industry Outlook Conference, the best academic exchange meeting in the digital field in South Korea, boasting more than 20 years of history and tradition.

R&D Funding Agency Session with IITP

Dr. Juhee Ki

Director, Institute of Information & Communications Technology Planning & Evaluation (IITP)

Dr. Ki is a Director of Global Cooperation Team which is in charge of international joint Research & Development program at IITP. She received her B.Sc. (2001) in Mathematics at the University of Seoul and M.Sc. (2003) degree and Ph.D. (2013) degree in Information Security from Korea University, Seoul, South Korea. Her main interests include Public Key Cryptography Application, Privacy & Anonymity and Standardization in the Cyber Security field. She is the Rapporteur of Question 1 (Security Standardization Strategy and Coordination) under Study Group 17 (Security) of International Telecommunication Union Telecommunication Standardization Sector (ITU-T). She had been a Visiting Scholar in department of Computer Science at University of California, Davis from August 2014 to July 2016.

R&D Funding Agency Session with IITP

Dr. Seonghwan Kim

President, The Association of Korean Canadian Scientists and Engineers
Professor, Mechanical and Manufacturing Engineering, University of Calgary, Canada

Dr. Seonghwan (Sam) Kim is a Professor and Canada Research Chair in Nano Sensing Systems in the Department of Mechanical and Manufacturing Engineering, Schulich School of Engineering (SSE) at the University of Calgary (UCalgary). He received his BSc (1998) and MSc (2000) degrees in Aerospace Engineering from Seoul National University, Seoul, South Korea and PhD (2008) in Mechanical, Aerospace and Biomedical Engineering from the University of Tennessee, Knoxville, USA. He was a Postdoctoral Research Associate at Oak Ridge National Laboratory, USA and an Acting Research Associate at the University of Alberta prior to his current position. In August 2013, Dr. Kim has founded the Nano/Micro-Sensors and Sensing Systems Laboratory (NMS3, https://www.ucalgary.ca/labs/nanosensors/home) at the UCalgary to develop high performance physical/chemical/biological sensors and sensing systems and to explore novel characterization techniques for nanomaterials, nanocomposites, and biomaterials. In addition, he is an active member of the Pipeline Engineering Centre in the UCalgary which focuses on new technology development for pipeline integrity and monitoring. He is a founding director of a start-up company, ESPARK Energy Inc., since January 2015.

R&D Funding Agency Session with IITP

Dr. Seok-Bum Ko

Professor, Department of Electrical and Computer Engineering, University of Saskatchewan
Professor, Division of Biomedical Engineering, University of Saskatchewan

Seokbum Ko is currently a Professor at the Department of Electrical and Computer Engineering and the Division of Biomedical Engineering, University of Saskatchewan, Canada. He received his PhD from the University of Rhode Island, USA in 2002. His areas of research interest include computer architecture/arithmetic, efficient hardware implementation of compute-intensive applications, deep learning processor architecture and biomedical engineering. He is an IEEE Cicuits and Systems Society Distinguished Lecturer (2024-2025), a senior member of IEEE circuits and systems society and an associate editor for IEEE TVLSI, IEEE TCAS-II, IEEE Access and IET Computers & Digital Techniques. He is an active member of IEEE CAS Technical Committee, IEEE P3109, IEEE754-2029, IEEE Domain-Specific Accelerators Standarads Committee and IEEE Emerging Processor Systems Standards Committee. He was an associate editor for IEEE TCASI (2019-2021). E-mail: seokbum.ko@usask.ca

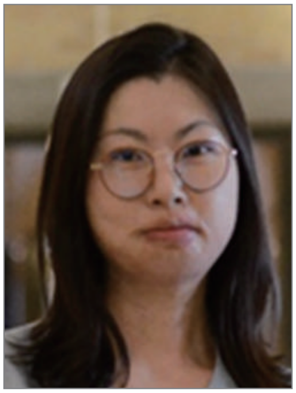
R&D Funding Agency Session with IITP

Dr. Hyo-Jick Choi

Associate Professor, University of Alberta

Dr. Hyo-Jick Choi is an associate professor in the Department of Chemical & Materials Engineering at the University of Alberta, and runs a sustainable engineering and drug delivery design (SEƎD) lab. Dr. Choi has made influential scientific contributions in global health by developing, 1) universal and reusable antimicrobial personal protective measures against pandemic/epidemic diseases, 2) cold-chain free solid oral vaccine technologies, 3) antimicrobial technologies against foodborne/seafood and hospital-acquired infectious diseases, and 4) colorimetric gas sensors for environment applications. His capability in integrative fusion technologies and their commercialization enabled him to establish two start-up companies based on his research findings. Dr. Choi is an Editorial Board Member of Scientific Reports. E-mail hyojick@ualberta.ca

R&D Funding Agency Session with IITP



Dr. Homin Shin

Senior Research Officer, National Research Council Canada

Dr. Shin is a Senior Research Officer at National Research Council Canada. Trained as a theoretical physicist, Dr. Shin has developed an understanding of a large variety of materials, such as colloids, polymers, liquid crystals, and bio/nano/energy materials, aiming to discover new materials with properties beyond those of currently existing materials. To this end, she uses a combination of analytic theory, numerical simulations, and machine learning, often in close collaboration with experimental groups and AI experts. Dr. Shin's publications have garnered a total of 1401 citations and she has an h-index of 14 (Google Scholar), which includes high-impact journal publications, such as Nat. Commun., ACS Nano, Physical Review Letters and PNAS. E-mail Homin.Shin@nrc-cnrc.gc.ca

R&D Funding Agency Session with IITP

Dr. Il Yong Kim

Professor, Queen's University

Dr. Il Yong Kim is a Professor in the Department of Mechanical and Materials Engineering at Queen's University, Kingston, Canada. His research interest is design optimization with applications in automotive and aerospace systems. KIM received his B.S in mechanical engineering from Korea University, and M.S. and Ph.D. degrees in mechanical engineering from the Korea Advanced Institute of Science and Technology (KAIST). He worked as an instructor and postdoctoral researcher in the Department of Aeronautics and Astronautics at M.I.T., where he taught undergraduate design course. KIM received a number of awards, including the Early Researcher Award in Canada, the recognition of the Experienced Humboldt Fellow in Germany, the Research Excellence Award at Queen's, and many paper awards at major scientific conferences. KIM is actively collaborating with global, multi-national companies in the automotive and aerospace industries, including General Motors, Magna, Bombardier Aerospace, Pratt & Whitney, Safran Landing Systems, and General Dynamics.

R&D Funding Agency Session with IITP

Dr. Simon S. Park

Professor, Mechanical Engineering, University of Calgary

Dr. Park is a professor at the Schulich School of Engineering, Dept. of Mechanical and Manufacturing Engineering, University of Calgary, Canada. He is a Schulich School of Engineering Industrial Research Chair in sensing and monitoring. He is a professional engineer in Alberta and is an associate member of CIRP (Int. Academy of Production Engineers) from Canada. Dr. Park received bachelor and master's degrees from the University of Toronto, Canada. He then continued his PhD at the University of British Columbia, Canada. He has worked in several companies including IBM manufacturing where he was a procurement engineer for printed circuit boards and Mass Prototyping Inc. dealing with 3D printing. His research interests include nanocomposites, printed electronics, sensors, IoTs, batteries and advanced manufacturing. He has also founded several start-up companies in sensing, batteries, and advanced manufacturing. He has received several awards including Young Innovator's Award, Schulich School of Engineering Teaching Award, Schulich School Research Excellence Award, CFI New Faculty Grant, Alberta Innovates New Faculty award, NSERC scholarships, etc. He is also serving as associate editors of several journals. Currently, he is directly supervising over 30 students and scholars at Multifunctional Engineering, Dynamics and Automation Lab (MEDAL, www.ucalgary.ca/medal). E-mail simon.park@ucalgary.ca

R&D Funding Agency Session with IITP

Dr. Yong Hoon Kim

Associate Professor, University of Windsor

Dr. Yong Hoon Kim is an Associate Professor of Civil and Environmental Engineering at the University of Windsor. Dr. Kim has received the B.S. and M.S. degrees in transportation from the University of Seoul, Seoul, Korea, in 2003 and 2006, respectively, and Ph.D. degree in Civil Engineering from Purdue University, West Lafayette, IN, USA, in 2017. He worked for two and a half years at the Seoul Institute in Korea as a research engineer. He also worked a Research Associate with the NEXTRANS Center, Purdue University. His research interests include Intelligent Transportation System, connected and autonomous vehicle technology, data analytics for connected transportation system, artificial intelligence for connected and autonomous vehicle applications, and traffic safety.

R&D Funding Agency Session with IITP

Dr. Gap Soo Chang

Professor, Physics and Engineering Physics, University of Saskatchewan

Dr. Chang is a Professor in the Department of Physics and Engineering Physics at the University of Saskatchewan. He received his B.Sc., M.Sc., and Ph.D. degrees in Experimental Condensed Matter Physics from Yonsei University, Seoul, Korea. He held postdoctoral researcher positions at Atomic-scale Surface Science Center, Korea and the University of Tennessee at Knoxville prior to joining the faculty at the University of Saskatchewan in 2003. His research interests encompass synchrotron-radiation X-ray spectroscopy and density functional theory (DFT) analysis for advanced electronics and energy materials, and the first-principles modeling for bio-molecular interaction. He has published over 130 research articles in peer-reviewed journals and delivered over 30 invited talks at international conference. Dr. Chang also served as the 21st President of Association of Korean Canadian Scientists and Engineers (AKCSE) in 2016 for 2-year term and is currently a Chair of Long-term Planning Committee and a ST&I Ambassador for National Research Council of Science and Technology Korea (NST). He was a board member of Canadian Association of Physicists (CAP), and Hydrographic Society of Korea, and a chair of International Activities Committee of Council, University of Saskatchewan. E-mail: gapsoo.chang@usask.ca

R&D Funding Agency Session with IITP

Dr. Jihyun Lee

Assistant Professor, University of Calgary

Dr. Jihyun Lee is an expert in manufacturing, mechatronics, artificial intelligence (AI), robotics, and sensors, and has contributed her expertise to the aerospace, automotive, and oil industries. Her research is directly related to improving manufacturing performance and automation based on robots and sensors. Her research has resulted in two knowledge and technology translations and twenty-five journal papers. Dr. Lee serves as the PI for many domestic and international research projects for robotic systems, manufacturing automation, and sensors. Dr. Lee has collaborated with many industry partners in Canada and Korea. Dr. Lee received a B.S. from Yonsei University and an M.Sc. & Ph.D. from the University of Michigan-Ann Arbor. After graduation, she worked for 2.5 years as a senior researcher in the department of ultra-precision machines and systems at the Korea Institute of Machinery and Materials in Korea, where she contributed to manufacturing and mechatronics. Dr. Lee joined the University of Calgary in 2019 then is leading a research group, the intelligent automation research laboratory (iAR Lab).

R&D Funding Agency Session with IITP

Dr. Eunsik Kim

Assistant Professor, University of Windsor

Dr. Kim received his Ph.D. from Penn State University in 2018. He is an Assistant Professor in Mechanical, Automotive & Materials Engineering at the University of Windsor. His research areas include human factors and ergonomics and the development of effective gamification through user-centered design. His current research focuses on developing an emotion assessment algorithm through such psychological and psychophysiological measurements as eye tracking, GSR, HRV, fEMG and EEG using machine-learning techniques as part of an NSERC Discovery Grant. He received the Graduate Scholarship for Excellence and the C. Norwood Wherry Memorial Graduate Fellowship in Engineering from Pennsylvania State University. Dr. Kim was also awarded the Best Paper Award by the Ergonomics Society of Korea. He has served as a consultant of ergonomic services for over 10 small-, medium-, and large-sized companies, using physical and physiological sensors to identify, analyze and control workplace risk factors and prevent work-related musculoskeletal disorders.

E-mail eskim@uwindsor.ca

KOFST-Space R&D

Invitation Only

Time: 15:15–16:45, June 17 (Monday) Canada, Mountain Daylight Time (MDT)

Place: KC 206

Sponsor: Korean Federation of Science and Technology Societies (KOFST)

Organizer: KOFST and The Association of Korean Canadian Scientists and Engineers (AKCSE)

Contact: Dr. Regina S.K. Lee, York University (reginal@yorku.ca)

Description: This special session serves as a forum to introduce and advocate for the recently formed Korea Aerospace Administration (KASA), fostering a platform for dialogue on enhancing aerospace collaboration between Korea and Canada; and facilitate discussions to explore strategies for promoting cooperation.

Program:

Time	Place	Topic	Speaker	Affiliation
15:15–15:20	KC 206	Opening Remarks	Dr. Tai Sik Lee	KOFST
15:20–15:25		Korea Aerospace Administration (KASA) - Introduction	Dr. Tai Sik Lee	KOFST
15:25–15:45		Space-Defence Technologies Alberta (SDTech-AB)	Dr. Susan Skone	University of Calgary
15:45–16:05		Space Utilization - Introduction of MOLIT Earth Observation Satellite (CAS500): Application and Data Policy	Dr. Suyoung Park	NGII
16:05–16:20		Space Exploration – Centre for Research in Earth and Space Science (CRESS)	Dr. Gunho Sohn	York University
16:20–16:40		Panel Discussion - promoting international cooperation and suggestions for KASA	All	
16:40–16:45		Closing & Photo time		

List of Participants:

Name	Position	Affiliation
Dr. Tai Sik Lee	President	KOFST
Dr. Seonghwan Kim	President of AKCSE and Professor, University of Calgary	AKCSE and University of Calgary
Dr. Regina S.K. Lee	Professor	York University
Dr. Susan Skone	Professor	University of Calgary
Dr. Wooil Moon	Professor Emeritus	University of Manitoba
Dr. Gunho Sohn	Professor	York University
Dr. Il Yong Kim	Professor	Queen’s University
Dr. Bumsoo Kim	Defense Scientist	Defence Research and Development Canada

KOFST-Space R&D

Chair: Dr. Regina Lee

Professor, York University, Canada

Regina Lee, PhD, PEng is Professor at the Department of Earth and Space Science and Engineering, York University, Toronto, Canada. Prof. Lee received her Ph.D. from the University of Toronto in 2000. It has been a focus of Prof. Lee's research to develop a series of satellite technologies that will lead to scientific nanosatellite missions. Currently, she's investigating several areas including MEMS based attitude sensors and actuators to incorporate their low-grade characteristics; and optical payloads including a star tracker for Resident Space Object (RSO) detection, identification and characterization with light curve analysis. To date, Dr. Lee has raised over $10M in independent funding, working with over 13 industry partners and trained over 100 HQPs. Currently, Dr. Lee serves as the director of York Microfabrication Facility (YMF). E-mail: reginal@yorku.ca

KOFST-Space R&D

Speaker: Dr. Tai Sik Lee

President of Korean Federation of Science and Technology Societies (KOFST)

Dr. Tai Sik Lee, inaugurated as the 21st President of the Korean Federation of Science and Technology Societies (KOFST) in March 2023, has significantly contributed to global science and technology cooperation. Key achievements include opening the Science and Technology Convention Center and hosting the 1st World Congress of Korean Scientists & Engineers with 2,460 participants from 18 countries. Dr. Lee holds a Bachelor's degree in Civil Engineering from Seoul National University and a Master’s and Ph.D. in Construction Management from the University of Wisconsin-Madison. He has held various prestigious positions, including Professor at Hanyang University, President of the Korea Institute of Civil Engineering and Building Technology (KICT), and President of the Korean Society of Civil Engineers. Currently, he serves as President of KOFST, Director of the Climate Change Center, Honorary Professor at Hanyang University, Director of the International Moonbase Alliance (IMA), and CEO of the International Space Exploration Research Institute (ISERI). Dr. Lee's notable achievements include winning a NASA Centennial Challenges competition in 2017 and receiving multiple awards for his contributions to science and technology. Additionally, Dr. Lee is involved in cultural activities as a representative of the theater company ‘Silgeuk(실극)’, a member of the choir ‘Diamante Blu’, and a co-producer of the play ‘King Lear’, promoting the integration of science and art.

KOFST-Space R&D

Speaker: Dr. Susan Skone

Professor and Associate Vice-President (Research), University of Calgary

Dr. Susan Skone is a Professor in the Department of Geomatics Engineering and Associate Vice-President (Research) at the University of Calgary. She has over 30 years of experience leading national projects in Global Navigation Satellite System (GNSS) technology and space environment characterization for commercial aviation, maritime navigation and spaceborne applications. Research results have been licensed and implemented in operational systems for GNSS and HF applications ranging from autonomous navigation to over-the-horizon-radar. She has delivered more than 50 sponsored projects and has led space policy and planning efforts (most recently for the U.S. national space weather strategy). She is a Killam Professor and Institute of Navigation Fellow. She serves in Boards and Executive of digital technology centres, and co-leads the Space-Defence Technologies Alberta program. She also served for 28 years as a Maritime Surface and Sub-Surface (MARS) Officer in the Royal Canadian Navy (Reserves).

Space-Defence Technologies Alberta

Susan Skone* and Emma Spanswick

University of Calgary, Calgary, Canada

From the wonders of space travel to the promise of global connectivity, modern life is increasingly linked to a global space industry growing at double-digits annually and projected to pass $1T by 2030. The defence landscape is similarly transforming, as the strategic character of space becomes an operational domain and dual-use technologies such as advanced materials, sensing systems, and robotics, among others, are feeding new innovation pathways. The potential for economic and technological benefits at this space-civil-defence nexus is tremendous. Within the Canadian space tech community - which ranks amongst the top-three worldwide - Alberta leads some of the fastest growing space-for-earth sectors, asserts the most space-active post-secondary community in the country, and is poised for differential advantage. Space and Defence Technologies Alberta, (SDTech_AB) capitalizes on this strategic opportunity.

Here we introduce the SDTech_AB program which leverages research strengths in six Campus Alberta institutions. A pan-Alberta R&D framework addresses four main themes (Emerging Technologies, Sensing our Environment, Situational Awareness, and Threat Detection and Response) building on Alberta's leadership in three pillars (space domain solutions, sub-orbital technologies, and joint-domain intelligence). Over the next five years we will leverage $7M provincial and $9M secured matching investments for more than 40 joint projects between post-secondary and industrial partners. Designed to engage end users in the space, defence, and downstream markets, anticipated program outcomes include advancing technology readiness in the space and defence sector, training more than 400 new staff and graduates, and the delivery of 50+ prototypes, products and disruptive solutions.

*Corresponding author; E-mail shskone@ucalgary.ca

KOFST-Space R&D

Speaker: Dr. Suyoung Park

Deputy Director for Research at National Land Satellite Center of National Geographic Information Institute, Republic of Korea

Dr. Park is a Deputy Director for Research at the National Land Satellite Center of the National Geographic Information Institute (NGII). She received her BE. and ME. from the Department of Geospatial Information Engineering at Inha University and PhD. from the Department of Infrastructure Engineering at the University of Melbourne. She focused on developing novel applications by integrating various sensors (in-situ sensors, drone and satellite images, GPS embedded smart targets) to enable quantitative and qualitative assessment of vegetation status (water stress level, evapotranspiration rate and vitality) in agricultural fields. Since 2021, she has joined the Korea Land Satellite Center, where she is in charge of the operation, data processing and distribution services of Korea's first public satellite (CAS500-1). Currently, she is focusing on satellite data policy, follow-up satellite planning for sustainable mission accomplishment and international cooperation to enhance use of land satellite information.

The Introduction of MOLIT's Earth Observation Satellites (CAS500-1 and CAS500-2): Achievements and Future Plans

Suyoung Park

National Land Satellite Center, National Geographic Information Institute (NGII), The Ministry of Land, Infrastructure and Transport (MOLIT), Gyeonggi-do, Republic of Korea

CAS500-1, a high-resolution satellite jointly developed by the Ministry of Land, Infrastructure, and Transport and the Ministry of Science and ICT, was successfully launched in March 2021. This paper presents the outcomes of utilizing satellite imagery across various domains and discusses associated feedback. Operated by the National Geographic Information Institute (NGII), CAS500-1 collects and disseminates spatial data to governmental entities and the public sector. The satellite captures images with a 50 cm resolution, which are then corrected geometrically and processed into Level 2 products—a value-added offering provided to the public free of charge. Level 2 imagery finds wide applications in land management, agriculture, forestry, urban planning, and academia. To enhance CAS500-1's utility, regular user demand and satisfaction surveys are conducted to inform future enhancements. Moreover, plans are underway for the development of a follow-up satellite, with a focus on aligning satellite performance with user requirements. NGII is committed to continually delivering satellite-based geospatial services and ensuring effective utilization of satellite imagery.

KOFST-Space R&D

Speaker: Dr. Gunho Sohn

Associate Professor and Chair, Department of Earth and Space Science and Engineering (ESSE)

Professor Gunho Sohn, Associate Professor of Geomatics engineering and Chair, Department of Earth and Space Science and Engineering at York University, stands at the forefront of smart mobility research, blending administrative acumen with pioneering scientific inquiry. As the inaugural director of the Mobility Innovation Centre (MOVE) and a leader in computer vision and photogrammetry, he is lauded for his contributions to urban digital twinning and smart mobility solutions. Professor Gunho Sohn distinguishes himself in smart mobility with a h-index of 30 and 5,255 citations across over 150 publications. His impactful work in autonomous vehicles and digital twinning, strengthened by strategic collaborations with entities like CFI, ORF and NSERC CREATE, has been recognized with the York University Research Leader Award twice and the PEO York Chapter Engineering Project of the Year Award, underscoring his innovation in urban mobility solutions. Leading a team with 10 co-applicants and collaborators, Professor Sohn aims to leverage his extensive experience in mobility research to design a research training program centered on the advanced applications of smart mobility.

Space Exploration – Centre for Research in Earth and Space Science (CRESS)

Gunho Sohn

Lassonde School of Engineering

The Centre for Research in Earth & Space Science (CRESS) stands at the forefront of research in planetary exploration, space technologies and climate and the environment. CRESS is propelling research into uncharted realms, driven by interdisciplinary collaboration across a broad spectrum of fields, from astronomy and astrophysics to geomatics and space engineering. Their overarching objective is to design scientific instruments and pioneer novel methodologies for space missions.

To date, the research centre has made a big mark on Canadian and international research, by contributing instruments to prominent space missions such as the NASA OSIRIS-APEX and NASA Phoenix Mars Missions. CRESS is committed to providing boundless opportunities for student engagement and experiential learning. In parallel, they aspire to elevate the graduate program in Earth & Space Science by granting students access to cutting-edge equipment, state-of-the-art laboratories, comprehensive facilities and high-impact research endeavours. The centre advances research at York University by leading the recruitment for strategic faculty appointments, creating and managing laboratory space, preparing major infrastructure grant applications, organizing research seminars and providing administrative support.

The presentation will provide a brief history and overview of the research programs and activities at CRESS, highlighting the collaboration between industry, government, and academic researchers.

*Corresponding author; E-mail gsohn@yoru.ca

Technical Session I

Open Session

Time: 17:00–18:15, June 17 (Monday) Canada, Mountain Daylight Time (MDT)

Place: KC 202

Sponsor: Association of Korean-Canadian Scientists and Engineers (AKCSE)

Organizer: AKCSE

Contact: Dr. Yong Hoon Kim, University of Windsor (kim523@uwindsor.ca)

Description: Biological Sciences, Biomedical Engineering and Health Sciences

Program:

Time	Place	Topic	Speaker	Affiliation
17:00–17:12	KC 202	Radiation dose enhancement using gold nanoparticles with a diamond linear accelerator target: Application in a Zebrafish xenograft model	Dr. Michael Ha	Dalhousie University
17:12–17:24		Nursing education contents development using technology and future direction of caring technology	Dr. Eunyoung Suh	Seoul National University
17:24–17:36		Highly effective salt-activated alcohol-based disinfectants with enhanced antimicrobial activity	Dr. Hyo-Jick Choi	University of Alberta
17:36–17:48		Revolutionizing the food industry: Turning tofu processing waste into a sustainable egg substitute	Dr. Martin J.T. Reaney	University of Saskatchewan
17:48–18:00		Exploring the value of fermented root and tuber crops and fruits: beyond α-Glycerylphosphorylcholine	Dr. Youn Young Shim	University of Saskatchewan
18:00–18:12		Robot-assisted image-guided high-intensity focused ultrasound therapy: advancements in non-invasive cancer treatment	Dr. Hyock Ju Kwon	University of Waterloo

List of Participants:

Name	Position	Affiliation
Dr. Yong Hoon Kim	Professor	University of Windsor
Dr. Michael Ha	Professor	Dalhousie University
Dr. Eunyoung Suh	Professor	Seoul National University
Dr. Hyo-Jick Choi	Professor	University of Alberta
Dr. Martin J.T. Reaney	Professor	University of Saskatchewan
Dr. Youn Young Shim	Senior Scientist	University of Saskatchewan
Dr. Hyock Ju Kwon	Professor	University of Waterloo

Technical Session I
Biological Sciences, Biomedical Engineering and Health Sciences

Chair: Dr. Youn Young Shim

Senior scientist, the University of Saskatchewan, Canada

Dr. Shim has also been working at the Department of Plant Sciences at the University of Saskatchewan and is an important team member in developing many of Prairie Tide's products. She obtained her M.Sc. and Ph.D. in the Department of Bioengineering and Technology at Korea University. She was a post-doctoral fellow (Food Sciences) at the University of Guelph and worked at the Agri-Food Canada in a Canadian Government Laboratory funded by the Natural Sciences and Engineering Research Council of Canada. She is a reviewer for several journals, the author of 80 peer-reviewed journal articles, and 200 presentations at national and international conferences since 1997. Her current research interest is determining the role of flaxseed proteins and peptides in health outcomes. She is coordinating partner institutions and joint research activities in Europe and Asia for the global marketing of natural food ingredients. Based on her activities, Dr. Shim was selected as an excellent scientist in the international research personnel exchange project with the funding of the Ministry of Science, Technology and Information and Communication, and she is carrying out this task at Sungkyunkwan University. E-mail younyoung.shim@usask.ca

Technical Session I
Biological Sciences, Biomedical Engineering and Health Sciences

Speaker: Dr. Michael N. Ha

MD, PhD, FRCPC, Radiation Oncologist, Nova Scotia Health
Assistant Professor, Dalhousie University, I3V Clinician Scientist in Oncology
Associate Member, Beatrice Hunter Cancer Research Institute

Dr. Michael Ha is a Radiation Oncologist and a Clinician Scientist at Dalhousie University and Nova Scotia Health. He completed his medical studies and residency at Dalhousie Medical School. Prior to that he received a Ph.D. in Medical Biophysics from the University of Toronto where he studied molecular biology, innate immunity and virology. Dr. Ha is the clinical lead in a project that uses gold nanoparticles as radiosensitizers in combination with a prototype linear accelerator located at Nova Scotia Cancer Care. For this work, his team was awarded the Innovation Grant from the Canadian Cancer Society and the work has been presented at multiple international meetings. Dr. Ha specializes in treating lung and CNS malignancies and is a founding member of the Thoracic Rapid Intake Palliative (TRIP) Radiotherapy Clinic which quickly assesses and treats palliative lung cancer patients. This clinic is a translational research hub where samples obtained from patients undergoing radiotherapy are studied to improve our understanding of radiation and its effect on the body's immune system. His current research interests include cancer-immune system interactions, nanoparticle-mediated radiosensitization, and the abscopal effect. Contact: Michael.Ha@dal.ca

Radiation dose enhancement using gold nanoparticles with a diamond linear accelerator target: Application in a Zebrafish xenograft model

Olivia Piccolo[1,2], John D. Lincoln[3], Nicole Melong[4], Benno C. Orr[2], Nick R. Fernandez[2], Jason N. Berman[2,4], James Robar[3,5], Michael N. Ha[5]*

[1]Department of Biology, Dalhousie University, Halifax, Nova Scotia, [2]Department of Pediatrics, IWK Health Centre/Dalhousie University, [3]Department of Physics and Atmospheric Science, Dalhousie University, [4]Children's Hospital of Eastern Ontario Research Institute/Department of Pediatrics, [5]University of Ottawa, Ottawa, Ontario4; Department of Radiation Oncology, Dalhousie University

Radiotherapy (RT) is an effective cancer treatment modality, but standard RT often causes collateral damage to nearby healthy tissues. To increase therapeutic ratio, radiosensitization via gold nanoparticles (GNPs) has been shown to be effective. One challenge is that megavoltage beams generated by clinical linear accelerators are poor initiators of the photoelectric effect. Previous computer models predicted that a diamond target beam (DTB) will yield 400% more low-energy photons, increasing the probability of interacting with GNPs to enhance the radiation dose by 7.7 fold in the GNP vicinity. After testing DTB radiation coupled with GNPs in multiple cell types, we saw decreased head-and-neck cancer (HNC) cell viability in vitro and enhanced cell-killing in zebrafish xenografts compared to standard RT. HNC cell lines also displayed increased double-stranded DNA breaks with DTB irradiation in the presence of GNPs. This study presents preclinical responses to GNP-enhanced radiotherapy with the novel DTB, providing the first functional data to support the theoretical evidence for radiosensitization via GNPs in this context, and highlighting the potential of this approach to optimize the efficacy of RT in anatomically difficult-to-treat tumors. We are now working towards tumor-specific targeting approaches.

* Correspondence: michael.ha@dal.ca ; Tel.: 1 (902) 473-1474

Technical Session I
Biological Sciences, Biomedical Engineering and Health Sciences

Speaker: Dr. Eunyoung, E. Suh
Professor, Seoul National University College of Nursing

Dr. Suh received her Ph.D. from University of Pennsylvania in 2004. She's been a Professor at Seoul National University College of Nursing since 2006. She is the director of the Center for World-leading Human-care Nurse Leader for the Future by BK21 Project of Korean Government. She is also the editor in chief, Asian Nursing Research(https://www.asian-nursingresearch.com), which is the top nursing journal in Korea. She serves as the president of Korean Academic Society of Nursing Education. Her research area is to develop various nursing educational contents using technology such as smart-phone applications for caring patients with chronic illness, heart transplantation, and cancer. She is the author or co-author of over 70 publications in research journals. E-mail esuh@snu.ac.kr

Nursing Educational Contents Development using Technology and Future Direction of Caring Technology

Eunyoung E. Suh[1,2]

[1]College of Nursing, Seoul National University, Seoul, Korea, [2]Research Insitute of Nursing Science, Seoul National University, Seoul, Korea

From the birth of contemporary nursing to the present day, nursing has been primarily practiced in hospitals, where illnesses are treated. Nevertheless, with the global demographic shift towards an aging population and the escalating demand for caring services beyond hospital confines, the realm of nursing is progressively expanding to provide independent care services. In response to the multifaceted demands for care, an innovative integration of technology has been employed not only to enhance the education of nursing professionals but also to facilitate the delivery of effective care. This presentation will elucidate three pioneering technological solutions specifically designed for nursing students and patients. Firstly, the "Chronic Illness Care Smartphone App" has been ingeniously developed to equip nursing students with the essential competencies for managing patients afflicted with chronic conditions such as hypertension and diabetes. Secondly, the "Self-care Health Diary Application" aims to empower patients who have undergone heart transplants with the tools to autonomously manage their health. Lastly, the "Health Promotion Application on Cancer Survivorship" intends to instruct nursing students in the nuanced care of cancer survivors. Then, the discourse will extend to the exploration of various technological devices aimed at enhancing elderly care within the super-aged society. An examination of the researcher's perspectives on the future trajectories of elderly care technology will illuminate forthcoming avenues of research within this area. Through this presentation, attendees will gain insights into the evolving landscape of elderly care, historically underpinned by women's caregiving labor, and how technology is poised to transform this critical area.

*Corresponding author; E-mail esuh@snu.ac.kr

Technical Session I
Biological Sciences, Biomedical Engineering and Health Sciences

Speaker: Dr. Hyo-Jick Choi
Associate Professor, University of Alberta

Dr. Hyo-Jick Choi is an associate professor in the Department of Chemical & Materials Engineering at the University of Alberta, and runs a sustainable engineering and drug delivery design (SEƎD) lab. Dr. Choi has made influential scientific contributions in global health by developing, 1) universal and reusable antimicrobial personal protective measures against pandemic/epidemic diseases, 2) cold-chain free solid oral vaccine technologies, 3) antimicrobial technologies against foodborne/seafood and hospital-acquired infectious diseases, and 4) colorimetric gas sensors for environment applications. His capability in integrative fusion technologies and their commercialization enabled him to establish two start-up companies based on his research findings. Dr. Choi is an Editorial Board Member of Scientific Reports. E-mail hyojick@ualberta.ca

Highly Effective Salt-Activated Alcohol-Based Disinfectants with Enhanced Antimicrobial Activity

Hyo-Jick Choi*

Department of Chemical and Materials Engineering, University of Alberta, AB, Canada

Contamination of solid surfaces represents a major source of infection and transmission of infectious diseases, threatening the safety of the vulnerable in private and public settings. To clean bio-contaminated surfaces, alcohol-based disinfectant has been predominantly used for disinfection of high-touch areas in diverse setting (i.e., touchscreens, door handles, keypads, and handrails in common areas, etc). Unfortunately, conventional alcohol-based disinfectants have clear limitations and the long-term survival of pathogens on solid surfaces and the occurrence of resistant organisms raised several growing concerns. To tackle the limitations of conventional disinfectants, we developed a highly effective disinfectant to achieve rapid inactivation and prevent the generation of resistant strains against a range of pathogens. The core of our strategy is to use disinfectant solutions composed of salt-containing alcohol formulations that can physically destroy pathogens through salt recrystallization and chemically by alcohol. We found that additional salt crystallization during the drying of the alcohol solution facilitated stronger biocidal effects than IPA-only formulations, regardless of their types of solid surfaces and pathogens, including alcohol-tolerant strains. That is, our disinfectant formulation exhibits the synergistic antimicrobial effect between chemical (via alcohol) and physical (via drying-induced salt crystallization) inactivation mechanisms. The presence of physical destruction of mechanism by salt crystallization can play a critical role in reducing the acquisition of antimicrobial resistance at even lower concentrations of alcohol (i.e., < 70% IPA). Our findings in this work can be useful in developing highly effective disinfectant formulations by minimizing the use of toxic antimicrobial substances in improving public health and safety. As such, this technology should be of immediate interest to those interested in antimicrobial materials, disinfection technology, protection against airborne diseases/food-borne diseases/hospital-associated infectious diseases, contact transmission prevention technologies and global/public health.

*Corresponding author; E-mail hyojick@ualberta.ca

Technical Session I
Biological Sciences, Biomedical Engineering and Health Sciences

Speaker: Dr. Martin J.T. Reaney
Professor, University of Saskatchewan

Dr. Martin J.T. Reaney is a distinguished professor at the College of Agriculture and Bioresources at the University of Saskatchewan. He holds the Saskatchewan Ministry of Agriculture (SMA) Chair of Lipid Quality and Utilization and is also a Visiting Professor at Jinan University's Department of Food Science and Engineering, and the Department of Food and Biotechnology at Korea University. Prof. Reaney's research is focused on exploring the potential of orbitides compounds in natural health products, pharmaceuticals, and cosmetics, and developing technology to bring these compounds to the market for a broad range of applications. He collaborates with industry partners and has worked with Agriculture and Agri-Food Canada. Prof. Reaney has published over 190 papers in peer-reviewed journals, including book chapters, and presented over 350 papers at conferences. His work has resulted in 30 US and 8 world patents, several of which have been commercialized, earning him numerous accolades, including Innovation Awards in both the US and Canada. Prof. Reaney is also recognized as a High-End Foreign Expert in China and serves as the World Kimchi Ambassador for the World Kimchi Institute. He can be reached at martin.reaney@usask.ca.

Revolutionizing the Food Industry: Turning Tofu Processing Waste (Aquaforté) into a Sustainable Egg Substitute

Moon Yeong Hwang[1], Youn Young Shim[1,2,3], Young Jun Kim[1], Martin J.T. Reaney[1,2,3]*

[1]Department of Food and Biotechnology, Korea University, Sejong, Korea, [2]Department of Food and Bioproduct Sciences, University of Saskatchewan, SK, Canada, [3]Prairie Tide Diversified Inc., Saskatchewan, Canada

This study investigates the potential of aquaforté (AÉ), derived from tofu whey, as an alternative to egg white and aquafaba (AQ) as a vegan cooking ingredient. A zero-waste, cost-effective process was developed to produce AÉ from tofu whey. Fresh AÉ was obtained from commercial tofu manufacturers Pulmuone Co., Ltd. (PAÉ) and Hangeuru Co., Ltd. (HAÉ). The composition, utility, and physicochemical properties of AÉ were compared to egg white. It was hypothesized that differences in AÉ between manufacturers might arise from the tofu coagulants used. Various coagulants were tested to determine their effects on the composition of tofu whey. Both commercial and laboratory-produced tofu whey had remarkable nutritional profiles, containing compounds such as resveratrol and isoflavone glycosides. PAÉ outperformed HAÉ in terms of foaming ability, isoflavone content, and solubility. The study proposes a standardized, cost-effective, and zero-waste process for whey-based emulsifiers by repurposing tofu wastewater as egg-free emulsifiers. The potential of AÉ extends beyond the capabilities of AQ, offering a way to reduce waste and utilize tofu by-products, thereby contributing to a more sustainable food industry. Substituting eggs with a vegan product such as AÉ could address protein allergies and contribute to a more sustainable and efficient food industry through upcycling practices. The potential of AÉ to act as an edible oil emulsifier could have wide-ranging applications in the food industry, further emphasizing its role in promoting sustainable practices.
*Corresponding author; E-mail martin.reaney@usask.ca

Technical Session I
Biological Sciences, Biomedical Engineering and Health Sciences

Speaker: Youn Young Shim

Senior scientist, the University of Saskatchewan, Canada

Dr. Shim has also been working at the Department of Plant Sciences at the University of Saskatchewan and is an important team member in developing many of Prairie Tide's products. She obtained her M.Sc. and Ph.D. in the Department of Bioengineering and Technology at Korea University. She was a post-doctoral fellow (Food Sciences) at the University of Guelph and worked at the Agri-Food Canada in a Canadian Government Laboratory funded by the Natural Sciences and Engineering Research Council of Canada. She is a reviewer for several journals, the author of 80 peer-reviewed journal articles, and 200 presentations at national and international conferences since 1997. Her current research interest is determining the role of flaxseed proteins and peptides in health outcomes. She is coordinating partner institutions and joint research activities in Europe and Asia for the global marketing of natural food ingredients. Based on her activities, Dr. Shim was selected as an excellent scientist in the international research personnel exchange project with the funding of the Ministry of Science, Technology and Information and Communication, and she is carrying out this task at Sungkyunkwan University. E-mail younyoung.shim@usask.ca

Exploring the Value of Fermented Root and Tuber Crops and Fruits: Beyond α-Glycerylphosphorylcholine

Timothy J. Tse[1], Youn Young Shim[1,2,3], Jihyun Choi[4], Young Jun Kim[3], Martin J.T. Reaney[1,2,3]*

[1]Department of Food and Bioproduct Sciences, University of Saskatchewan, SK, Canada, [2]Prairie Tide Diversified Inc., Saskatchewan, Canada, [3]Department of Food and Biotechnology, Korea University, Sejong, Korea, 4Cheongju Broadcasting Co., Ltd., Cheongju, Korea

Root and tuber vegetables, along with fruits, are attractive substrate alternatives for bioethanol production due to their high starch and sugar contents. During the fermentation process, various value-added products are often co-produced, which can add significant value to the producer after enrichment and purification processes. In this study, various substrates, including carrot, beet, butternut squash, sweet potato, lotus root, purple top turnip, red potato, russet potato, yam, cassava, banana, and plantain were subjected to Saccharomyces cerevisiae fermentation to observe their suitability as a substrate for producing ethanol and other value-added co-products. The ethanol yield achieved on many of the substrates was comparable to wheat (var AC Andrew), with concentrations ranging from 30.44 g/L ± 2.11 g/L (beet) to 70.04 g/L ± 5.88 g/L (lotus root). Accumulation of common value-added co-products, including organic acids (lactic acid, acetic acid, and succinic acid) and glycerol, was observed after 72 h of fermentation. However, the concentration of lactic acid and acetic acid varied, likely due to the presence of endogenous bacteria. Interestingly, the nootropic α-glyceryl phosphorylcholine (α-GPC) accumulated during fermentation of these substrates, with purple top turnip accumulating the most (0.91 g/L ± 0.34 g/L) after wheat (1.25 g/L ± 0.16 g/L). Finally, methanol accumulation (0.10 ± 0.1 g/L [cassava] to 1.69 ± 0.42 g/L [purple top turnip]) was observed only in vegetable and fruit substrates but not in wheat, possibly due to the presence of pectins. Nonetheless, these crops show promise in the application of biofuel production, and optimization of the fermentation conditions may improve the production of value-added components, with a focus on industrial and nutraceutical compounds such as succinic acid and α-GPC, respectively. The enrichment and purification of these compounds could provide producers with new market opportunities for these valuable value-added commodities. *Corresponding author; E-mail martin.reaney@usask.ca

Technical Session I
Biological Sciences, Biomedical Engineering and Health Sciences

Speaker: Dr. Hyock Ju Kwon

Professor, University of Waterloo

Dr. HJ Kwon is a Professor in the Department of Mechanical and Mechatronics Engineering at University of Waterloo. His primary research focuses on artificial intelligence applications in manufacturing and the advancement of biomedical devices and equipment. Dr. Kwon earned his BS degree from Seoul National University and an MS degree from KAIST in Korea. With over 12 years of invaluable industry experience at Samsung Electronics, Texas Instruments, and Saeron Envitech, he furthered his education, obtaining MS and PhD degrees in Mechanical Engineering from the University of Alberta. Following the completion NSERC Postdoctoral Fellowship, during which he conducted research at the California Institute of Technology. He subsequently joined the University of Waterloo as a faculty in 2008, bringing a wealth of expertise and innovation to his academic pursuits. E-mail hjkwon@uwaterloo.ca.

Robotic-Assisted Image-Guided High-Intensity Focused Ultrasound Therapy: Advancements in Non-Invasive Cancer Treatment

Jeong-woo Han[1], Moslem Sadeghi-Goughari[1], Hyock Ju Kwon[1]*

[1]*Department of Mechanical and Mechatronics Engineering, Univ. of Waterloo, ON, Canada*

In the domain of oncology, new image-guided technologies are reshaping our approach to treatment, shifting away from traditional surgeries to less invasive alternatives. In this direction, focused ultrasound (FUS) treatment, also known as high-intensity focused ultrasound (HIFU), gains increasing attention. HIFU focuses ultrasound beams to target tumors, conducted as an outpatient procedure without the need for incisions, thereby offering a swift recovery period. This approach holds significant promise for enhancing the quality of life for millions of patients. Despite its potential for patients, HIFU has not reached its full potential for non-invasive cancer treatment. Concerns about treatment time and precise targeting remain challenging challenges. To overcome these obstacles, our study introduces an innovative robotic-assisted system for image-guided HIFU therapy. This system incorporates a robotic mechanism that allows for six degrees of freedom in focusing the ultrasound, thus enhancing the precision and efficiency of the treatment. Furthermore, our approach integrates AI with ultrasound guidance to refine treatment accuracy and speed. The AI-powered imaging system facilitates real-time tumor identification, reducing the expertise required from practitioners and improving the quality of tumor ablation. The combination of robotics and AI not only enables precise control over the ablation process, minimizing damage to surrounding healthy tissue but also ensures comprehensive treatment of the tumor with minimized ablation area. Additionally, this synergistic accelerates the treatment process, depending on the transducer's movement time, and guarantees that no tumor area remains untreated. Our solution represents a strategic advancement in patient body treatment, promising to set a new standard for non-invasive cancer therapy. *Corresponding author; E-mail hjkwon@uwaterloo.ca

Technical Session II

Open Session

Time: 17:00–18:15, June 17 (Monday) Canada, Mountain Daylight Time (MDT)

Place: KC 204

Sponsor: Association of Korean Canadian Scientists and Engineers (AKCSE)

Organizer: AKCSE

Contact: Dr. Yong Hoon Kim, University of Windsor (kim523@uwindsor.ca)

Description: Artificial Intelligence and its applications, Quantum Technologies

Program:

Time	Place	Topic	Speaker	Affiliation
17:00–17:12	KC 204	Integration of traditional and telematics data for efficient insurance claims prediction	Dr. Himchan Jeong	Simon Fraser University
17:12–17:24		AI model development of road debris detection through integration of the Korean public dataset with heuristic analysis	Jaemin Jeong	Hallym University
17:24–17:36		National commuting time analysis based on mobile bigdata	Dr. Juyoung Kim	Korea Institute of Transport Institute
17:36–17:48		AI-enhanced NifteRT: Precision radiotherapy for mobile tumours	Dr. Jihyun Yun	University of Alberta
17:48–18:00		Aerial point cloud completion using denoising diffusion probabilistic models	Sunghwan Yoo	York University
18:00–18:12		Diffusion model for content-aware image style transfer	Dr. WonSook Lee	University of Ottawa

List of Participants:

Name	Position	Affiliation
Dr. Yong Hoon Kim	Professor	University of Windsor
Dr. Himchan Jeong	Professor	Simon Fraser University
Jaemin Jeong	Ph.D. student	Hallym University
Dr. Juyoung Kim	Director	Korea Institute of Transport Institute
Dr. Jihyun Yun	Professor	University of Alberta
Sunghwan Yoo	Ph.D. student	York University
Dr. WonSook Lee	Professor	University of Ottawa

Technical Session II
Artificial Intelligence and its applications, Quantum Technologies

Chair: Dr. Himchan Jeong
Assistant Professor, Simon Fraser University

Dr. Jeong received his Ph.D. from the University of Connecticut in 2020. He is an Assistant Professor in Statistics and Actuarial Science at Simon Fraser University. As a Fellow of the Society of Actuaries (SOA), he has been actively involved in teaching and conducting research in actuarial science for several years. In recognition for his academic achievements and excellence, he has been awarded the James C. Hickman Scholarship from SOA recently in 2018-2020. His current research interest is predictive modeling for ratemaking and reserving of property and casualty insurance. E-mail: Himchan_jeong@sfu.ca

Technical Session II
Artificial Intelligence and its applications, Quantum Technologies

Speaker: Dr. Himchan Jeong

Assistant Professor, Simon Fraser University

Dr. Jeong received his Ph.D. from the University of Connecticut in 2020. He is an Assistant Professor in Statistics and Actuarial Science at Simon Fraser University. As a Fellow of the Society of Actuaries (SOA), he has been actively involved in teaching and conducting research in actuarial science for several years. In recognition for his academic achievements and excellence, he has been awarded the James C. Hickman Scholarship from SOA recently in 2018-2020. His current research interest is predictive modeling for ratemaking and reserving of property and casualty insurance. E-mail: Himchan_jeong@sfu.ca

Integration of Traditional and Telematics Data for Efficient Insurance Claims Prediction

Hashan Peiris1, Himchan Jeong1*, Jae-Kwang Kim2, Hangsuck Lee3

[1]Department of Statistics and Actuarial Science, Simon Fraser University, Burnaby, BC, Canada, [2]Department of Statistics, Iowa State University, Ames, IA, United States, [3]Department of Mathematics, Sungkyunkwan University, Seoul, Korea

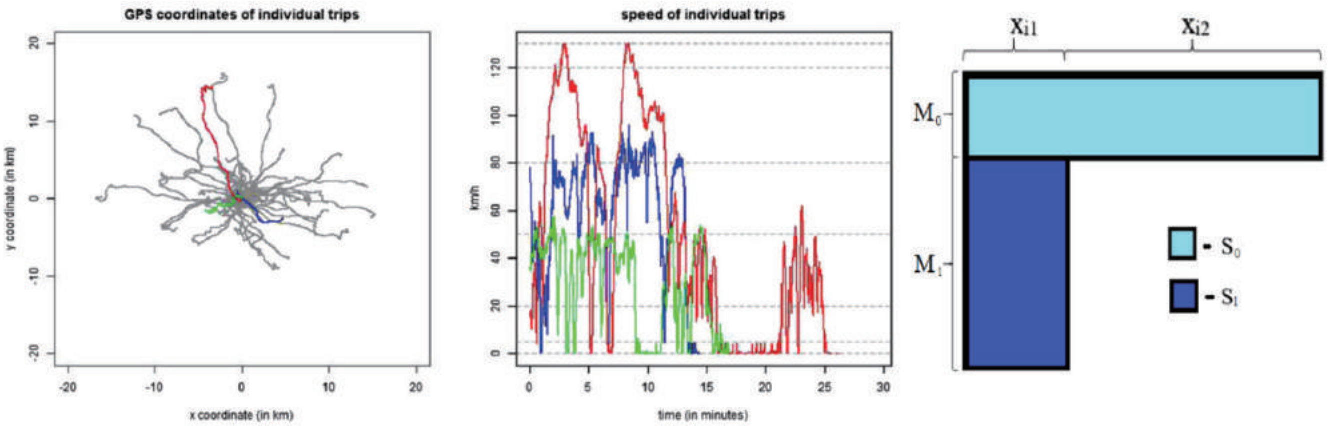


Figure 1: [Left] 200 individual trips of a car driver [Middle] Resulting speed profiles of the three colored trips (Wüthrich, 2017) [Right] Pictorial visualization of S_0 (traditional data), S_1 (telematics data), x_i1 (traditional features), and x_i2 (telematics features).

While driver telematics has gained attention for risk classification in auto insurance, scarcity of observations with telematics features has been problematic, which could be owing to either privacy concerns or favorable selection compared to the data points with traditional features. To handle this issue, we apply a data integration technique based on calibration weights for usage-based insurance with multiple sources of data. It is shown that the proposed framework can efficiently integrate traditional data and telematics data and can also deal with possible favorable selection issues related to telematics data availability. Our findings are supported by a simulation study and empirical analysis in a synthetic telematics dataset.

*Corresponding author; E-mail: Himchan_jeong@sfu.ca

Technical Session II
Artificial Intelligence and its applications, Quantum Technologies

Speaker: Jaemin Jeong

Ph.D. Student, Hallym University, Korea (Visiting Research Student, University of Ottawa)

Mr. Jeong is a Ph.D. student in Computer Engineering at Hallym University. His research topic is artificial intelligence applications and deep learning model optimization for medical sleep stage classification. He has been honored with numerous awards from nationwide AI competitions and has authored two journal papers. Additionally, he holds several patents. He finds pleasure in contributing to open-source software projects.
E-mail jaemin.jeong@hallym.ac.kr

AI Model Development for Road Debris Detection through Integrating Public Korean Landscape Dataset with Heuristic Analytics

Jaemin Jeong[1,2,3], Jiho Cho[1], Won-Sook Lee[3]*, Jeong-Gun Lee[2]*

[1]UnleashifAI Inc., Ottawa, Canada, [2]Department of Computer Engineering, Hallym University, Chuncheon, Korea, [3]School of Electrical Engineering and Computer Science, University of Ottawa, Ottawa, Canada

The importance of Road Debris Detection (RDD) for enhancing road safety and advancing autonomous driving technologies is increasingly recognized. However, a lack of comprehensive, geographically specific datasets for RDD presents a substantial challenge. Traditionally, this gap has been addressed through synthetic datasets in 3D environments or generative models like Generative Adversarial Networks and Style Transfer. Our research tackles this challenge by proposing a novel RDD approach that leverages real-world data. First, we utilize publicly available Korean datasets from AI-HUB to train RDD models specifically tailored to the Korean landscape. Second, we employ meticulous data analysis and heuristic integration to enhance the Korean datasets for RDD tasks. Finally, we explore YOLOv9 models of varying sizes to achieve a balance between accuracy and computational efficiency for deployment on light devices in autonomous vehicles. These strategies go beyond highlighting the limitations of existing datasets. We actively develop a robust RDD system with a geographically relevant and enhanced dataset, ultimately contributing to safer roads and fostering practical autonomous driving systems.
*Corresponding author; E-mail jeonggun.lee@hallym.ac.kr

Technical Session II
Artificial Intelligence and its applications, Quantum Technologies

Speaker: Dr. Juyoung Kim

Research Fellow and Director, Dept. of National Transport Bigdata of Korea Transport Institute

Dr. Kim received his Ph.D. from University of Seoul in 2005. He is a Research Fellow and Director of Dept. of National Transport Bigdata at Korea Transport Institute. Korea Transport Institute has been building the National Transport DB since 1999. As the head of the national transport DB construction project, he is building a national standard demand analysis DB used to evaluate the feasibility of transportation SOC. The national transportation DB construction project is leading the establishment of standard transportation demand models such as modal split models as well as passenger and cargo ODs for predicting traffic demand and builds standard transport statistics such as modal split rates, transport congestion cost. Recently, the area of establishing the national transportation DB is expanding by analyzing detailed and various traffic indicators using transportation big data such as mobile, vehicle GPS, and public transportation cards.

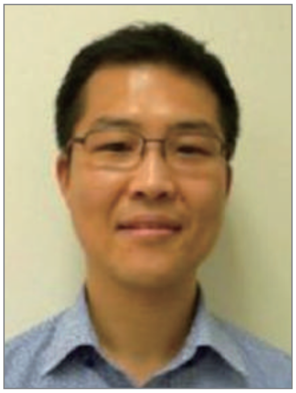
National Commuting Time Analysis based on Mobile Bigdata

Juyoung Kim[1]

[1]*Department of National Transport Bigdata, Korea Transport Institute, Sejong, Korea**

In the domain of oncology, new image-guided technologies are reshaping our approach to treatment, shifting away from traditional surgeries to less invasive alternatives. In this direction, focused ultrasound (FUS) treatment, also known as high-intensity focused ultrasound (HIFU), gains increasing attention. HIFU focuses ultrasound beams to target tumors, conducted as an outpatient procedure without the need for incisions, thereby offering a swift recovery period. This approach holds significant promise for enhancing the quality of life for millions of patients. Despite its potential for patients, HIFU has not reached its full potential for non-invasive cancer treatment. Concerns about treatment time and precise targeting remain challenging challenges. To overcome these obstacles, our study introduces an innovative robotic-assisted system for image-guided HIFU therapy. This system incorporates a robotic mechanism that allows for six degrees of freedom in focusing the ultrasound, thus enhancing the precision and efficiency of the treatment. Furthermore, our approach integrates AI with ultrasound guidance to refine treatment accuracy and speed. The AI-powered imaging system facilitates real-time tumor identification, reducing the expertise required from practitioners and improving the quality of tumor ablation. The combination of robotics and AI not only enables precise control over the ablation process, minimizing damage to surrounding healthy tissue but also ensures comprehensive treatment of the tumor with minimized ablation area. Additionally, this synergistic accelerates the treatment process, depending on the transducer's movement time, and guarantees that no tumor area remains untreated. Our solution represents a strategic advancement in patient body treatment, promising to set a new standard for non-invasive cancer therapy. *Corresponding author; E-mail hjkwon@uwaterloo.ca

Technical Session II
Artificial Intelligence and its applications, Quantum Technologies



Speaker: Dr. Jihyun Yun, PhD, FCCPM

Assistant professor, Medical Physics

Dr. Yun received his Ph.D. from the University of Alberta in 2013. He is a Senior Medical Physicist at the Cross Cancer Institute and an Assistant Professor of Oncology at the University of Alberta. He is a fellow of the Canadian College of Physicists in Medicine and a full member of the American Association of Physicists in Medicine. In the clinical setting, his specialty lies in radiation oncology physics, with a primary focus on brain radiosurgery. On the academic front, his research interests encompass the application of AI for real-time tumour motion management and the concurrent use of linear accelerators and MRI in radiotherapy. He has been honored with several awards, including the J.R. Cunningham Young Investigators Award. As the principal investigator and co-investigator, he has led and collaborated on multiple provincial and national research grants, including a project grant from the Canadian Institutes of Health Research. E-mail: jyun@ualberta.ca

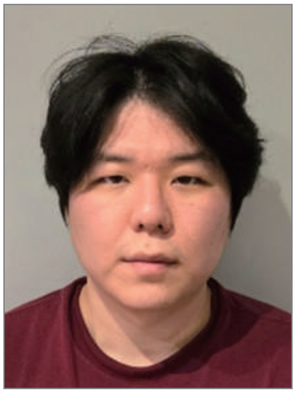
AI-Enhanced NifteRT: Precision Radiotherapy for Mobile Tumours

Gawon Han[1], Neil Johnson[2], Mark Wright[1], Jihyun Yun[1,2]*

[1]Department of Oncology, Medical Physics division, University of Alberta, Edmonton, Alberta, Canada, [2]Department of Medical Physics, Cross Cancer Institute, Edmonton, Alberta, Canada

Cancer remains the primary cause of death in Canada, with approximately 50% of patients undergoing radiotherapy (RT) as part of their treatment. RT employs ionizing radiation to eliminate tumour cells, typically administered via a device known as a linear accelerator (linac). When a tumour remains stationary during treatment, such as with brain tumours, modern RT can achieve sub-millimeter precision by targeting the tumour accurately while sparing surrounding healthy tissue. However, the challenge arises with mobile tumours, such as with lung tumours, which can move and change shape due to respiratory and cardiac motions. This mobility complicates the delivery of precise RT, mainly due to limitations in real-time tumour imaging and tracking. To address this challenge, our goal is to improve the geometric precision of RT for treating mobile tumours using the Alberta linac-MR, an innovative hybrid system that combines a linac with MRI. We have developed a novel RT method called non-invasive intra-fractional tumour-tracked RadioTherapy (nifteRT), which involves four continuous steps during irradiation: real-time MR imaging, automatic tumour contouring, and tumour motion prediction. We have developed several AI-based algorithms for each component of nifteRT, utilizing fully-connected neural networks, convolutional neural networks, and long short-term memory networks, respectively. The efficacy of nifteRT has been demonstrated in 2013 by delivering precise radiation (< 1.7 mm error) to a moving target simulating 1D lung tumour motion in the linac-MR. Currently, our focus is on enhancing nifteRT to achieve clinical applicability, aiming for < 3 mm total RT delivery error for mobile tumours.
*Corresponding author; E-mail jyun@ualberta.ca

Technical Session II
Artificial Intelligence and its applications, Quantum Technologies



Speaker: Sunghwan Yoo

Ph.D. Student, Earth and Space Science at Lassonde School of Engineering, York University

Sunghwan is a Ph.D. student in the Department of Earth and Space Science and Engineering at Lassonde School of Engineering, York University. He completed his bachelor's degree in Statistics and Astro Physics at University of Toronto and in process of an integrated master's and Ph.D. program. He started his research career in his undergraduate as a research assistant in the Medical Imaging department at University of Toronto, and he led the research in prostate cancer detection using MRI and Deep Learning techniques. In his graduate studies, he was involved in research projects exploring large scale point cloud semantic segmentation with Deep Learning and an autonomous train system. Currently, he is studying and researching outdoor point cloud scene completion through diffusion AI, while furthering his work on large scale point cloud semantic segmentation. This blend of projects underscores his commitment to pushing the boundaries of Deep Learning applications in complex spatial data analysis.
Email: jacobyoo@yorku.ca

Aerial Point Cloud Completion using Denoising Diffusion Probabilistic Models

Sunghwan Yoo, Gunho Sohn*

Department of Earth and Space Science and Engineering, York University, Ontario, Canada

The process of generating detailed point clouds for extensive geographical areas through drone-based surveying is traditionally characterized by multiple overlapping flights. This method, while effective in capturing comprehensive environmental data, is notably resource-intensive, necessitating substantial time and financial commitments. We propose a novel approach that significantly alleviates these constraints by integrating point cloud completion techniques with advanced diffusion models. Our methodology leverages the inherent capabilities of scaling diffusion models to infer and reconstruct missing data points, enabling the use of comparatively sparser point clouds obtained from fewer, shorter drone flights. We demonstrate that through strategic application of these models, it is possible to produce high-fidelity point clouds that closely approximate those generated through conventional, more exhaustive surveying methods. This approach can markedly reduce the operational costs and time requirements associated with large-scale drone surveys, while maintaining a high level of detail and accuracy in the resulting point clouds. *Corresponding author; E-mail gshon@yorku.ca

Technical Session II
Artificial Intelligence and its applications, Quantum Technologies

Speaker: Dr. WonSook Lee

Professor, Electrical Engineering and Computer Science, University of Ottawa

Prof. Lee received her Ph.D. from University of Geneva in 2000. She is a Professor in the School of Electrical Engineering and Computer Science, Faculty of Engineering at the University of Ottawa and also the director of Lab of Images, Intelligence and Innovation (LIII). With background in Mathematics and Computer Science, her main research areas cover Computer Graphics, Computer Vision, Virtual/Augmented Reality, Machine/Deep Learning and Medical Imaging. She is the author or co-author about 140 peer-reviewed conference/journal publications. Through the years in the University of Ottawa, she has awarded several research grants such as NSERC DISCOVERY, NSERC RTI, CFI, ORF, ORNEC, CIHR/NSERC CHRP, NSERC Engage, SME4SME, NCE GRAND and Global Frontier R&D program by the National Research Foundation of Korea. Most of grants, she is the Principal Investigator. E-mail wslee@uottawa.ca

Diffusion Model for Content-aware Image Style Transfer

Jungmin Hwang, Won-Sook Lee

School of Electrical Engineering and Computer Science, Faculty of Engineering, University of Ottawa, Canada

Despite the advancements made in image generation and editing using diffusion models, there remains a significant challenge in preserving content effectively during style transfer. Content preservation is crucial for improving image editing tools. One strategy to address this challenge involves determining areas of high content within an image guided by text prompt and preserving them while stylizing the image during diffusion's reverse process. Our proposed method tackles this by refining features through Convolution Block Attention Module, and then, anchoring representative points in these content-rich areas for both the source and generated images. Through our attention maps guidance, we selectively focus on these anchor points to maintain more important features. Additionally, we utilize contrastive learning in a self-supervised manner to enhance content preservation while transferring style. By integrating these techniques into a conventional diffusion model, our method eliminates the need for fine-tuning or auxiliary networks, speeding up the inference process compared to other diffusion methods. Our experiments demonstrate the superiority of our approach, particularly in preserving content of the image during editing, surpassing both other diffusion models and GAN-based approaches.

Technical Session III

Open Session

Time: 17:00–18:15, June 17 (Monday) Canada, Mountain Daylight Time (MDT)

Place: KC 206

Sponsor: Association of Korean-Canadian Scientists and Engineers (AKCSE)

Organizer: AKCSE

Contact: Dr. Yong Hoon Kim, University of Windsor (kim523@uwindsor.ca)

Description: Mechanical, Civil - I

Program:

Time	Place	Topic	Speaker	Affiliation
17:00–17:18	KC 206	Evaluation of internal void related defects in reinforced concrete slab using electromagnetic wave properties	Dr. Hajin Choi	Soongsil University
17:18–17:36		Human-robot interaction control for assist-as needed in exoskeleton-based gait rehabilitation	Dr. Jung Wook Park	Simon Fraser University
17:36–17:54		Development of hand gesture interaction in virtual environmental through computer vision	Dr. Eunsik Kim	University of Windsor
17:54–18:12		Tailoring multicomponent composites and foam properties via micro-structuring	Dr. Patrick C. Lee	University of Toronto

List of Participants:

Name	Position	Affiliation
Dr. Yong Hoon Kim	Professor	University of Windsor
Dr. Hajin Choi	Professor	Soongsil University
Dr. Jung Wook Park	Professor	Simon Fraser University
Dr. Eunsik Kim	Professor	University of Windsor
Dr. Patrick C. Lee	Professor	University of Toronto

Technical Session III
Mechanical, Civil and Aerospace Engineering I

Chair: Dr. Jung Wook (Ed) Park

Professor, Simon Fraser University

Dr. Park received the B.A.Sc. degree in mechanical engineering from the University of British Columbia, Vancouver, BC, Canada, in 1996, and the M.A.Sc. and Ph.D. degrees in mechanical engineering from the University of Toronto, Toronto, ON, Canada, in 1999 and 2003, respectively. He is currently a Professor with the School of Mechatronic Systems Engineering, Simon Fraser University (SFU), Surrey, BC, Canada, where he is also the Scientific Director of WearTech Labs – a University Core Research Facility. He is also Associate Dean, Academic, of the Faculty of Applied Sciences and an Associate Member of the Faculty of Health Science at SFU. His current research interests include wearable technologies, biomechatronic, biomedical technologies, and medical devices for healthcare. He is the author and co-author of over 150 publications, including over 20 patents. Finally, he is a co-founder of a university spinoff, Human in Motion Robotics, which develops next generation wearable robotic exoskeletons.

Technical Session III
Mechanical, Civil and Aerospace Engineering I

Speaker: Dr. Hajin Choi

Associate Professor, School of Architecture, Soongsil University
Visiting Professor, Civil and Environmental Engineering, University of Waterloo

Prof. Choi, is a visiting professor who joined the Department of Civil and Environmental Engineering (CEE) at the University of Waterloo (UWaterloo) in 2024, an associate professor at the school of architecture in Soongsil University, Korea, and prior to that, served as an Research Associate at Federal Highway Administration, Turner-Fairbank Highway Research Center (TFHRC). His principal research focuses on developing novel non-destructive testing and evaluation that enable infrastructure assessment by analyzing multi-physics data. Since 2018, he has been awarded research funds totaling $1.4M as PI and $2.2M as Co-PI, from Federal, State/Provincial, and industry research sponsors in Korea, with most of this funding being associated with concrete bridge-related research projects. To date, he has published over 40 journal and conference papers, with a major focus on non-destructive evaluation and construction materials for civil infrastructure. He currently Chairs the Korea Concrete Institute's (KCI) committee on Structural Inspection (402) and the Korean Society for Non-destructive Testing's (KSNT) committee on Structural Safety.

Evaluation of Internal Void Related Defects in Reinforced Concrete Slab using Electromagnetic Wave Properties

Hajin Choi[1,2]*, Taemin Lee[1], Ukyong Woo[1], Minju Kang[1], Jinyoung Hong[1,2], Chul Min Yeum[2]

[1]School of Architecture, Soongsil University, Seoul, Korea, [2]Department of Civil and Environmental Engineering, University of Waterloo, ON, Canada

This study aimed to develop a damage-detection algorithm based on the electromagnetic wave properties inside a reinforced concrete structure. The proposed method involved employing two algorithms based on data measured using ground-penetrating radar—a common electromagnetic wave method in civil engineering. The possible defect area was identified based on the energy dissipated by the damage in the frequency-wavenumber domain, with the damage localized using the calculated relative permittivity of the measurements. The proposed method was verified through a finite difference time-domain-based numerical analysis and a testing slab with artificial damage. As a result of verification, the proposed method quickly identified the presence of damage inside the concrete, especially for honeycomb-like defects located at the top of the rebar. This study has practical significance in scanning structures of a large area faster time than other non-destructive testing methods, such as ultrasonic methods.

*Corresponding author; E-mail hjchoi@ssu.ac.kr

Technical Session III
Mechanical, Civil and Aerospace Engineering I

Speaker: Dr. Jung Wook (Ed) Park
Professor, Simon Fraser University

Dr. Park received the B.A.Sc. degree in mechanical engineering from the University of British Columbia, Vancouver, BC, Canada, in 1996, and the M.A.Sc. and Ph.D. degrees in mechanical engineering from the University of Toronto, Toronto, ON, Canada, in 1999 and 2003, respectively. He is currently a Professor with the School of Mechatronic Systems Engineering, Simon Fraser University (SFU), Surrey, BC, Canada, where he is also the Scientific Director of WearTech Labs – a University Core Research Facility. He is also Associate Dean, Academic, of the Faculty of Applied Sciences and an Associate Member of the Faculty of Health Science at SFU. His current research interests include wearable technologies, biomechatronic, biomedical technologies, and medical devices for healthcare. He is the author and co-author of over 150 publications, including over 20 patents. Finally, he is a co-founder of a university spinoff, Human in Motion Robotics, which develops next generation wearable robotic exoskeletons.

Human-Robot Interaction Control for Assist-as-Needed in Exoskeleton-based Gait Rehabilitation

Milad Mousavi, Siamak Arzanpour, Jung Wook (Ed) Park*

School of Mechatronic Systems Engineering, Simon Fraser University, Surrey, BC, Canada

Patients with partial lower-limb impairments benefit from gait rehabilitation to enhance muscle memory and coordination. Traditionally, therapists manually assist patients, adjusting the support provided. However, lower-limb exoskeletons offer a promising alternative, reducing therapist workload by automating assistance based on patient needs. This study introduces a human-robot interaction technique enabling a self-balancing exoskeleton to adaptively adjust assistance in response to patient-initiated forces, using joint torque measurements to estimate interaction torques. The exoskeleton aims to maintain the user's intended movement path with minimal deviation, achieved by integrating admittance and impedance controls. These controls are fine-tuned to ensure the robot's movements are initiated by the patient's effort, allowing for precise foot positioning. This method ensures that forces along and perpendicular to the predefined path facilitate progression and manage deviation, with deviations confined within a predefined boundary. This approach highlights the potential of adaptive self-balancing exoskeletons in transforming gait rehabilitation. By offering personalized and responsive assistance, it paves the way for improved independence and outcomes for individuals with lower-limb mobility impairments, marking a significant advancement in robotic rehabilitative technologies.

*Corresponding author; e-mail: ed_park@sfu.ca

Technical Session III
Mechanical, Civil and Aerospace Engineering I

Speaker: Dr. Eunsik Kim

Assistant Professor, University of Windsor

Dr. Kim received his Ph.D. from Penn State University in 2018. He is an Assistant Professor in Mechanical, Automotive & Materials Engineering at the University of Windsor. His research areas include human factors and ergonomics and the development of effective gamification through user-centered design. His current research focuses on developing an emotion assessment algorithm through such psychological and psychophysiological measurements as eye tracking, GSR, HRV, fEMG and EEG using machine-learning techniques as part of an NSERC Discovery Grant. He received the Graduate Scholarship for Excellence and the C. Norwood Wherry Memorial Graduate Fellowship in Engineering from Pennsylvania State University. Dr. Kim was also awarded the Best Paper Award by the Ergonomics Society of Korea. He has served as a consultant of ergonomic services for over 10 small-, medium-, and large-sized companies, using physical and physiological sensors to identify, analyze and control workplace risk factors and prevent work-related musculoskeletal disorders.
E-mail eskim@uwindsor.ca

Development of Hand Gesture Interaction in Virtual Environments Through Computer Vision

Afrooz Shakeri, Eunsik Kim*

1 Mechanical, Automotive & Materials Engineering, University of Windsor, Ontario, Canada

Work-related lifting tasks can result in lower back pain, making it a primary cause of workplace injuries. The National Institute for Occupational Safety and Health (NIOSH) developed the revised NIOSH lifting equation (RNLE) to mitigate the risk of lifting tasks. However, manual measurement of RNLE parameters suffers from observer fatigue and bias and is not cost-effective. Thus, the purpose of this research is to develop computer vision for classifying the risks associated with lifting tasks by integrating changes in facial expressions along with changes in electrocardiogram (ECG) and electrodermal activity (EDA) bio-signals. Ten males and ten females participated in the experiment. The participants conducted four lifting conditions by considering both optimal and poor lifting conditions. We categorized tasks based on the Lifting Index (LI): LI<1 for safe tasks, 0<LI<1 for medium risk, and 2<LI<3 for high risk. Adjusting the load weight simulated different risk levels (tasks). Participants attempted each task for 3 minutes (12 liftings), with breaks between tasks and conditions. We explored different machine learning classifiers and Neural Networks had the highest accuracy. The facial-only model attained accuracies of 71% for binary- and 54% for multiclass classification. Adding bio-signals improved the accuracy to 80% for binary- and 57% for multiclass classification. Additionally, a recall value of 92% indicated the model's effectiveness in identifying unsafe tasks among all true unsafe tasks. *Corresponding author; E-mail eskim@uwindsor.ca

Technical Session III
Mechanical, Civil and Aerospace Engineering I

Speaker: Dr. Patrick C. Lee
Associate Professor, University of Toronto

Dr. Lee serves as an Associate Professor within the Department of Mechanical and Industrial Engineering at the University of Toronto. He obtained his B.Sc. in Mechanical Engineering from the University of British Columbia, and pursued his M.A.Sc. and Ph.D. in Mechanical Engineering at the University of Toronto. With a wealth of industry experience, Dr. Lee has contributed significantly, having previously held positions as a Research Scientist and Project Leader at The Dow Chemical Company. In 2014, he transitioned to academia, assuming the role of Assistant Professor at the University of Vermont. There, he established a pioneering research platform centered on lightweight and hybrid composite micro-structuring. Returning to the University of Toronto in 2018, Dr. Lee continues his impactful research, focusing on the processing and characterization of hybrid nano-composites and foams. His contributions have been widely recognized, with numerous publications and several prestigious awards honoring his work. E-mail patricklee@mie.utoronto.ca

Tailoring Multicomponent Composites and Foam Properties via Micro-structuring

J.U. Lee, N.D. Sansone, R. Aguiar, A.A. Faysal, J. Zhao, Patrick C. Lee*

Multifunctional Composites Manufacturing Laboratory (MCML), Department of Mechanical, Department of Mechanical and Industrial Engineering, University of Toronto, Toronto M5S 3G8, Canada

Our team currently prioritizes the development of hierarchically structured hybrid composites and micro-/nano-layered (MNL) structures to precisely adjust engineering properties through micro-/nano-phase structuring. We are working on creating hierarchically structured hybrid composites utilizing Graphene Nanoplatelets (GnPs), Halloysite Nanotubes (HNT) and Glass Fibers (GFs) to enhance polymeric composite properties. By capitalizing on synergistic effects, these multifunctional composites can be customized for high-performance applications. The nano-sized HNTs are attached electrostatically to micro-sized GF, forming a hierarchical fibrous assembly. Compared to the leading biphasic composite used in the automotive industry for tough components, our hybrid composite shows significant improvements: 84% higher impact strength, 27% higher specific tensile strength, 56% higher tensile toughness, and 30% higher specific flexural strength. Additionally, it offers a 20% weight reduction and a 255% increase in processability (melt-flow index). We aim to develop high-performance structural reinforcement particles (SRPs) with micro-/nano-sized fibers based on Laser-Induced Graphene (LIG) utilizing advanced manufacturing techniques like MNL coextrusion to introduce 1D, 2D, and 3D reinforced phases within plastic matrices. Our goal is to produce robust, lightweight, economically viable composites employing recycled resins and leveraging advanced microcellular foaming technology for further weight reduction. We focus on crafting composites suitable for high-value applications including filters, aircraft-aerospace, medical and packaging sectors, plastics recycling, and future mobility.
*Corresponding author; E-mail patricklee@mie.utoronto.ca

Technical Session IV

Open Session

Time: 17:00–18:15, June 17 (Monday) Canada, Mountain Daylight Time (MDT)

Place: KC 208

Sponsor: Association of Korean Canadian Scientists and Engineers (AKCSE)

Organizer: AKCSE

Contact: Dr. Yong Hoon Kim, University of Windsor (kim523@uwindsor.ca)

Description: Mechanical, Civil - II

Program:

Time	Place	Topic	Speaker	Affiliation
17:00–17:18	KC 208	Prediction of Human Driver Behaviour using Artificial Intelligence: Implications and Challenges for Traffic Operation and Safety	Dr. Chris Lee	University of Windsor
17:18–17:36		A study on the development of terrain following algorithm considering digital terrain elevation data (DTED)	Dr. Sangchul Lee	Korea Aerospace University
17:36–17:54		Enhancing remote inspection using a 5G-enabled drone	Dr. Chul Min Yeum	University of Waterloo
17:54–18:12		Toward the environmental aging and durability of polymer nanocomposites through sequential multiscale modeling	Dr. Seunghwa Yang	Chung-Ang University / University of Alberta

List of Participants:

Name	Position	Affiliation
Dr. Yong Hoon Kim	Professor	University of Windsor
Dr. Chris Lee	Professor	University of Windsor
Dr. Sangchul Lee	Professor	Korea Aerospace University
Dr. Chul Min Yeum	Professor	University of Waterloo
Dr. Seunghwa Yang	Professor	Chung-Ang University / University of Alberta

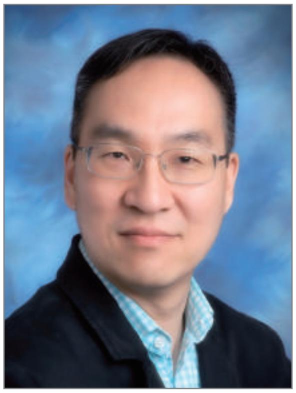
Technical Session IV
Mechanical, Civil and Aerospace Engineering II

Chair: Dr. Chul Min Yeum

Assistant Professor, University of Waterloo

Prof. Yeum is an assistant professor who joined the Department of Civil and Environmental Engineering (CEE) at the University of Waterloo in 2018. He received a B.S. and M.S. from CEE at the Korea Advanced Institute of Science & Technology (KAIST) and Ph.D. from CEE at Purdue University. His principal research focuses on developing novel implementations of computer vision, robotics, and deep learning methods that enable visual assessment by analyzing large volumes of images. Since 2015, he has made significant progress in vision-based structure inspection methods that can sift through large volumes of images to identify and classify critical structural components and damage. To date, he has published over 50 journal and conference papers, with a major focus on vision-based structural health monitoring and post-disaster assessment for civil infrastructure (Google Scholar, H-index 17 since 2011). He currently holds a Discovery Grant and Alliance from NSERC, CFI-JELF, Mitacs Accelerate, HIIFP from Ministry of Transportation of Ontario, and a research partnership with Rogers to develop 5G-enabled smart city applications.

Technical Session IV
Mechanical, Civil and Aerospace Engineering II



Speaker: Dr. Chris Lee

Professor, Department of Civil and Environmental Engineering, University of Windsor

Dr. Lee received the Ph.D. degree in Civil Engineering (Transportation) from the University of Waterloo. His main research interests are in traffic safety, driver behavior, advanced traffic operation and control, and emerging vehicle technologies including connected and autonomous vehicles. Dr. Lee has conducted research on vehicle interaction and conflicts in car-truck mixed traffic and manual-autonomous vehicle mixed traffic, car-following and lane-changing behaviour, prediction of crash frequency and injury severity, safety evaluation of countermeasures, advanced real-time speed control for freeways, driver safety in partially automated vehicles, and aggressive driving behaviour. Dr. Lee is an Associate Editor of two academic journals - Accident Analysis and Prevention and Canadian Journal of Civil Engineering.

Prediction of Human Driver Behaviour using Artificial Intelligence: Implications and Challenges for Traffic Operation and Safety

Chris Lee

Civil and Environmental Engineering, University of Windsor, Windsor, ON, Canada

Prediction of human driver behaviour is important to assess the impacts of changes in traffic, road geometry and environmental conditions on traffic operation and safety. Drivers' reaction by acceleration and deceleration can disrupt traffic flow which leads to congestion and increase the risk of collision with other vehicles. Conventionally, mathematical models have been developed to predict drivers' car-following and lane-changing behaviour based on vehicle kinematics theory and drivers' pre-specified decision processes. However, as more variety of types of vehicles (e.g., human-driven or self-driving vehicles) share the road, mathematical models have limitations in capturing dynamic changes in human driver behaviour while interacting with these different vehicle types. To overcome this limitation, variety of data-driven models have also been developed using artificial intelligence (AI), more specifically machine learning algorithms. In spite of high prediction accuracy of these AI-based models, the models require a large amount of data for training, which decreases the computational efficiency of the models. Moreover, AI-based models do not generally provide interpretable relationships among different variables, which help identify the factors affecting driver behaviour. This presentation demonstrates challenges with practical application of AI-based models to the prediction of driver behaviour with an emphasis on car-following behaviour. This presentation also discusses future direction of research to enhance the applicability of AI-based models to the improvement of traffic operation and safety based on the predicted driver behaviour.

*Corresponding author; E-mail cclee@uwindsor.ca

Technical Session IV
Mechanical, Civil and Aerospace Engineering II

Speaker: Dr. Sangchul Lee

Professor, the School of Aerospace & Mechanical Engineering and the Department of Smart Air Mobility, Korea Aerospace University

Sangchul Lee received his B.S. and M.S. degrees in Aeronautical Engineering from Seoul National University, Korea, in 1986 and 1988, respectively. He got his Ph.D. degree from Texas A&M University in 1994. Then he worked for Samsung Aerospace Industries, Ltd. and Korea Aerospace Industries, Ltd. from 1994 to 2006. He joined Korea Aerospace University in 2006, currently serving as a professor of the School of Aerospace and Mechanical Engineering. His research interests include flight dynamics and aircraft control, dynamics and control of space structures, avionics system design, system engineering and management, and software engineering. Currently, he is serving as a BK21FOUR program director of Smart Drone Convergence E&R center of Korea Aerospace University

A Study on the Development of Terrain Following Algorithm considering Digital Terrain Elevation Data(DTED)

Hyunju Lee[1], Haryeon Lee[1], Sangchul Lee[1]*

[1]*Department of Smart Air Mobility, Korea Aerospace University, Goyang-si, Gyeonggi-do, Republic of Korea*

In military flight area, the terrain following(TF) technique plays an important role, offering the capability for aircraft to fly close to the ground to minimize the risk of detection by enemies. Maintaining a flightworthy trajectory, with a specific clearance height over terrain, is essential to avoid collisions with the ground. Proper acquisition of terrain information should be implemented to provide a precise trajectory. The terrain information can be obtained from radar and from a digital terrain database. The terrain profile can be generated using radar scan data, a digital terrain database, or a combination of both. Usually radar scan data have limitations due to the radar's maximum range. Generally, TF predominantly considers longitudinal motion along the aircraft's path, allowing for the generation of a 2-dimensional terrain profile. The terrain profile is utilized as the source for the TF trajectory.

The trajectory generation algorithm using 3-mask morphology method and circular method consists of generating TF path and TF trajectory. It is assumed that the terrain profile is generated using radar scan data which is gathered in the DTED Level 2 environment. The terrain profile depicted in Fig. 1 serves as an example of terrain information for TF.

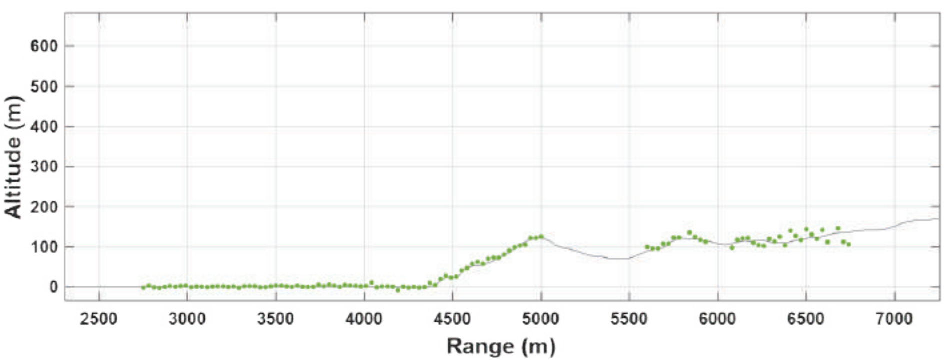


Figure 1. Terrain profile

The 3-mask morphology method and circular path method are used for generating TF path, then it converted into the TF trajectory. Assuming the constant aircraft speed, TF path comprises a circular path and a straight path, therefore, the path is converted into a trajectory that shows the position, speed, and flight path angle. Figure 2 provides an example of TF trajectory based on the 3-mask morphology and circular path. In this case, the active mode profile which uses the radar scan data serves as reference path.

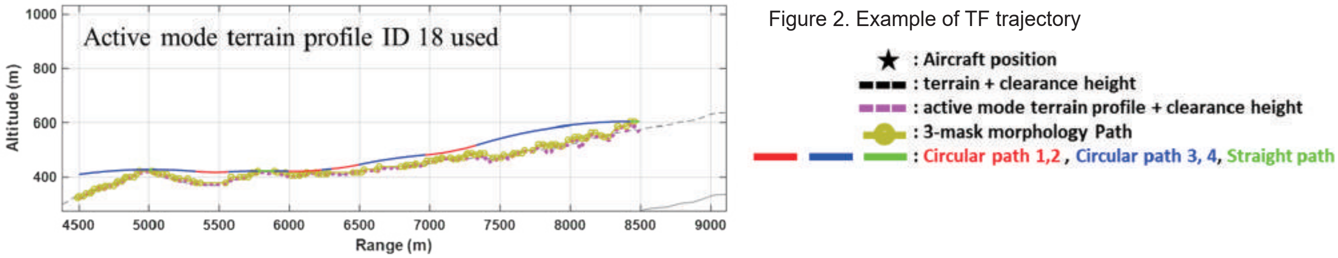


Figure 2. Example of TF trajectory

This paper proposes the TF simulator which consists of the radar simulator, the terrain following computer(TFC) simulator, and the flight simulator as shown in Fig. 3.

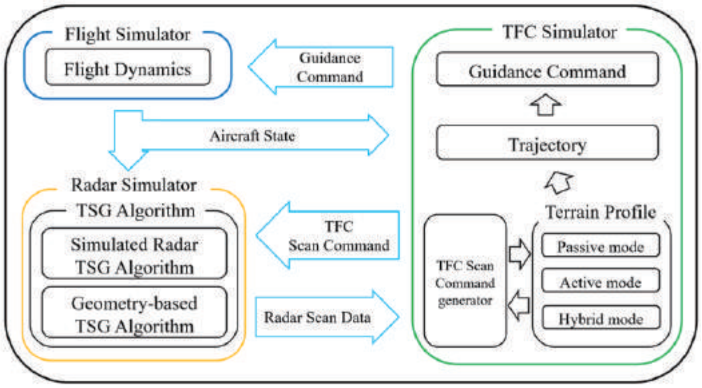


Figure 3. Configuration of Terrain Following Simulator

The TF simulator could be used for the development of TF algorithm and initial validation without real flight test.

Technical Session IV
Mechanical, Civil and Aerospace Engineering II

Speaker: Dr. Chul Min Yeum

Assistant Professor, University of Waterloo

Prof. Yeum is an assistant professor who joined the Department of Civil and Environmental Engineering (CEE) at the University of Waterloo in 2018. He received a B.S. and M.S. from CEE at the Korea Advanced Institute of Science & Technology (KAIST) and Ph.D. from CEE at Purdue University. His principal research focuses on developing novel implementations of computer vision, robotics, and deep learning methods that enable visual assessment by analyzing large volumes of images. Since 2015, he has made significant progress in vision-based structure inspection methods that can sift through large volumes of images to identify and classify critical structural components and damage. To date, he has published over 50 journal and conference papers, with a major focus on vision-based structural health monitoring and post-disaster assessment for civil infrastructure (Google Scholar, H-index 17 since 2011). He currently holds a Discovery Grant and Alliance from NSERC, CFI-JELF, Mitacs Accelerate, HIIFP from Ministry of Transportation of Ontario, and a research partnership with Rogers to develop 5G-enabled smart city applications.

Enhancing Remote Inspection using a 5G-Enabled Drone

Chul Min Yeum*, Max Midwinter, Syed Muhammad Raza Rizvi, Huaiyuan Weng, Kyungwan Han, Anas Share

University of Waterloo, ON, Canada

This study, conducted in partnership with Rogers Communications, addresses the significant challenges faced in the manual inspection of civil infrastructure across Canada. These challenges are largely due to the inefficiencies and safety hazards inherent in traditional methods, compounded by the limitations of existing drone technology, such as the necessity for skilled pilots, high operational costs, stringent regulatory requirements, and GPS unreliability in urban areas. Our research proposes a groundbreaking approach leveraging 5G-enabled drones augmented with Artificial Intelligence (AI) at the Mobile Edge Computing (MEC) level, aiming to revolutionize tower inspection processes. The objective of our study is to design a drone inspection system that utilizes 5G technology to offload AI computational tasks to the MEC. This approach is expected to significantly reduce the drone's payload and operational costs while minimizing safety risks. The forthcoming phase of our research will focus on developing advanced computer vision algorithms for in-depth 2D/3D semantic analysis. Furthermore, the study explores the integration of Augmented Reality (AR) to enable interactive, hands-free data collection, thereby eliminating the need for conventional control devices. Overall, our study seeks to surpass the capabilities of traditional inspection methods by providing a real-time information system for more accurate and cost-effective inspections.

E-mail cmyeum@uwaterloo.ca

Technical Session IV
Mechanical, Civil and Aerospace Engineering II

Speaker: Dr. Seunghwa Yang
Professor

Dr. Yang received his Ph.D. of mechanical engineering from Seoul National University in 2011. He is an associate professor of the school of energy systems engineering (Mechanical engineering division) at Chung-Ang University since 2015. Throughout his career to date, he has focused on developing pioneering scale bridging art combining in-silico computational simulations at extreme scale and continuum micromechanics, as well as effectively applying them to various service environment-related phenomena. He authored 54 highly cited papers in renowned SCI(E) journals and 1 technical book chapter. He received Young Scientist awards from several Korean academic societies KSME, COSEIK, KMSM. He is an associate editor of the Journal of Mechanical Science and Technology. He has been serving as a board member of Korean Society of Mechanical Engineering, Korean Society of Composites Materials, and founding member of Korean Multiscale Mechanics Society. E-mail fafala@ cau.ac.kr

Toward the environmental aging and durability of polymer nanocomposites through sequential multiscale modeling

Inseok Jeon[1], Sunyong Kwon[2], Seunghwa Yang[1]*

[1]School of Energy Systems Engineering, Chung-Ang University Seoul, Korea, [2]Samyang Corporation Daejeon, Korea

Engineering polymers and their composites are continuously exposed to environmental aging condition over the whole lifetime service. The aging phenomena is generally categorized into hygroscopic, chemical and physical aging each of which respectively involves the penetration of moisture, reactive oxidation under irradiation, and steady state relaxation and densification at ambient condition. The most challengeable feature of the researches on the inspection and mitigation of environmental aging is that it takes a very long time. Meanwhile, considerably advanced synthesis and processing technique of polymers has successfully shortened the time to develop new materials, thus, a new breakthrough in evaluation of the long time durability of polymers and composites is required. In this technical presentation, a sequential multiscale modeling approach for hygroscopic aging of epoxy-based composites and coating liners are demonstrated. To describe more realistic invasion of moisture into potential microstructural flaws such as free volumes and interfaces, a combined simulation incorporating open system simulation and classical ensemble simulation is adopted. The susceptibility of moisture penetration and the degradation of materials' interface in load transfer problem of epoxy composites is determined from the virtually aged molecular models. Finally, the hygroscopic constitutive model based on the mean field micromechanics model is derived and bridged to the molecular dynamics simulation results to develop a novel predictive model for the long time aging and durability of engineering composites.

*Corresponding author; E-mail fafala@ cau.ac.kr

Technical Session V

Open Session

Time: 17:00–18:15, June 17 (Monday) Canada, Mountain Daylight Time (MDT)

Place: KC 210

Sponsor: Association of Korean-Canadian Scientists and Engineers (AKCSE)

Organizer: AKCSE

Contact: Dr. Yong Hoon Kim, University of Windsor (kim523@uwindsor.ca)

Description: Material Science, Physics, Nano

Program:

Time	Place	Topic	Speaker	Affiliation
17:00–17:18	KC 210	Atomic resolution and real-time electron microscopy research platform of KBSI for energy-semiconductor nanomaterials	Dr. Hee-Suk Chung	Korea Basic Science Institute
17:18–17:36		Machine learning-assisted simulation detection of volatile organic compounds using multimodal MOFs/MWCNTs gas sensor	Yelim Choi	Seoul National University of Science and Technology
17:36–17:54		Harnessing machine learning for quantum transport simulations	Dr. Youngki Yoon	University of Waterloo
17:54–18:12		Evaluation of long-term thermal fatigue property and microstructures of additively manufactured injector nozzles for gas turbine applications	Dr. Dongyi Seo	National Research Council of Canada

List of Participants:

Name	Position	Affiliation
Dr. Yong Hoon Kim	Professor	University of Windsor
Dr. Hee-Suk Chung	Principal Researcher	Korea Basic Science Institute
Yelim Choi	Ph.D. Student	Seoul National University of Science and Technology
Dr. Youngki Yoon	Professor	University of Waterloo
Dr. Dongyi Seo	Senior Research Officer	National Research Council of Canada

Technical Session V

Materials Science and Engineering, Physics, Chemistry, and Nano Technology

Chair: Dr. Dongyi Seo

Senior Research Officer, Aerospace Research Centre of National Research Council Canada

Dr. Dongyi Seo is a senior research officer at the high temperature materials group, Aerospace Research Centre of National Research Council Canada. He received his Ph.D. degree in Materials Science from Michigan State University in 1998. He manages several significant projects on assessment of high-temperature materials and coatings and repair technology of metallic materials with the gas turbine OEMs and international research organizations. As an Adjunct Professor at Carleton University, he has been working and supervising students on the development of joining technology and evaluation of mechanical and environmental properties of various metallic materials as collaborative projects between NRC, and international research organizations such as Korea Institute of Materials Science, Korea Institute of Industrial Technology-South Korea, Australia's Nuclear Science and Technology Organization-Australia, IHI/Tohoku University-Japan, and Los Alamos National Lab., Michigan State University, and University of Tennessee-USA. He has authored and co-authored 76 peer-reviewed journals, 34 conference proceedings, 55 internal technical reports, and 103 technical presentations at international and national conferences including 22 invited papers and plenary talks. E-mail: dongyi.seo@nrc-cnrc.gc.ca

Technical Session V

Materials Science and Engineering, Physics, Chemistry, and Nano Technology

Speaker: Dr. Hee-Suk Chung

Group Leader, Principal Researcher, Korea Basic Science Institute (KBSI)

Dr. Chung earned Ph.D. in Department of Materials Science and Engineering from Seoul National University in 2010. Subsequently, he held positions as a postdoctoral fellow at the University of Pennsylvania and as a senior researcher at Samsung Electro-Mechanics. Presently, he serves as a group leader of electron microscopy group for materials science at the Korea Basic Science Institute (KBSI). Dr. Chung's research interests lie at the intersection of advanced electron microscopy on materials science. Dr. Chung, along with his collaborative group, focuses on developing and applying innovative, often in situ electron microscopy techniques to image and quantify nanoscale phenomena essential for elucidating structure-property relationships in materials. With over 120 journal papers authored or co-authored, he also holds the role of academic director at the Korean Society of Microscopy. E-mail hshcung13@kbsi.re.kr

Atomic Resolution and Real-time Electron Microscopy Research Platform of KBSI for Energy-Semiconductor Nanomaterials

Sang-Gil Lee[1], Ji-Hyun Lee[1], Jae Hyuck Jang[1], Tae-Sung Bae[1], Hee-Suk Chung[1]*

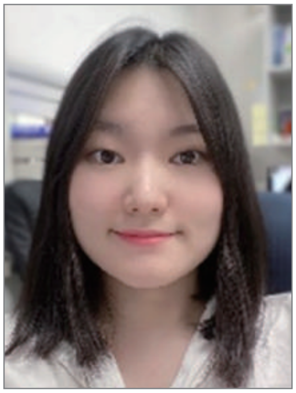
[1]*Electron Microscopy Group for Materials Science, Division of Analytical Science, Korea Basic Science Institute, Daejeon, Korea*

KBSI collaborates with prominent international organizations to advance fundamental science, the cornerstone of national scientific and technological advancement. Through partnerships, KBSI conducts research, provides support, and engages in collaborative projects in analytical science and technology, as well as the development of research infrastructures including facilities and equipment. In its pursuit of becoming a globally recognized open research platform, KBSI actively participates in joint research initiatives, collaborates on equipment development, and fosters researcher exchange programs. Playing a pivotal role, KBSI contributes significantly to fortifying our scientific infrastructure, ultimately enhancing the quality of life for the Korean. In this presentation, we aim to showcase exemplary cases of atomic resolution and real-time electron microscopy analysis conducted at KBSI, while also elucidating international collaborations and future research directions in energy and semiconductor nanomaterials areas of the Fourth Industrial Revolution.

*Corresponding author; E-mail hschung13@kbsi.re.kr

Technical Session V

Materials Science and Engineering, Physics, Chemistry, and Nano Technology



Speaker: Yelim Choi

Ph.D. candidate Student, Seoul National University of Science and Technology

Ms. Choi is a Ph.D. candidate in Environmental Engineering at the Seoul National University of Science and Technology. Her research initially focused on developing efficient methodologies for measuring and analyzing air pollutants, with a particular emphasis on volatile organic compounds (VOCs). In her Ph.D. studies, she aims to enhance the precision and efficiency of air pollutant analysis by integrating machine learning algorithms with state-of-the-art detection technologies, such as chromatography and metal-organic framework (MOF)-based sensors. E-mail yelim9502@seoultech.ac.kr

Machine learning-assisted simultaneous detection of volatile organic compounds using multimodal MOFs/MWCNTs gas sensor

Yelim Choi[1], Seonghwan Kim[2], Daekeun Kim[1]*

[1]Department of Environmental Engineering, Seoul National University of Science and Technology, Seoul, Republic of Korea, [2]Department of Mechanical and Manufacturing Engineering, Schulich School of Engineering, University of Calgary, AB., Canada

In indoor environments where concentrations of volatile organic compounds (VOCs) can increase due to inadequate ventilation, real-time monitoring of air quality is required for proper indoor air quality management. Sensor applications can benefit from the promising capabilities of metal-organic compounds (MOFs), known for their vast surface area and tunable pore size. However, the low electrical conductivity of MOFs requires integration with conductive composites, such as carbon nanotubes and graphene oxide, to improve performance and overcome problems of cross-sensitivity. This research aimed to develop a multimodal sensor that utilizes MOFs combined with multi-walled carbon nanotubes (MWCNTs) to simultaneously detect a mixture of VOCs, including benzene, ethanol, and 2-butanone. This approach ensures reliable and accurate detection of VOCs, making it a promising solution for various applications. Three MOFs, namely ZIF-8/MWCNT, Cu-BTC/MWCNT, and UiO-66/MWCNT, were synthesized and used as sensing films. The sensors with each sensing film were fabricated using quartz crystal microbalance, resistive sensors, and electrochemical impedance spectroscopy techniques, respectively. Material properties were analyzed through X-ray diffraction, scanning electron microscopy, and UV-visible spectrometer analyses. The senser response was measured over a concentration range of 10 ppmv to 500 ppmv. Response ($\Delta f/f0$, $\Delta R/R0$, and $\Delta Z/Z0$), response time, and recovery time were evaluated. A random forest classification algorithm achieved 95% accuracy in identifying the three compounds, improving sensor selectivity for single-compound detection. The regression model reveals that the multimodal gas sensor was effective in identifying the concentration of each compound in the gas mixture, with R-square values of 0.65 for ethanol, 0.91 for 2-butanone, and 0.75 for benzene.

*Corresponding author; E-mail kimd@seoultech.ac.kr

Technical Session V

Materials Science and Engineering, Physics, Chemistry, and Nano Technology

Speaker: Dr. Youngki Yoon

Associate Professor, University of Waterloo

Dr. Youngki Yoon is an Associate Professor in the Department of Electrical and Computer Engineering at the University of Waterloo. He obtained his B.E. degree in Metallurgical Engineering from Korea University in 1999, followed by his M.S. and Ph.D. degrees in Electrical and Computer Engineering from the University of Florida in 2005 and 2008, respectively. Then, he worked as a Postdoctoral Researcher at the University of California, Berkeley from 2009 to 2013. His area of research focuses on t he modeling and simulation of emerging and exploratory devices. He has made significant contributions to the field, having published over 90 journal papers and conference articles that have been cited about 7,000 times, resulting in an h-index of 28. In recognition of his contributions, Dr. Yoon has received several prestigious awards, including the Early Researcher Award from the Ministry of Ontario and the WIN Research Leader Award.
E-mail youngki.yoon@uwaterloo.ca

Harnessing Machine Learning for Quantum Transport Simulations

Michael Spinazze[1], Sunkook Kim[2], Youngki Yoon[1,*]

[1]Department of Electrical and Computer Engineering, University of Waterloo, Ontario, Canada, [2]School of Advanced Materials Science and Engineering, Sungkyunkwan University, Republic of Korea

Investigating new materials for the development of electronic devices requires an understanding of their electronic transport properties, which is typically characterized by a Hamiltonian matrix. Wannier tight-binding (TB) Hamiltonians are widely adopted, as they are advantageous for computational efficiency. However, generating such Hamiltonians remains a computationally expensive and requires often tedious procedure. In the state-of-the-art method to generate Hamiltonians, density functional theory (DFT) calculations are first performed to produce the ab initio Bloch states and energy band structure. Subsequently, the Wannier TB parameters are obtained by projecting the Bloch states onto a basis set of localized atomic-like orbitals. This method produces numerically accurate results but is resource-intensive and relies on a trial-and-error approach for selecting the initial guesses of the localized orbitals. Machine learning (ML) can be leveraged to provide a more convenient avenue for generating Hamiltonians, requiring fewer inputs and fewer computational resources compared to the conventional method. In the ML approach, the TB Hamiltonian matrix elements are initialized from a normal distribution and adjusted using a stochastic gradient descent algorithm to reproduce the ab initio band structure. Thus, only the energy eigenvalues are required as inputs for the fitting process. In addition, the ML technique can be used to refine TB Hamiltonians derived from the conventional Wannier method, enabling a more precise reproduction of the ab initio band structure. This ML technique underscores the potential of ML in the fields of material science and nanoelectronics and can accelerate the development of TB models for quantum transport simulations.

*Corresponding author; Email: youngki.yoon@uwaterloo.ca

Technical Session V

Materials Science and Engineering, Physics, Chemistry, and Nano Technology

Speaker: Dr. Dongyi Seo

Senior Research Officer, Aerospace Research Centre of National Research Council Canada

Dr. Dongyi Seo is a senior research officer at the high temperature materials group, Aerospace Research Centre of National Research Council Canada. He received his Ph.D. degree in Materials Science from Michigan State University in 1998. He manages several significant projects on assessment of high-temperature materials and coatings and repair technology of metallic materials with the gas turbine OEMs and international research organizations. As an Adjunct Professor at Carleton University, he has been working and supervising students on the development of joining technology and evaluation of mechanical and environmental properties of various metallic materials as collaborative projects between NRC, and international research organizations such as Korea Institute of Materials Science, Korea Institute of Industrial Technology-South Korea, Australia's Nuclear Science and Technology Organization-Australia, IHI/Tohoku University-Japan, and Los Alamos National Lab., Michigan State University, and University of Tennessee-USA. He has authored and co-authored 76 peer-reviewed journals, 34 conference proceedings, 55 internal technical reports, and 103 technical presentations at international and national conferences including 22 invited papers and plenary talks. E-mail: dongyi.seo@nrc-cnrc.gc.ca

Evaluation of Long-term Thermal Fatigue Property and Microstructures of Additively Manufactured Injector Nozzles For Gas Turbine Applications

Dongyi Seo[1]*, Taylor Robertson[1], Se-Hyun Ko[2], Ji-Hyun Sung[2], Byoung-Soo Lee[2], Ho-Joon Choi[2]

[1]Aerospace Research Centre, National Research Council of Canada, Ottawa, Ontario, K1A 0R6, Canada, [2]Korea Institute of Industrial Technology (KITECH), Cheonan-si, Chungcheongnam-do, 31056, Republic of Korea

Fuel injector nozzles have been identified as an ideal component for the early adoption of additive manufacturing technologies in gas turbine industries. This is due to their complex internal geometries which are required proper air and fuel mixing and are difficult to manufacture using conventional techniques. Additionally, fuel injectors are subject to less active stresses than other gas turbine components. In this presentation, newly designed thermal fatigue test rig is introduced to assess durability of the structures. Fuel injector nozzles are manufactured by laser powder bed fusion (LPBF) processes with Hastelloy-X powders. Thermal fatigue testing consists of a 180 second heat profile where the test piece is inductively heated to the target temperature (~750oC) and cooled back to minimum 50 °C. Test samples are cycled for up to 20,000 cycles to examine any external and internal damage due to thermal fatigue. Residual stresses of selected AM nozzles are characterized through X-Ray diffraction (XRD) both prior to and post thermal cycling. Microstructures of the AM nozzles in as-received and tested conditions are characterized through optical microscope (OM) and scanning electron microscope (SEM) examination. From this study, long-term thermal fatigue properties of the AM nozzles are investigated in terms of the AM processes, residual stresses, and microstructures. *Corresponding author; E-mail dongyi.seo@nrc-cnrc.gc.ca

Technical Session VI

Open Session

Time: 15:15–16:45, June 17 (Monday) Canada, Mountain Daylight Time (MDT)

Place: KC 210

Sponsor: Association of Korean Canadian Scientists and Engineers (AKCSE)

Organizer: AKCSE

Contact: Dr. Yong Hoon Kim, University of Windsor (kim523@uwindsor.ca)

Description: Intelligent city

Program:

Time	Place	Topic	Speaker	Affiliation
15:15–15:26	KC 210	Smart Cities in Korea: A historical review and prospect	Dr. Sang Ho Lee	Hanbat National University
15:26–15:37		AI-based infrastructure health monitoring for sustainable infrastructure asset management	Dr. Myungsik Do	
15:37–15:48		Conceptualization of hyper-connected intelligent city and sustainable urban development	Dr. Seheon Kim	
15:48–15:59		Planning the vitality city in hyper-connected intelligent city, South Korea	Dr. Sungsu Jo	
15:59–16:10		Towards a Hyper-connected intelligent city: application to power-to-x driven urban metabolism circularity	Dr. Chan Yong Sung	
16:10–16:21		Development of urban planning technologies utilizing big data and artificial intelligence: focusing on big data-based city diagnostics	Dr. Yoon Taik Leem	
16:21-16:32		Development of big data-based urban diagnostics: assessing spatial equity in public wi-fi provision	Dr. Seungho Yang	
16:32–16:43		Introduction to the Augmented Urban Space Modeling (AUSM) Lab and Mobility Innovation Centre (MOVE) at York University	Dr. Gunho Sohn	York University

List of Participants:

Name	Position	Affiliation
Dr. Yong Hoon Kim	Professor	University of Windsor
Dr. Gunho Sohn	Professor	York University
Dr. Chan Yong Sung	Professor	Hanbat National University
Dr. Myungsik Do	Professor	Hanbat National University
Dr. Sang Ho Lee	Professor	Hanbat National University
Dr. Seheon Kim	Professor	Hanbat National University
Dr. Seungho Yang	Professor	Hanbat National University
Dr. Sungsu Jo	Professor	Hanbat National University
Dr. Yoon Taik Leem	Professor	Hanbat National University

Technical Session VI
Intelligent City

Chair: Dr. Seheon Kim

Assistant Professor, Department of Urban Engineering, Hanbat National University

Dr. Kim received his Ph.D. from Eindhoven University of Technology (TU/e) in 2020. He is Assistant Professor of the Department of Urban Engineering at Hanbat National University. Research activities of his multidisciplinary group concern the development and application of innovative models and ICT tools for urban planning and transportation. Several projects relate to innovative ICT apps, smart mobilities and urban transportation. His work has been published in prestigious journals such as Transportation Research Part A, Transportation Research Part B, Transportation Part C, Journal of Transport Geography, Transportation Research Record, Transportmetrica B, and Journal of Advanced Transportation. E-mail sh.kim@hanbat.ac.kr

Technical Session VI
Intelligent City

Speaker: Dr. Sang Ho Lee

Professor, Department of Urban Engineering, Hanbat National University

Sang Ho Lee is a professor at the Department of Urban Planning and Engineering, Hanbat National University, Korea. He also was head of Korean Regional Science Association, and the member of Korean Government Smart City Committee which initiates research on the future of city and region and propels Korea Smart City. His research focuses on smart city and smart region planning, design and application; forecasting the futuristic society, planning the smart services and the mobile/built smart infrastructure (IoT), designing the smart spatial structure and land use, and management planning. He worked at Samsung Group and is a member of Korean Presidential Committee on Balanced National Development Planning and Policy. He designed the philosophy, vision, and strategies of Korea Smart City and built Seoul and Busan Smart City Master Plan. He was the president of Korean Rgional Science Association, and was Dean of Construction, Environment and Design in Hanbat National University, and International Jury of Barcelona Smart City Award. He can be contacted at lshsw@hanbat.ac.kr.

Smart Cities in Korea: A Historical Review and Prospect

Sang Ho Lee*

[1]*Department of Urban Engineering, Hanbat National University, Daejeon 34158, Korea*

A smart city is an urban area where information and communication technologies (ICTs) and green eco-technologies (GETs) are embedded to provide citizens with access to information and eco-friendly services anytime, anywhere. Unlike virtual cities existing only in cyberspace, smart cities integrate computer chips and sensors into the physical infrastructure. Korea has continuously developed national smart city strategies like Cyber Korea, e-Korea, U-Korea, and Smart Korea since the 1970s under the philosophy of communication, sharing, and balance. Early initiatives focused on computerization and internet access, while later U-City initiatives aimed to converge virtual and physical spaces through ICT-embedded urban infrastructure and services.

Korea introduced its own U-City smart city brand in 2006, promoting solutions through U-Services, U-Technologies, U-Infrastructures and U-Management. However, this top-down, technology-driven approach had limitations. Korea's current smart city roadmap aims to reinforce global smart city initiatives and create an innovation ecosystem. Key smart city features include green eco-intelligence like air/water monitoring, Internet of Things for efficient infrastructure operation, citizen participation in decision-making, and integrated big data analysis to improve services.

Korea enacted the U-City law in 2008, revised as the Smart City Act in 2017, providing financial support for comprehensive plans, pilot cities, and R&D funding. Local governments have developed smart city master plans, while the national test-bed experiments with 4th industrial revolution technologies like smart mobility and administration services. Through continued policy efforts at the national and local levels, Korea strives to enhance quality of life and sustainable urban development via smart city initiatives.

*Corresponding author; E-mail lshsw@hanbat.ac.kr

Technical Session VI
Intelligent City

Speaker: Dr. Myungsik Do

Professor, Department of Urban Engineering Hanbat National University

Prof. Do received his Ph.D. from Kyoto University in 2000. He served as a senior researcher at the Korea Institute of Civil Engineering and Building Technology (KICT) and has been a Professor in the Department of Urban Engineering at Hanbat National University since 2002. He currently serves as the branch president of the Daejeon, Sejong and Chungcheong areas of the Korean Society of Transportation (KST), and also serves as vice president of the Korea Institute of Intelligent Transportation Systems. He received numerous awards including the Best young researcher award from the Korean Society of Civil Engineers (KSCE), the Best Paper award from KST, and the Academic award from the Korea Institute of Intelligent Transportation Systems. He is the author or co-author of over 150 publications including 5 patents and 100 journal papers. He has recently been interested in using UAV to monitoring infrastructure conditions and AI-based application, and has been consistently writing about Infrastructure asset management for various conferences including KSCE. E-mail msdo@ hanbat.ac.kr

AI-based Infrastructure Health Monitoring for Sustainable Infrastructure Asset Management

Myungsik Do[1]*, Yu-Mi Jeong[1], Seheon Kim[1]

[1]*Department of Urban Engineering, Hanbat National University, Daejeon 34158, Korea*

For efficient asset management of infrastructure, monitoring of the current condition of the facility must be prioritized, and research on infrastructure health monitoring has been actively conducted recently. In this paper, a novel method for monitoring road pavement and pedestrian space using the Mobile Mapping System (MMS), Unmanned Aerial Vehicle (UAV) and a deep learning detection algorithm was presented. MMS and UAV, which were used as equipment to monitor and grade the current condition of the infrastructure, obtained the necessary data considering the characteristics of each equipment. Furthermore, an optimal maintenance method through economic analysis was presented targeting the pavement section of Daejeon metropolitan city. In the case of pedestrian space, a method was proposed to calculate the LOS based on object detection of objects that pose a risk of conflict to pedestrians and cyclists and fixed objects such as trees, bus stops and electric poles that affect the effective width. As a result of monitoring the pavement and pedestrian space conditions, it was confirmed that the pavement ratings were good in the order of national highways, municipal roads, and roads of provinces. In addition, economic analysis using pavement deterioration model showed that micro-surfacing, one of the preventive maintenance methods, is the most economical in terms of maintenance costs and user costs. The results of this study are expected to be used as fundamental reference for local governments' infrastructure asset management.

*Corresponding author; E-mail msdo@hanbat.ac.kr

Technical Session VI
Intelligent City

Speaker: Dr. Seheon Kim

Assistant Professor, Department of Urban Engineering, Hanbat National University

Dr. Kim received his Ph.D. from Eindhoven University of Technology (TU/e) in 2020. He is Assistant Professor of the Department of Urban Engineering at Hanbat National University. Research activities of his multidisciplinary group concern the development and application of innovative models and ICT tools for urban planning and transportation. Several projects relate to innovative ICT apps, smart mobilities and urban transportation. His work has been published in prestigious journals such as Transportation Research Part A, Transportation Research Part B, Transportation Part C, Journal of Transport Geography, Transportation Research Record, Transportmetrica B, and Journal of Advanced Transportation. E-mail sh.kim@hanbat.ac.kr

Conceptualization of Hyper-Connected Intelligent City and Sustainable Urban Development

Changhy Yi[1], Seungho Yang[1], Seheon Kim[1]*, Sungsu Jo[1]

[1]*Department of Urban Engineering, Hanbat National University, Daejeon 34158, Korea*

The concept of a smart city, leveraging innovative technologies to maximize urban efficiency, and the notion of sustainable urban development, supporting the advancement of cities across environmental, economic, and social dimensions, are mutually reinforcing approaches. Considering these two concepts holds the potential to inform important directions for the development trajectory of contemporary urban spaces. The objective of this research is to delineate the conceptual underpinnings and guiding principles of hyper-connected intelligent city as a means to realizing sustainable urban development. Within the confines of this study, hyper-connected intelligent city is defined as urban environments where advanced smart technologies are implemented across spatial domains to overcome locational constraints and facilitate interconnectivity among people, facilities, and spaces, transcending temporal and spatial boundaries through various technologies. Contemporary metropolitan areas are confronted with a multitude of urban issues, encompassing demographic changes, economic adversities, social inequalities, and environmental degradation, with concerted efforts being undertaken at national and local governments to address these challenges. Within the scope of this research, the focus is directed towards elucidating the values that ought to be pursued in order to address core urban issues confronting Korean society and attain sustainable urban development. The former encompasses population decline and urban shrinkage, pressing issues that Korean society must confront, while the latter pertains to economic vitality, environmental sustainability, and social inclusion, which are internationally recognized concerns aligned with the Sustainable Development Goals (SDGs). To effectively tackle these issues, it is postulated that the urban spatial structure of hyper-connected intelligent connected city, characterized by a compact-connected form, will facilitate effective resolution of urban problems and realization of desired urban values.

*Corresponding author; E-mail sh.kim@hanbat.ac.kr

Technical Session VI
Intelligent City

Speaker: Dr. Sung Su Jo

Associate Professor, Department of Urban Engineering, Hanbat National University

Dr. Sung Su Jo is an assistant professor of urban and smart city planning at the Hanbat National University, South Korea. He was the committee member of KASEA Quarterly Journal and AKC 2023. He also has leading Smart City Planning and Design LAB, which initiates research on the national and local smart city projects in South Korea. His research focuses on smart city planning and its application; forecasting the futuristic society, planning the smart services and the mobile/built smart infrastructure, designing the smart spatial structure and land use, and management planning. He worked City Futures Research Centre (CFRC) at University of New South Wales (UNSW), Sydney. He designed the smart city strategies and services of Seoul and Busan Smart City Master Plan. He can be contacted at ssjo@hanbat.ac.kr.

Planning the Vitality City in Hyper-connected Intelligent City, South Korea

Sung Su Jo*

Department of Urban Engineering, Hanbat National University, Daejeon 34158, Korea

Urbanization brings about various urban problems. In particular, Korean cities have recently experienced a decline in urban competitiveness due to changes in industrial structure. Furthermore, the vitality of cities such as living, playing, and working has been deteriorating due to the worsening socio-economic conditions, such as the pandemic. In response to these challenges, this study proposes the Hyper-connected Vital City Model (HVCM) as a means to enhance urban vitality. The characteristics of HVCM has the following:
Firstly, this HVCM explores the potential of big data, generated by citizens' activities, to improve the vibrancy of community spaces. We can gain valuable insights into how people interact with these spaces by analyzing data on citizen activity (floating population data), consumption patterns (credit cards data), and traffic patterns (transportation cards data). This information can then be used to monitor people activity, diagnose areas for improvement, and simulate. Secondly, this city model can utilize a Digital Twin platform to simulate the arrangement, investment, and attraction of necessary industries within an urban environment to promote economic vitality of cities.
*Corresponding author; E-mail ssjo@hanbat.ac.kr

Technical Session VI
Intelligent City

Speaker: Dr. Chan Yong Sung
Professor, Department of Urban Engineering, Hanbat National University

Dr. Chan Yong Sung is a full professor in the Department of Urban Engineering at Hanbat National University. Dr. Sung's research focuses on how human and environment interact each other. He has published papers in areas of environmental planning, protected area management, landscape ecology, and light pollution. He has served an editor at Frontiers in Ecology and Evolution and Korean Journal of Environment and Ecology. He has taught environmental planning, urban ecosystem ecology, advanced GIS, remote sensing, basic and advanced statistics, and research method. He received Bachelor's degree from Hongik University, Master of Public Affairs (MPA) degree from Indiana University at Bloomington, and Ph.D. from Texas A&M University. Prior to joining Hanbat National University, he served as post-doctoral research associate at Texas Transportation Institute and as an assistant professor in the Department of Environmental Planning at Keimyung University.

Towards a Hyper-connected Intelligent City: Application to Power-to-X (P2X) Driven Urban Metabolism Circularity

Seheon Kim[1], Seungho Yang[1], Chan Yong Sung[1]*

[1]*Department of Urban Engineering, Hanbat National University, Daejeon 34158, Korea*

In the face of rapid urbanization and escalating energy demands, cities are embracing hyperconnectivity and intelligent systems to optimize resource utilization and enhance sustainability. This research explores the concept of a hyperconnected intelligent city, focusing on the integration of Power-to-X (P2X) technologies and urban metabolism circularity. The advent of P2X technologies, which encompass processes such as Power-to-Gas (P2G), Power-to-Liquid (P2L), and Power-to-Heat (P2H), presents a transformative opportunity for urban centers to shift towards renewable energy sources. By harnessing surplus renewable energy, P2X technologies enable the conversion of electricity into alternative energy carriers, such as hydrogen, synthetic fuels, and heat, which can be stored, transported, and utilized across various energy sectors. In the context of urban metabolism, P2X-driven urban circularity entails the efficient utilization and recycling of resources within the city energy system. Through the integration of smart grids, energy management systems, and advanced infrastructure, hyperconnected intelligent cities can optimize energy flows, reduce waste, and mitigate environmental impacts. Furthermore, the synergistic coupling of P2X technologies with circular economy principles fosters resource recovery, promotes resilience, and minimizes dependency on finite resources. This research highlights the multifaceted benefits of adopting P2X driven urban metabolism circularity in hyperconnected intelligent cities, including decarbonization, economic benefits, and improved quality of life. However, realizing this vision requires concerted efforts from policymakers, urban planners, technology developers, and stakeholders to overcome technical, regulatory, and socioeconomic challenges. By leveraging P2X technologies as enablers of sustainable urban development, cities can pave the way towards a more resilient, equitable, and regenerative future.

*Corresponding author; E-mail cysung@hanbat.ac.kr

Technical Session VI
Intelligent City

Speaker: Dr. Yoon Taik Leem

Professor, Vice-president, Hanbat National University

Dr. Leem is a professor at the Department of Urban Engineering, Hanbat National Univiersity, Daejeon, Korea. He finished his Ph.D in Urban Planning at Yonsei Univesity, Seoul, Korea after undergraduate and master course in architecture and transportation planning at the same university. As field experience, he worked for a construction company as concrete engineer and Korea Maritime Institute as a senior researcher. His research covers from site planning to urban and regional planning. He was involved lots of smart city policy building with planning and design for real sites. Dr. Leem is also interested in urban development and management policies including urban regeneration of declined urban area. He has served as advisory committee members for diverse governmental and private bodies.

Development of Urban Planning Technologies Utilizing Big Data and Artificial Intelligence: Focusing on Big Data-Based City Diagnostics

Seungho Yang[1], Hyojin Baek[1], Yoon Taik Leem[1]*

[1]*Department of Urban Engineering, Hanbat National University, Daejeon 34158, Korea*

The rapid advancement of big data and artificial intelligence (AI) technologies is driving socioeconomic development, prompting efforts to leverage these technologies across various sectors to address challenges and foster innovation. Concurrently, the urban planning field faces increasing pressures to respond to diverse development needs, establish citizen-centric plans, and evaluate the efficacy of existing urban plans. This study aims to renew the urban planning process and system by developing big data and AI-based methodologies to address these emerging imperatives.

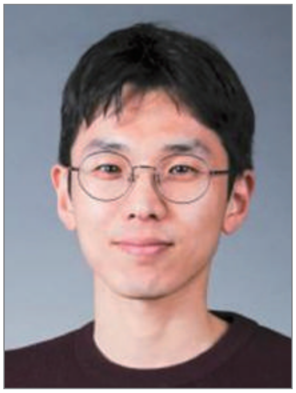
The research objective was to develop a methodology for diagnosing and forecasting cities by utilizing big data and AI technologies. Preliminary research identified 10 relevant urban planning fields, and diagnostic indicators and indices were developed for each field, leveraging existing statistical data and big data sources. These indicators and indices were pilot-tested in three cities to assess their applicability empirically.

Specifically, within the information and communication field, three diagnostic indicators were proposed for the infrastructure sector and five for the service sector. These indicators were then combined and weighted to develop an information and communication infrastructure index. This index exemplifies the study's approach to integrating diverse data sources and methodologies to support data-driven urban planning and decision-making.

Overall, this research contributes to the integration of emerging technologies into urban planning practices, facilitating more responsive, evidence-based, and citizen-oriented urban development strategies.

*Corresponding author; E-mail ytleem@hanbat.ac.kr

Technical Session VI
Intelligent City



Speaker: Dr. Seungho Yang

Assistant Professor, Department of Urban Engineering, Hanbat National

Dr. Seungho Yang is an assistant professor in the Department of Urban Engineering at the Hanbat National University, South Korea. His major is urban planning & design. He got his Ph.D. in engineering from Seoul National University in South Korea in 2014. After three years of experience in the private and public sector at South Korea, he studied as a postdoctoral fellow at York University in Toronto, Canada from 2018 to 2020. At the York University, he conducted research related to sustainable mobility systems using the campus digital twin platform and computer vision technology. He has been working at Hanbat University since 2021, conducting research related to urban planning and design using big data and artificial intelligence technologies. His main research topic is urban design & Planning and digital twin city. E-mail sh.yang@hanbat.ac.kr

Development of Big Data-Based Urban Diagnostics: Assessing Spatial Equity in Public Wi-Fi Provision

Hyojin Baek[1], Seungho Yang[1]*

[1]*Department of Urban Engineering, Hanbat National University, Daejeon 34158, Korea*

The guidelines for urban basic plans in South Korea stipulate enhancing smart city infrastructure and presenting indicators related to information and communication technologies to accommodate the technological changes brought about by the Fourth Industrial Revolution. Based on this, new urban planning indicators suitable for future have been proposed by utilizing big data related to the information and communication field, one of which is the public Wi-Fi supply indicator. This indicator evaluates the user convenience of smart services provided to citizens in the future smart city model.

In this study, two aspects of analysis are performed regarding the supply of public Wi-Fi, distinguishing between resident and active populations. For the resident population aspect, the spatial distribution of public Wi-Fi is compared with that of vulnerable residential areas. 100-meter grid-level resident population and income level data are utilized. Through this analysis, the study diagnoses whether public Wi-Fi in the city is equitably supplied across income levels in terms of smart city service provision and examines the patterns.

For the active population aspect, the spatial distribution of public Wi-Fi is compared with that of the active population. To this, 100-meter grid-level active population and credit card usage data are employed. This analysis examines the spatial congruence and patterns between high-activity areas and public Wi-Fi supply, deriving implications. Through the above analyses, the study expects to diagnose the supply level of public Wi-Fi in terms of spatial efficiency and equity, and provide insights into the future nature and role of public Wi-Fi supply.

*Corresponding author; E-mail sh.yang@hanbat.ac.kr

Technical Session VI
Intelligent City

Speaker: Dr. Gunho Sohn

Associate Professor and Chair, Department of Earth and Space Science and Engineering (ESSE)

Professor Gunho Sohn, Associate Professor of Geomatics engineering and Chair, Department of Earth and Space Science and Engineering at York University, stands at the forefront of smart mobility research, blending administrative acumen with pioneering scientific inquiry. As the inaugural director of the Mobility Innovation Centre (MOVE) and a leader in computer vision and photogrammetry, he is lauded for his contributions to urban digital twinning and smart mobility solutions. Professor Gunho Sohn distinguishes himself in smart mobility with a h-index of 30 and 5,255 citations across over 150 publications. His impactful work in autonomous vehicles and digital twinning, strengthened by strategic collaborations with entities like CFI, ORF and NSERC CREATE, has been recognized with the York University Research Leader Award twice and the PEO York Chapter Engineering Project of the Year Award, underscoring his innovation in urban mobility solutions. Leading a team with 10 co-applicants and collaborators, Professor Sohn aims to leverage his extensive experience in mobility research to design a research training program centered on the advanced applications of smart mobility.

Introduction to the Augmented Urban Space Modeling (AUSM) Lab and Mobility Innovation Centre (MOVE) at York University

Gunho Sohn[1]*

[1]Department of Earth and Space Science and Engineering, Lassonde School of Engineering, York University, 4700 Keele Street, Toronto, ON M3J 1P3, Canara

The Augmented Urban Space Modeling (AUSM) Lab and the Mobility Innovation Centre (MOVE) at York University are pioneering research institutions dedicated to advancing urban sustainability and mobility through innovative technological solutions. Led by Dr. Gunho Sohn, these centers focus on the virtualization and augmentation of urban spaces using cutting-edge technologies such as photogrammetry, computer vision, and machine learning. At the AUSM Lab, our primary research objective is to create detailed and accurate models of urban environments from remotely sensed imagery and point clouds. These models enhance spatial awareness and support data-driven decision-making processes, addressing the multifaceted challenges faced by modern cities. By integrating graphical modelling and vision-based navigation, we develop comprehensive 3D reconstructions that aid infrastructure management and urban planning. The MOVE Centre complements this work by focusing on intelligent systems for sustainable urban mobility. Our projects include the development of advanced data analytics, visualization tools, and simulations that support urban mobility solutions. We strive to harmonize human-robot interactions, optimize transportation networks, and enhance the safety and efficiency of urban mobility systems. Together, AUSM and MOVE are at the forefront of research that transforms visual and spatial data into actionable insights, paving the way for smarter, more resilient urban environments. Our collaborative efforts with various stakeholders ensure that our research not only addresses current urban challenges but also anticipates future needs, fostering a sustainable urban future for all. *Corresponding author; E-mail gsohn@yorku.ca

Clean Energy and Technology Forum

Open Session

Time: 9:00–10:30, June 18 (Tuesday) Canada, Mountain Daylight Time (MDT)

Place: KC 101/103/105

Sponsor: Association of Korean-Canadian Scientists and Engineers (AKCSE)

Organizer: AKCSE

Contact: Dr. Yong Hoon Kim, University of Windsor (kim523@uwindsor.ca)

Description: The session aims to create opportunities for professionals to connect and collaborate and encourage the development and adoption of new solution for clean energy and sustainable technology.

Program:

Time	Place	Topic	Speaker	Affiliation
9:00–9:30	KC 101/103/105	Towards Net-Zero Emission Energy Systems in Canada	Dr. David B. Layzell	University of Calgary & The Transition Accelerator
9:30–10:00		Lean Electrolyte Lithium Metal Batteries	Dr. Hee-Tak Kim	Korea Advanced Institute of Science and Technology (KAIST)
10:00–10:30		Alberta, Canada: South Korea's strong economic partner in the hydrogen & critical minerals	Victor Lee	Canadian Embassy in Korea

List of Participants:

Name	Position	Affiliation
Dr. Yong Hoon Kim	Professor	University of Windsor
Dr. David B. Layzell	Emeritus Professor and energy systems architect	University of Calgary & The Transition Accelerator
Dr. Hee-Tak Kim	Professor/Director	KAIST, LG energy solution-KAIST battery research centre
Victor Lee	Counsellor	Alberta Government Representative in Korea Counsellor (Commercial), Canadian Embassy in Korea

Clean Energy and Technology Forum

Chair: Dr. Yong Hoon Kim

Associate Professor, University of Windsor

Dr. Yong Hoon Kim is an Associate Professor of Civil and Environmental Engineering at the University of Windsor. Dr. Kim has received the B.S. and M.S. degrees in transportation from the University of Seoul, Seoul, Korea, in 2003 and 2006, respectively, and Ph.D. degree in Civil Engineering from Purdue University, West Lafayette, IN, USA, in 2017. He worked for two and a half years at the Seoul Institute in Korea as a research engineer. He also worked a Research Associate with the NEXTRANS Center, Purdue University. His research interests include Intelligent Transportation System, connected and autonomous vehicle technology, data analytics for connected transportation system, artificial intelligence for connected and autonomous vehicle applications, and traffic safety.

Clean Energy and Technology Forum

Speaker: Dr. David B Layzell

Emeritus Professor and Energy Systems Architect, The Transition Accelerator

David Layzell is an Emeritus Professor from the University of Calgary and an Energy Systems Architect for the Transition Accelerator, a non-profit focused on the net-zero energy system transition in Canada. His research uses techno-economic and environmental modeling tools to identify credible, compelling, and capable pathways for transitioning Canada's energy systems to net-zero greenhouse gas (GHG) emissions by mid-century. Before assisting in the launch of the Transition Accelerator in 2019, David established the Canadian Energy System Analysis Research (CESAR) Initiative at the U of C in 2013 and was Executive Director of the Institute for Sustainable Energy, Environment and Economy (ISEEE) at the U of C (2008-12). As a Professor at Queen's University (Kingston, ON), he set up and ran the BIOCAP Canada Foundation (1998-2008), founded a scientific instrumentation company called Qubit Systems Inc. and was elected 'Fellow of the Royal Society of Canada' (FRSC) for his research contributions.

Towards Net-Zero Emission Energy Systems in Canada

David B. Layzell[1]

[1]Energy Systems Architect, The Transition Accelerator, Virtual non-profit operating across Canada

Achieving net-zero greenhouse gas (GHG) emissions by mid-century requires transformative changes in the energy systems of Canada, the world's 6th largest energy producer and a country that currently exports more than half of its primary energy production. Demand for fossil carbon-based energy carriers (i.e. gasoline, diesel, natural gas) must shift to zero emission carriers (e.g. electricity, biofuels, hydrogen) that are produced with minimal or no GHG emissions and are used with technologies that meet the needs of the demand sectors. To gain a window on a 'Made-in-Canada' net-zero future, we built a Net-Zero Energy System Transition (NZEST) model that uses techno-economic analyses to identify credible, compelling, and capable carrier-technology solutions for demand sectors and regions across Canada. As a nation with only 0.5% of the world's population but 7% of the global land area, the model also explores Canada's potential role in the export of zero-emission energy carriers to other, more densely populated regions.

In this presentation, I will describe how the NZEST model works, and summarize results of an NZEST scenario that projects a tripling in electricity generation/use, a 6-fold increase in biofuel production/use, and a new role for oil and gas in the production of hydrogen and ammonia as energy carriers to meet domestic and export demand. The figure provided here shows the current and possible future transition of Canada's energy carriers in a net-zero future.

*Contact Email: dlayzell@ucalgary.ca

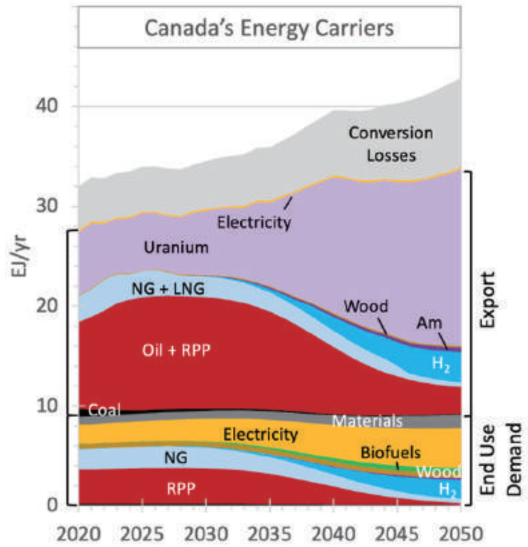


Figure. Historical and net-zero projection of Canada's energy carriers to serve either domestic, end-use demand or energy export from 2020 to 2050. Am, ammonia; EJ, Exajoules; NG, natural gas.

Clean Energy and Technology Forum

Speaker: Dr. Hee-Tak Kim

Professor, Korea Advanced Institute of Science and Technology

Dr. Hee-Tak Kim serves on the faculties of Chemical and Biomolecular Engineering at KAIST. He obtained his Ph.D. in Chemical Engineering at KAIST in 1999. Dr. Kim's current work focuses on design of electrochemical energy devices including secondary batteries, fuel cells and water electrolysis. Dr. Kim's group explore new battery solutions which extend cruise range of electric vehicle and provide better performances and economics for energy storage system. The research includes electrode and electrolyte development for lithium metal and lithium sulfur batteries. His research features the combination of multi-scale structural engineering, simulation, and electrochemical engineering to address the key issues in this field. He is currently the head of Frontier Research Lab. which is a research center for the collaboration of KAIST and LG energy solution. He also leads KAIST-Samsung SDI battery education program. E-mail heetak.kim@kaist.ac.kr

Lean Electrolyte Lithium Metal Batteries

Hee-Tak Kim*

Chemical and Biomolecular Engineering, KAIST, Daejeon, Korea

Liquid electrolyte-based lithium metal battery (LMB) presents a promising alternative to overcome the limitations of lithium-ion batteries in enhancing energy density. In recent years, a deeper understanding of the degradation of Li metal electrodes in liquid electrolytes has been achieved, with a particular emphasis on the impact of the solid electrolyte interphase (SEI) on Li electrode morphology and corrosion. Consequently, there is a growing need for effective methodologies to understand the ideal SEI structure on lithium metal anodes and control its formation. Despite these advances, current LMB technology still falls short of achieving the targeted 500 Wh kg-1 and struggles with insufficient charging rate, demanding further improvement. In this talk, insights gained from the previous LMB researches are summarized and discussed. Building upon the insights, we propose solutions to achieve energy-dense LMBs, introducing a composite interlayer or a borate-pyran electrolyte. The composite interlayer leveraging ceramic solid electrolyte and gel electrolyte effectively suppresses Li corrosion by altering electrolyte solvation structure, enabling the successful operation of LMB with carbonate electrolytes. The borate-pyran electrolyte transforms large LiF crystallites in the SEI into fine crystalline or glassy LIF, which suppress Li corrosion. LMBs assembled with the borate-pyran electrolyte delivered a high full-cell-level energy density of > 400 Wh/kg and operated for 400 cycles. The case studies provide fresh insights into addressing the two critical problems of LMB: inhomogeneous Li morphology and Li corrosion.

*Corresponding author; E-mail heetak.kim@kaist.ac.kr

Clean Energy and Technology Forum

Speaker: Victor Lee

Alberta Government Representative in Korea
Counsellor (Commercial), Canadian Embassy in Korea

Victor has 15 years of international business development and foreign affairs experience – with expertise in the global energy-security and the food-security subjects. Previously, Victor served as a Managing Director – Saskatchewan India Office/Counsellor (Commercial), High Commission of Canada in New Delhi; Trade and Investment Director - Asia Pacific, Alberta Ministry of Economic Development, Trade and Tourism (EDTT); and a Trading Manager (Mineral and Energy Resources), Mitsui & Co. Victor also has relevant international business development experience from E*TRADE, and the University of Toronto's Centre for International Experience. Victor, a Certified International Trade Professional (CITP®|FIBP®), is a graduate from the University of Toronto, Trinity College, holds an MBA from the University Toronto, and Global Executive MBA from SDA Bocconi School of Business (Milan, Italy).

Alberta, Canada: South Korea's strong economic partner in the hydrogen & critical minerals

Victor Lee

Alberta Government Representative in Korea
Counsellor (Commercial), Canadian Embassy in Korea

Alberta, Canada, is becoming a key economic partner for South Korea, particularly in the fields of clean hydrogen and critical minerals. This presentation will review the growing economic relationship between Alberta and South Korea, and introduce the strategic roles and responsibilities of the Alberta Government Office in Korea (which is co-located within the Canadian Embassy in Seoul). It will focus on outlining the commercial and R&D opportunities between Alberta and Korea, and discuss the potential for collaborative projects involving Alberta's sustainably sourced and cost-effective blue hydrogen, as well as the extraction and processing of critical minerals such as nickel, cobalt, magnesium, and lithium. The presentation aims to provide a clear plan for enhancing bilateral economic ties and promote sustainable economic collaboration between Korea-Alberta-Canada.

Clean Energy and Technologies Forum (Hydrogen/Fuel cell/CCUS)

Open Session

Time: 10:30–11:40, June 18 (Tuesday) Canada, Mountain Daylight Time (MDT)

Place: KC 205

Sponsor: Association of Korean-Canadian Scientists and Engineers (AKCSE)

Organizer: AKCSE

Contact: Dr. ChungHyuk Lee, Toronto Metropolitan University (chunghyuk.lee@torontomu.ca)

Description: Clean energy, Hydrogen, Fuel cell, CCUS

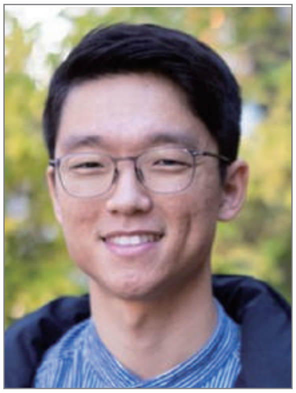
Program:

Time	Place	Topic	Speaker	Affiliation
10:30–10:35	KC 205	Opening - Introduction	Chair	
10:35–10:55		High Performance and Recyclable Ionomer-free Porous Transport Electrodes for Proton-Exchange-Membrane Water Electrolyzers	Dr. Jason Keonhag Lee	University of Victoria
10:55–11:15		Smart Sensor Fusion System for Monitoring Blended Hydrogen in Natural Gas Pipelines	Dr. Hansaem Lee	University of Calgary
11:15–11:35		Transport Phenomena in Electrochemical Energy Conversion Devices	Dr. ChungHyuk Lee	Toronto Metropolitan University (TMU)
11:35–11:40		Closing	Chair	

List of Participants:

Name	Position	Affiliation
Dr. Jason Keonhag Lee	Assistant Professor	University of Victoria
Dr. Hansaem Lee	Postdoctoral Associate	University of Calgary
Dr. ChungHyuk Lee	Assistant Professor	Toronto Metropolitan University (TMU)

Clean Energy and Technologies Forum (Hydrogen/Fuel cell/CCUS)



Chair: Dr. ChungHyuk Lee

Assistant Professor, Toronto Metropolitan University, Canada

Dr. Lee received his Ph.D. in mechanical engineering from the University of Toronto. Prior to his professorship, he worked as a postdoctoral fellow at Los Alamos National Laboratory (LANL), and as a research associate at National Research Council Canada. He is currently an Assistant Professor at the department of chemical engineering at Toronto Metropolitan University. His research group (Fluids and Electrochemical Engineering Laboratory) focusses on the area of electrochemical energy systems such as fuel cells and electrolyzers. He received awards including the 2022 Canadian Light Source Young Investigator Excellence Award and the US Department of Energy Hydrogen and Fuel Cell Technologies Office Postdoctoral Recognition Award. He is an editorial board member of Scientific Reports (Nature Publishing Group) and InterPore Journal, and a member of H2CAN2.0 (Canada Strategic Hydrogen R&D Network). He is currently serving as the local chapter president of the Greater Toronto-Lake Ontario Chapter of the Association of Korean-Canadian Scientists and Engineers.

Clean Energy and Technologies Forum (Hydrogen/Fuel cell/CCUS)

Speaker: Dr. Jason Keonhag Lee

Assistant Professor, University of Victoria, Canada

Dr. Jason Keonhag Lee serves as an Assistant Professor in the Department of Mechanical Engineering at the University of Victoria. His research focuses on advancing clean hydrogen production technologies through electrochemical energy conversion, collaborating closely with Accelerating Community Energy Transformations (ACET) and Institute for Integrated Energy Systems (IESVic). He earned his Ph.D. from the Department of Mechanical and Industrial Engineering at the University of Toronto and obtained his M.A.Sc. and B.Eng. from the Department of Mechanical Engineering at the University of Victoria. Dr. Lee worked as a postdoctoral researcher at Lawrence Berkeley National Laboratory where he contributed to the development of water electrolyzers. His efforts were acknowledged with a runner-up recognition for the Department of Energy Hydrogen Fuel Cell Technology Office's Postdoctoral Award. Dr. Lee has an impressive publication record of 43 peer-reviewed publications 19 conference proceedings and abstracts, and a textbook chapter. E-mail jasonklee@uvic.ca

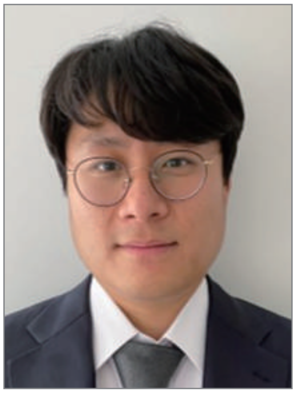
High Performance and Recyclable Ionomer-free Porous Transport Electrodes for Proton-Exchange-Membrane Water Electrolyzers

Jason Keonhag Lee[1,2,3,*], Xiong Peng[3]

[1]Department of Mechanical Engineering, University of Victoria, Victoria, BC V8P 5C2, Canada, [2]Institute for Integrated Energy Systems (IESVic), University of Victoria, Victoria, BC V8P 5C2, Canada, [3]Energy Technology Area, Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA

The widespread adoption of clean hydrogen technologies requires a large-scale deployment of water electrolyzers as a prerequisite. Proton-exchange-membrane (PEM) water electrolyzers stand out among various types of electrolyzers available today for large-scale applications due to their compact design and rapid response time. Despite continuous efforts to upscale PEM water electrolyzer capacity, cost remains a significant challenge. Specifically, the limited availability of iridium catalysts used in oxygen evolution reaction are projected to become the major cost driver at GW scale, necessitating catalyst loading reduction and recycling processes. In this work, we present the development of ionomer-free porous transport electrodes (PTEs) that reduces the cost of PEM water electrolyzers. The ionomer-free PTEs exhibit superior performance (< 600 mV at 1.8 A/cm2) compared to the traditionally prepared PTEs at low catalyst loading of 0.10 mgIr/cm2. Additionally, the ionomer-free PTEs offer excellent durability, demonstrated by a voltage degradation of 29 mV at average rate of 0.58 mV per 1000-cycles after 50k cycles of accelerated-stress tests. Bypassing the usage of ionomers in the catalyst layer facilitate component recycling, with reapplication of Ir coating on a degraded PTE showing promise in restoring performance lost during degradation tests. The ionomer-free PTEs not only enhance performance and durability of PEM water electrolyzers but also provide effective means to reduce cost for their GW-scale production.

Clean Energy and Technologies Forum (Hydrogen/Fuel cell/CCUS)



Speaker: Dr. Hansaem Lee

Postdoctoral Associate, University of Calgary, Canada

Dr. Hansaem Lee received his Ph.D. from Seoul National University of Science and Technology in 2021 and currently works as a Postdoctoral Associate specializing in smart sensor fusion for environment and energy at the University of Calgary. He is the author or co-author of over 30 publications including 4 patents and 30 journal papers. With a focus on cutting-edge research in smart sensor fusion, he excels in integrating analytical chemistry, multimodal sensor technologies, and advanced artificial intelligence (AI) model development. His expertise lies predominantly within the fields of environment and energy. Dr. Lee boasts extensive experience gained from his research endeavors, which encompass soil science, water treatment methodologies, and innovative approaches to waste recycling. Leveraging his profound knowledge and background in environmental and energy domains, he is dedicated to advancing research aimed at developing a next-generation monitoring network based on microAI. E-mail Hansaem.lee1@ucalgary.ca

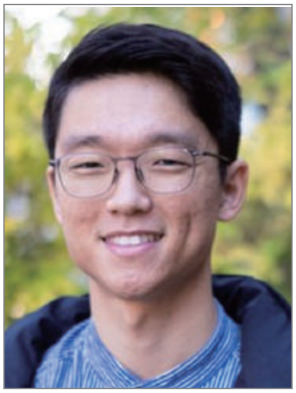
Smart Sensor Fusion System for Monitoring Blended Hydrogen in Natural Gas Pipelines

Hansaem Lee[1], Seung-ik Han[1], Seonghwan Kim[1], Ron Hugo[1], Simon S. Park[1]*

[1]*Department of Mechanical and Manufacturing, University of Calgary, AB, Canada*

With hydrogen (H_2) gaining prominence in the energy sector as a clean and sustainable energy source, its blending with natural gas for pipeline transportation is increasingly common. However, maintaining the safety and uniformity of H_2 blends poses challenges due to its unique properties, notably its low molecular weight. To tackle this, advanced smart sensor fusion systems have been developed for comprehensive internal and external monitoring of H_2 within pipelines. Internally, a blend of ultrasonic and thermal conductivity sensors has been deployed, offering full-range concentration measurement and dependable performance even under varying gas conditions such as flow rates, pressure, and temperature fluctuations. Externally, quartz crystal microbalance with dissipation and electrochemical impedance spectroscopy has been integrated for H_2 leak detection, showcasing effective H_2 sensing capabilities in ambient conditions. This multimodal sensing approach has demonstrated superior accuracy compared to single-sensor setups, with artificial intelligence further enhancing performance to achieve heightened accuracy and sensitivity in H_2 detection. This research underscores the potential of smart sensor fusion systems in ensuring the safe and efficient transportation of blended H_2 in pipelines, which is crucial for advancing toward sustainable energy solutions. Future advancements are anticipated to not only enhance the performance of smart systems but also minimize environmental impact by gathering data from a broader range of environments.

Clean Energy and Technologies Forum (Hydrogen/Fuel cell/CCUS)



Speaker: Dr. ChungHyuk Lee

Assistant Professor, Toronto Metropolitan University, Canada

Dr. Lee received his Ph.D. in mechanical engineering from the University of Toronto. Prior to his professorship, he worked as a postdoctoral fellow at Los Alamos National Laboratory (LANL), and as a research associate at National Research Council Canada. He is currently an Assistant Professor at the department of chemical engineering at Toronto Metropolitan University. His research group (Fluids and Electrochemical Engineering Laboratory) focusses on the area of electrochemical energy systems such as fuel cells and electrolyzers. He received awards including the 2022 Canadian Light Source Young Investigator Excellence Award and the US Department of Energy Hydrogen and Fuel Cell Technologies Office Postdoctoral Recognition Award. He is an editorial board member of Scientific Reports (Nature Publishing Group) and InterPore Journal, and a member of H2CAN2.0 (Canada Strategic Hydrogen R&D Network). He is currently serving as the local chapter president of the Greater Toronto-Lake Ontario Chapter of the Association of Korean-Canadian Scientists and Engineers.

Transport Phenomena in Electrochemical Energy Conversion Devices

ChungHyuk Lee*, Andre Pin Chun Lee, Fazele Karimian Bahnamiri, Yi Ren

Department of Chemical Engineering, Toronto Metropolitan University (TMU), Toronto, Canada

Curtailing anthropogenic CO_2 gas emission is a crucial first step to mitigate a catastrophic climate disaster. Transportation is projected to remain as the main source of CO_2 emission until 2050, contributing to about ~27% of the total carbon emissions from the energy sector. A promising alternative to the current internal combustion engines in automotive applications is the hydrogen fuel cell, which can produce on-demand electricity with zero carbon emissions. They are particularly advantageous for heavy-duty vehicle applications owing to their high intrinsic power density and short refueling time. When fuel cells are coupled with water electrolyzers powered by renewable energy sources (i.e., green hydrogen), a complete decarbonization of the transportation sector can be realized. A water electrolyzer is an electrochemical energy conversion device that generates H_2 from electrical energy and liquid water. With renewable energy, it produces high purity H_2 (99.999%) at a compressed state in absence of carbon emissions. In addition, significant research efforts towards carbon conversion to useful chemical feedstocks (e.g., ethylene and syngas) via CO_2 electrolysis are required to directly lower the greenhouse gas levels in our atmosphere and mitigate further climate disasters. Despite their promise, several challenges remain for the wide adoption of electrochemical energy conversion devices, including insufficient performance and durability, and high balance-of-plant cost. Many of these problems are inherently related to transport phenomena within the devices; here, I present the research efforts at the Fluids and Electrochemical Engineering Lab at TMU to directly address these challenges, using experimental diagnostics, design and fabrication of multifunctional materials, and assessment of device performance and durability.

Clean Energy & Environment

Open Session

Time: 10:30–12:00, June 18 (Tuesday) Canada, Mountain Daylight Time (MDT)

Place: KC 206

Sponsor: Association of Korean-Canadian Scientists and Engineers (AKCSE)

Organizer: AKCSE

Contact: Dr. Yong Hoon Kim, University of Windsor (kim523@uwindsor.ca)

Description: The session aims to achieve two main goals: providing everyone with widespread access to clean and affordable energy, and effectively tackling climate change, all while maintaining uninterrupted economic advancement.

Program:

Time	Place	Topic	Speaker	Affiliation
10:30–10:45	KC 206	Utilizing a web GIS-based spatial decision support tool for low-carbon policy	Dr. Gyoungju Lee	Korea National University of Transportation
10:45–11:00		Predicting Korea's population distribution trends using SSP*RCP scenarios: detailed grid-based analysis for urban and regional planning strategies	Hye-ryeon Jo	Gyeongsang National University
11:00–11:20		Monitoring atmospheric and climate environment in Canada and Korea	Dr. Yong-seung Chung	Korea National Univ of Education
11:20–11:32		Study on climate change impact assessment for city-scale with the SSP Scenario-hyper-local climate data downscaling method	Dr. Jaiho Oh	Pukyong National University
11:32–11:45		Study on climate change impact assessment for city-scale with the SSP Scenarios-Analysis of major climate change characteristics	Dr. Jaiho Oh	Pukyong National University
11:45–12:00		Developing a spatiotemporal regression model to predict the figure greenhouse gas emissions	Dr. Jiyoung Park	Murepa Korea

List of Participants:

Name	Position	Affiliation
Dr. Yong Hoon Kim	Professor	University of Windsor
Dr. Gyoungju Lee	Professor	Korea National University of Transportation
Hye-ryeon Jo	Ph.D. Student	Gyeongsang National University
Dr. Yong-seung Chung	Professor / Director in atmospheric environment	Korea National Univ of Education
Dr. Jaiho Oh	Professor / CEO of Nano C&W	Pukyong National University
Dr. Jiyoung Park	CEO	Murepa Korea

Clean Energy & Environment

Chair: Dr. Yong Hoon Kim

Associate Professor, the University of Windsor, Canada

Dr. Yong Hoon Kim is an Associate Professor of Civil and Environmental Engineering at the University of Windsor. Dr. Kim has received the B.S. and M.S. degrees in transportation from the University of Seoul, Seoul, Korea, in 2003 and 2006, respectively, and Ph.D. degree in Civil Engineering from Purdue University, West Lafayette, IN, USA, in 2017. He worked for two and a half years at the Seoul Institute in Korea as a research engineer. He also worked a Research Associate with the NEXTRANS Center, Purdue University. His research interests include Intelligent Transportation System, connected and autonomous vehicle technology, data analytics for connected transportation system, artificial intelligence for connected and autonomous vehicle applications, and traffic safety.

Clean Energy & Environment

Speaker: Dr. Gyoungju Lee

Professor, Korea National University of Transportation

Dr. Lee earned his Ph.D. from the State University of New York at Buffalo. He is a Professor at the Korea National University of Transportation (KNUT) and has authored or co-authored numerous journal articles and working papers. His research interests include urban analytics, spatial analysis, and GIS modeling in urban and regional planning, as well as spatial monitoring, microsimulation, web GIS, and spatial data visualization. Currently, he is involved in several research and development projects, which include developing a spatial knowledge inference engine, an LLM-based autonomous GIS interface, and low-carbon land use modeling. E-mail: lgjracer@ut.ac.kr

Utilizing a Web GIS-Based Spatial Decision Support Tool for Low-Carbon Policy

Gyoungju Lee[1], Yohan Han[1]*

[1]*Dept. of Urban Transportation Engineering,, Korea National University of Transportation, Chung-ju, Korea*

The global agreement on the need to tackle rising carbon emissions, which are driving climate change and threatening sustainability, has led countries to adopt strict low-carbon policies. Carbon emissions come from a wide range of activities spread across different locations, making the data related to these emissions inherently spatial—that is, tied to specific places and their characteristics. Understanding this spatial data is crucial because it helps reveal patterns and insights that can guide the spatial decision-making support process in implementing low-carbon policies. Nowadays, there's a wealth of data available on carbon emissions, and the growth of open-source communities has made it easier to access and analyze this information through web-based platforms. This study suggests using a Web GIS (Geographic Information System) dashboard as a tool for managing and analyzing carbon emission data. Such a dashboard can support complex decision-making by providing a clear view of where emissions are highest, how they are changing over time, and where interventions might be most effective. The goal is to make it easier for policymakers to implement effective low-carbon strategies by leveraging detailed spatial information. Keywords: Low-carbon, spatial data, open-source community, spatial decision-making support process, Web GIS.

Corresponding author; E-mail: snrn5008@naver.com

Clean Energy & Environment

Speaker: Hye-ryeon Jo

Ph.D. candidate

Hye-ryeon Jo is a doctoral candidate in the Department of Urban Systems Engineering at Gyungsang National University. She commenced her studies in March 2024. Her research interests lie in landscape architecture, urban planning, regional development, climate change, and social problem-solving. She primarily employs GIS and spatial statistics as research tools. Her current research focuses on refining statistical models for population forecasting and utilizing machine learning for studying spatial and infrastructural optimization in response to demographic changes.
E-mail. svooc5@gnu.ac.kr

Predicting Korea's Population Distribution Trends Using SSP*RCP Scenarios: Detailed Grid-Based Analysis for Urban and Regional Planning Strategies

Young-eun Kang[1]*, Hye-ryeon Jo[1]

[1]*Department of Landscape Architecture, Gyeongsang National University, Gyeongsangnam-do, Korea*

Although socio-economic pathways (SSPs) influenced by climate change and related Representative Concentration Pathways (RCPs) scenarios are important, there has been a significant gap in research focusing on precise population forecasts at the regional level. This study aims to provide detailed predictions of Korea's population from 2020 to 2100 at the grid level by merging predictions from SSP1 to SSP5 with varying levels of urbanization indicated by RCP degrees. Using data from the National Statistical Office, the International Institute for Applied Systems Analysis (IIASA), and global forecasts of RCPs, we generated reference and projected populations for each grid. Our work achieved the ability to map population distribution under different socio-economic scenarios and identify areas likely to experience increased population concentration based on urbanization levels. To enhance the reliability of our data, we weighted the total floor area of buildings in each grid unit when determining the standard population allocation. The population of South Korea in 2100 is predicted to range from 23,682,176 people in the SSP3.45 scenario to 43,478,423 people in the SSP5.85 scenario. Furthermore, the local government area expected to experience the most significant population growth is 'Gyeonggi-do', with a projected increase of 23% from 2020. These findings provide valuable insights for developing sustainable urban planning and strategies for regional development and conservation. They shed light on regions that are likely to undergo significant population shifts and migration in the future.
*Corresponding author; E-mail yekang@gnu.ac.k

Clean Energy & Environment

Speaker: Dr. Yong-seung Chung

Professor, Director in atmospheric environment

Dr Chung received his Ph.D. from University of Tsukuba in 1978, M.Sc. from the University of Alberta in 1972 and B.Sc. from Seoul N University in 1962. He is a Professor Emeritus at Korea N University of Education and Director of Korea Centre for Atmospheric Environment Research. He is a Permanent Fellow of Korean Academy of Science and Technology, and he was a Director of the KOFST for ~15 years. He has achieved an int. recognition in the area of atmospheric environment. He received numerous awards including a Research Prize of the Canadian Meteorological Society in 1973, the Korea Science Prize from the President of Korea in 1996 and two medals from the Government of Korea. He is the author of over 100 int. journals. He is the Founder and Editor-in-Chief of the Int. Journal of Air Quality, Atmosphere and Health of Springer for 12 years (Impact Factor 5.1). He is the Founder and organizes two int. conferences since 1985, and is the Founding President of the AKCSE in 1986. E-mail: kccar1@naver.com

Monitoring atmospheric and climate environment in Canada and Korea

Yong-Seung Chung

Korea Centre for Atmospheric Environment Research/Korea National University of Education, Cheong-ju, 28177 Korea

In 1972 we found that the frequency maxima of lee cyclone formation in the Canadian Rockies consisted of three distinct centres: in lees of the SW Alberta Range, the Churchill Range, and the Mackenzie Mts. Most lee cyclones formed initially under orographically produced diffluent cross-barrier flow, superimposed on a zone of low-level convergence and orographic descent. The initial formation of cyclones in the East Asian Mts occurred in the Altai-Sayan Mts, Tibetan Plateau, Taihang Mts, Mouth of the Yantze River, Korea Mts, etc. Since 1982 satellite measurements have been used in the analysis of large-scale air pollution generated from forest fires, large urban and industrial areas. To cite a few examples, smoke plumes from the eruption of Mount St Helens in WA were successfully tracked as far as Sask. Man., and NY. Air pollutants from the NE Midwest and Ohio valley were found to produce high ozone concentrations in Canada. Long-range transport of sulphates with S-SW airflows from the US produced high sulphur pollutants in Ontario and caused acid rain to occur. Air pollution transport from INCO Sudbury was observed at 400 km from the source. At the northern most station, Alert, it was found that CO_2 and SO_4= varied with warm airflows coming from southern latitudes. These caused air pollution and climate warming with significant summer ice melts in the Arctics, opening potential new sea-ways for large ships from Asia to the Atlantic. Continuous monitoring of greenhouse gases at the Tae-an site in Korea was initiated in 1990 and the joint study with NOAA, US found that the levels of CO_2 and CH_4 were higher than 40 other NOAA sites in the world. Airflows from 350~700 km distance in China were causing higher values of greenhouse gases to increase air temperature. Climate change has been studied and we found that air temperature and rainfall have increased in the recent 50 years. Also, Changma rain changed with sporadic heavy rain with linear convective storms. Duststorms occurred in Mongol and Inner Mongolia and we achieved many scientific findings on the transport and impacts of pollutants to the Korean Peninsula. These findings prompted the creation of an international workshop from 2002. China consumes large amount of fossil fuels and industrial activities produce substantial air pollution. In 1993, our team first discovered the massive transport of air pollution from China to the Yellow Sea and its recurrent significant impact on the air quality in Korea. As a striking example, on August 12, 2015, violent explosions and massive fires occurred in Tianjin, China and released extensive amount of toxic gas, smoke and dust into the atmosphere. Air quality measurements in our W Cheong-ju site showed the shocking impacts of widespread smoke and emissions from Tianjin. Also, monitoring of first heavy snowfalls in the Paek-du Mt has been carried out annually over 20 years. It was known that all sea-ports of north Korea were ice-free during winter months, albeit the freeze-up of Nampo port and nearby sea was observed each year. *Corresponding author; E-mail: kccar1@naver.com

Clean Energy & Environment

Speaker: Dr. Jaiho Oh

Professor, Pukyong National University

Dr. Jaiho Oh, founder and CEO of Nano C&W Co. Ltd., has an exceptional career in atmospheric science. He has been a professor at Pukyong National University, Director of the Forecast Bureau at the Korea Meteorological Administration, and held positions at Yonsei University and Argonne National Laboratory. Dr. Oh obtained his Ph.D. and Master's degrees from Oregon State University and his Bachelor's from Seoul National University. Dr. Oh has led research projects on climate change adaptation, severe weather, and high-resolution meteorological analysis, focusing on the impact of climate factors on monsoon precipitation, high-resolution climate prediction, and climate change analysis. He has published numerous papers in prestigious journals and holds several patents related to meteorological data generation and prediction. His expertise and innovative research have significantly contributed to the advancement of atmospheric science. E-mail jjho2023@gmail.com

Study on climate change impact assessment for city-scale with the SSP Scenarios -hyper-local climate data downscaling method

Suin Moon[1], Jaiho Oh[1]*, Morang Huh[1], Jiwon Oh[1]

[1]Nano C&W Co. Ltd., (13449) 54 Changeop-ro Sujeong-gu Seongnam-si Gyeonggi-do, Republic of Korea

Dense urban areas are more vulnerable to the risks posed by climate change. To develop effective climate change response measures, detailed climate change analysis at the regional level must be conducted. This study presents a method for producing high-resolution data that can be used for regional climate analysis by downscaling climate model data reflecting the IPCC's Shared Socioeconomic Pathways (SSP) scenarios. For this purpose, the regional climate model HadGEM3-RA (Hadley Centre Global Environmental Model version 3 regional model) data, one of the outputs of the CORDEX-EA (Coordinated Regional Climate Downscaling Experiment-East Asia) II project under the WCRP (World Climate Research Program), was utilized. To reflect the topographical characteristics of the target area, the HadGEM3-RA data was downscaled using a diagnostic model, producing ultra-high-resolution data (90m) at the city scale for key climate elements such as temperature, wind, and precipitation on a daily basis. Post-processing was performed to correct the climate model bias and calibrate the model values against the current climate, resulting in the final ultra-detailed climate model data. This ultra-detailed climate model data can be used in various fields, such as assessing urban climate disaster vulnerability to heatwaves and floods. Furthermore, if the climate change scenario data presented in this study is utilized for urban climate change impact assessments and risk analyses, and contributes to the formulation and evaluation of actual policies, it is expected to accelerate the transition to safer and more resilient cities in the face of climate change.

*Corresponding author; E-mail jjho2023@gmail.com

Acknowledgment: This work was supported by Korea Environment Industry & Technology Institute (KEITI) through the 'Climate Change R&D Project for New Climate Regime', funded by Korea Ministry of Environment (MOE) (2022003570008).

Clean Energy & Environment

Speaker: Dr. Jaiho Oh

Professor, Pukyong National University

Dr. Jaiho Oh, founder and CEO of Nano C&W Co. Ltd., has an exceptional career in atmospheric science. He has been a professor at Pukyong National University, Director of the Forecast Bureau at the Korea Meteorological Administration, and held positions at Yonsei University and Argonne National Laboratory. Dr. Oh obtained his Ph.D. and Master's degrees from Oregon State University and his Bachelor's from Seoul National University. Dr. Oh has led research projects on climate change adaptation, severe weather, and high-resolution meteorological analysis, focusing on the impact of climate factors on monsoon precipitation, high-resolution climate prediction, and climate change analysis. He has published numerous papers in prestigious journals and holds several patents related to meteorological data generation and prediction. His expertise and innovative research have significantly contributed to the advancement of atmospheric science. E-mail jjho2023@gmail.com

Study on climate change impact assessment for city-scale with the SSP Scenarios-Analysis of major climate change characteristics

Suin Moon[1], Jaiho Oh[1]*, Morang Huh[1], Jiwon Oh[1]

[1]Nano C&W Co. Ltd., (13449) 54 Changeop-ro Sujeong-gu Seongnam-si Gyeonggi-do, Republic of Korea

Climate change is having diverse impacts on cities worldwide. To effectively respond to climate change, detailed climate impact assessments at the city level should be conducted based on climate change scenarios. This study analyzed the main climate change characteristics at the city scale using the Shared Socioeconomic Pathways (SSP) scenarios developed by the IPCC. For this purpose, climate change model data for the East Asian region, combining Representative Concentration Pathways (RCP) scenarios and SSP scenarios, were downscaled. To project changes in key climate elements such as temperature, wind, and precipitation, the future climate period was set from 2021 to 2100, and changes were analyzed in 10-year intervals. The future climate changes were compared and analyzed on a monthly basis, using the analysis results of the current climate period set from 2001 to 2020 as a reference. Climate change in cities is closely related to socioeconomic risks. To assess the vulnerability of cities to extreme climate events such as heat waves and heavy rainfall, detailed climate analysis by region is essential. The results of this study, along with in-depth impact assessments on various sectors, are expected to contribute to a comprehensive diagnosis of climate change risks in cities and the establishment of effective adaptation measures.

*Corresponding author; E-mail jjho2023@gmail.com

Acknowledgment: This work was supported by Korea Environment Industry & Technology Institute (KEITI) through the 'Climate Change R&D Project for New Climate Regime', funded by Korea Ministry of Environment (MOE) (2022003570008).

Clean Energy & Environment

Speaker: Jiyoung Park

CEO, MUREPA KOREA

Dr. Park received his Ph.D. in Planning from the University of Southern California in 2007. He founded MUREPA KOREA in 2018 while having served an associate professor at the University at Buffalo, The State University of New York since 2008. The main research area is urban and regional economic system modeling, studying the economic costs and resilience effects of shocks on urban transport and environmental systems, particularly those associated with extreme events. Since 2003, Dr. Park developed the National Interstate Economic Model (NIEMO), an operational economic model that spatially separates the 50 US States and the District of Columbia. NIEMO is formulated to help examine the scale and policy implications of infrastructure services and freight transport across multiple spaces and times and is used to address and integrate urban freight transport, land use, and environmental issues into urban and regional planning systems. E-mail jiyoungp@murepa.com

Developing a spatiotemporal regression model to predict the future greenhouse gas emissions

Changkeun Park[1], Minsu Son[2], Jiyoung Park[1,3]*

[1]Future Industrial Economy Research Lab, MUREPA KOREA, Seoul, Korea, [2]Korea Institute of Civil Engineering and Building Technology, Seoul, Korea, [3]University at Buffalo, SUNY, NY, USA

This study focuses on a new approach to constructing a spatiotemporal model to predict a future greenhouse gas emission indicator. The basic spatial and industrial data structure used in this study includes 17 provinces and 33 industries generating greenhouse gas emission data in the analysis. Temporal data includes years from 2000 to 2020 and targets up to 2100. Predicting future greenhouse gas emissions at the regional level is critical in developing assessment scenarios based on the AR 6 from the IPCC to evaluate the effects of climate change in Korea. For this purpose, this study set up the greenhouse gas emission indicators as the dependent variable. It incorporated independent variables such as historical population, real Gross Regional Domestic Product (GRDP) by industry, employee and business counts by industry, and petroleum products consumption by industry for 17 provinces. Additionally, the model includes macroeconomic indicators (economic trends, price, consumer sentiment, stock price indexes, and interest rate) at the national level and regional-specific indicators such as unemployment rate and households' disposable income. The target year of greenhouse gas emissions will be used as a major indicator evaluating Korea's local assessment scenarios, contributing to understanding regional variations in greenhouse gas emissions and providing climate change policy effectiveness for policymakers.

*Corresponding author; E-mail jiyoungp@murepa.com

2024 Canada-Korea Battery Value Chain Workshop

Open Session

Time: 10:30–18:00, June 18 (Tuesday) Canada, Mountain Daylight Time (MDT)

Place: KC 201

Host: National Research Council of Science & Technology (NST) and National Research Council of Canada (NRC)

Organizer: Korea Institute of Energy Research (KIER) and Association of Korean-Canadian Scientists and Engineers (AKCSE)

Contact: Dr. Simon Park, University of Calgary (simon.park@ucalgary.ca)

Description: This session is to discuss Canada Korea Battery value chain and collaborations

Program:

Time	Topic	Speaker	Affiliation
10:30–10:45	Opening Remarks	Dr. Seonghwan Kim Dr. Lakshimi Krishnan Dr. Bok Chul Kim	AKCSE President NRC NST Chairperson
Part 1. Battery Research Show Case			
10:45–10:50	Overview of NST and GRIs	Video	NST
10:50–11:05	R&D activities on the next generation rechargeable secondary battery of KIER	Dr. Sun-Hwa Yeon	KIER
10:55–11:10	Critical Battery Materials Initiative project by NRC	Lawrence Charlebois	NRC
11:10–11:25	KIGAM's R&D Activities on Battery minerals	Dr. Seong-Jun Cho	KIGAM
11:25–11:40	KIMM's R&D Activities on Digital Transformation for Advanced Battery Manufacturing Systems	Dr. Taik-Min Lee	KIMM
11:40–11:55	Overview of Battery Research Activities in Alberta and Canada	Jin Tak	Alberta Innovates
11:55–12:00	Q&A Session		
12:00–13:00	Lunch CKC		
Part 2. Batteries Upstream - Critical Battery Material value chains, from mining to processing in Korea and Canada			
13:00–13:15	Design of Flotation Circuit for the Black Mass of a Spent Li-ion Battery	Dr. Kwang-Seok You	KIGAM
13:15–13:30	An Overview of Battery Mineral in Canada	TBD	GSC
13:30–13:45	Thermodynamic Speciation of Citric Acid Based-waste LIB's Leach Liquor in the Presence of Reducing Agents	Dr. Rina Kim	KIGAM
13:45–14:00	Risk in the global supply chain of battery minerals	Dr. Seong-Jun Cho	KIGAM
14:00–14:15	Cathode active materials from Canadian resources	Chae-Ho Yim	NRC

Time	Topic	Speaker	Affiliation
Part 3 Batteries Midstream - Processors and refiners purify the raw materials, then use them to create cathode and anode active battery materials; commodities traders buy and sell raw materials to firms that produce battery cells. Advanced Battery materials and technology to enhance the energy density, safety, and utilization			
14:30–14:45	Solid state battery projects - 'Operando measurements of battery materials in dynamic conditions'	Dr. Michael Fleischauer	NRC
14:45–15:00	Materials for all solid-state LI-metal battery	Dr. Boyun Jang	KIER
14:30–14:45	Development of electrode materials technology for sustainable secondary batteries	Dr. Jin-woo Yi	KIMS
14:45–15:00	Outlook for Silicon Anodes	Dr. Chaneel Park	MakeSens
15:00–15:30	Health Break		
Part 4 Batteries Midstream & Downstream			
15:30–15:45	Development of Electrode Structures and Manufacturing Technologies for Eco-Friendly Battery Production	Dr. Jaehak Lee	KITECH
15:45–16:00	Lignin-based glassy carbon (LGC) products for alkali-ion batteries and supercapacitors	Jin Tak	CarbonIP/InnoTech Alberta
16:00–16:15	Battery Development of Hybrid Power-plant for Hydrogen Fuel-Cell UAV	Dr. Yong Wun Jung	KARI
16:15–16:30	TBD (On-line)	TBD	EoneMobile
16:30–16:45	Black Mass Recycling: Enhancing Battery Materials Circularity	Dr. Andriy Plugatry	NRC-CBMI
16:45–17:00	Issues in the Current Battery Recycling Technology and Development of Eco-Friendly Technology	Dr. Jung-Je Woo	KIER
17:00–17:15	Core Technologies for Advanced Battery Manufacturing Systems and its Digitalization Technology	Dr. Taik-Min Lee	KIMM
17:15–17:25	Health Break		
Part 5 Panel Discussion and Networking			
	Intro	Chae-Ho Yim	NRC
17:30–17:45	Panel Discussion		
17:45–17:50	Concluding Remarks	Dr. Seong Ok Han	KIER
17:50–18:00	Networking		

2024 Battery Workshop Session

Chair: Dr. Simon S. Park

Professor, Mechanical Engineering, University of Calgary

Dr. Park is a professor at the Schulich School of Engineering, Dept. of Mechanical and Manufacturing Engineering, University of Calgary, Canada. He is a Schulich School of Engineering Industrial Research Chair in sensing and monitoring. He is a professional engineer in Alberta and is an associate member of CIRP (Int. Academy of Production Engineers) from Canada. Dr. Park received bachelor and master's degrees from the University of Toronto, Canada. He then continued his PhD at the University of British Columbia, Canada. He has worked in several companies including IBM manufacturing where he was a procurement engineer for printed circuit boards and Mass Prototyping Inc. dealing with 3D printing. His research interests include nanocomposites, printed electronics, sensors, IoTs, batteries and advanced manufacturing. He has also founded several start-up companies in sensing, batteries, and advanced manufacturing. He has received several awards including Young Innovator's Award, Schulich School of Engineering Teaching Award, Schulich School Research Excellence Award, CFI New Faculty Grant, Alberta Innovates New Faculty award, NSERC scholarships, etc. He is also serving as associate editors of several journals. Currently, he is directly supervising over 30 students and scholars at Multifunctional Engineering, Dynamics and Automation Lab (MEDAL, www.ucalgary.ca/medal). E-mail simon.park@ucalgary.ca

2024 Battery Workshop Session
Part 1. Battery Research Show Case

Speaker: Dr. Sun-Hwa Yeon

Principal researcher/Chief, Energy Storage Research Department, Korea Institute of Energy Research, South Korea

Dr. Sun-Hwa Yeon is a principal researcher of Energy Storage Lab. at Korea Institute of Energy Research (KIER) from 2010. She manages the large-scale battery devices and materials related to the energy storage system (ESS) and electric vehicle (EV) research efforts. She has been serving as Korean delegate of the Executive Committee of IEA Technology Collaboration Programme on Energy Storage (ES-TCP) since 2016 in Korea. She has been appointed to a committee for Carbon Neutrality Section by the Science Advisory Board, Ministry of Foreign Affairs (MOFA), Republic of Korea, from 2021. She was also serving as a R&D Planner for Battery subject of Energy & Environment Field in National Research Foundation of Korea (NRF) during 2016 ~ 2018. She has over 24 years of technical and management experience for the advanced battery system of renewable and transportation energy storage applications in the academic and private sectors. During this period, she has published numerous articles (approximately 105) in peer-reviewed journals, patent applications (approximately 80), and many articles to the ESS magazines, leading many national R&D projects related to ESS, EV, and second-rechargeable battery. Prior to her work with the KIER, she worked as a postdoctoral research fellow and project leader at A.J. Drexel Nanotechnology Institute of Drexel University. She received a Ph.D. in Chemical Engineering from the Korea Advanced Institute of Science and Technology (KAIST), and an MS from Pohang University of Science and Technology (POSTECH), South Korea. E-mail ys93@kier.re.kr

R&D activities on the next generation rechargeable secondary battery of KIER

Sun-Hwa Yeon*

Energy Storage Research Department, Korea Institute of Energy Research (KIER), 152 gajeong-ro, Yuseong-gu, Daejeon, 34129, South Korea

With the rise of renewables, energy storage played a much greater role in providing flexibility, with important deployments in both short-term and long-term balancing markets. The potential of distributed energy storage technologies is increasing with a rapidly growing contribution by renewable energies. The effective role of battery energy storage system in KIER will be considered, particularly in respect of battery energy storage technologies, with along examining the rechargeable secondary batteries in energy storage technologies and applications. At present, the demand for efficient energy storage equipment is increasing owing to the increasing requirement for clean energy. However, even the most promising Li-ion battery (LIB) technologies are limited by the energy density ranges required for EVs ranges compared to those for internal combustion vehicles. Next generation rechargeable secondary batteries, such as solid-state battery, Li-S battery, and non-lithium based battery, are potentially suitable for bridging the gap between the low energy density levels and specific capacities of rechargeable batteries, as they exhibit the high theoretical energy density values. In this study, we are going to present R&D activities on the next generation rechargeable secondary battery of KIER. Main research targets are the advanced Li-based battery for high energy density and redox flow battery for large-scale, long-duration, and low price energy storage system. Furthermore, we conduct in-depth analyses of the practical use of the batteries to determine the best global market.

2024 Battery Workshop Session
Part 1. Battery Research Show Case

Speaker: Lawrence Charlebois

Manager, Critical Battery Materials Initiative (CBMI), National Research Council of Canada

Lawrence has over 15 years of professional research engineering and consulting experience across the energy, minerals and environmental sectors. He holds a B.A.Sc. in Geological and Environmental Engineering from Queen's University, a M.A.Sc. in Mining Engineering and Mineral Processing from the University of British Columbia as well as professional experience in supply chain and operations management. He has served as Convenor and Chair for an International Standards Organization (ISO) Mining Standards Task Force and currently serves as advisor to the Canadian Standards Association Natural Resources Strategic Steering Committee. As Senior Project Advisor and Initiative Manager at the National Research Council of Canada, Lawrence is currently responsible for the administration of a strategic research and development initiative under the Advanced Clean Energy program of the Clean Energy Innovation Research Centre. Lawrence is a licensed Professional Engineer and Professional Geoscientist.

The Critical Battery Materials Initiative (CBMI) at the National Research Council of Canada

Hosted by the National Research Council of Canada's Clean Energy Innovation Research Centre, the Critical Battery Materials Initiative will establish automated, AI-enabled platforms that can discover new critical battery materials and processes in a third of the time it takes today, contributing to the growth of the Canadian battery supply chain. This 4-year initiative, launched in 2023, will provide funding for projects aligned with the Canadian Critical Minerals Strategy to grow targeted capabilities and partnerships under our Advanced Clean Energy program. To accelerate our impact in battery mineral processing and battery materials discovery, the initiative will combine the unique platforms and expertise of the NRC's Clean Energy Innovation Research Centre with grants and contributions funding for eligible academic and industrial partners.

Two technology areas will be developed to deliver on CBMI's objectives:

1. Midstream battery minerals processing acceleration platform: Self-driving labs and machine learning approaches to develop more efficient and sustainable processing pathways to produce battery materials from raw and recycled source materials
2. Battery materials acceleration platform: Self-driving labs and machine learning approaches to discover new battery materials with optimized performance, safety and sustainability characteristics

2024 Battery Workshop Session
Part 1. Battery Research Show Case

Speaker: Dr. Seong-Jun Cho

Principal Researcher, Korea Institute of Geoscience and Mineral Resources (KIGAM)

Dr. Cho has been a principal researcher of Korea Institute of Geoscience and Mineral Resources (KIGAM), Daejeon, Korea. He has over 28 years of experience in the research for the development of geophysical exploration technologies as well as in evaluating mineral projects and establishing policies to secure minerals. He served as the director of the Mineral Resources Division of KIGAM. Now he has been focusing on critical mineral exploration such as lithium, nickel, graphite, REE both domestically and abroad. He received the B.Eng. degree in petroleum and mineral resources engineering, the M.Eng. degree, and the Ph.D. degree in applied geophysics from the Seoul National University, Korea.

KIGAM's R&D Activities on Battery minerals

Seong-Jun Cho

Mineral resource div, Korea Institute of Geoscience and Mineral Resources (KIGAM), Daejeon, Korea

The surge in demand for batteries due to carbon neutrality and energy transition has led to supply and demand instability of battery minerals, and the transition from internal combustion engines to electric vehicles has become the most important cause of the surge in demand for battery minerals, and the risk of supply chain of those, which are named critical minerals, is the biggest obstacle to the transition to electric vehicles. KIGAM predicted a surge in demand for battery minerals and minerals related to electric vehicles after the Paris Agreement and prepared accordingly. KIGAM conducted a comprehensive analysis of the supply chain from minerals such as lithium, nickel, graphite, and rare earths to battery materials, and published many reports, including reports from government ministries, requesting government preparations and measures, and is still in close contact with the Ministry of Trade, Industry and Energy and the Ministry of Foreign Affairs to propose strategies for securing minerals for electric vehicles. In the field of research and development, we are focusing on analyzing the entire supply chain of battery minerals, analyzing deficient technologies, and focusing on research to solve them. For lithium and nickel, we are using AI, 3D geological modeling, and drones to explore mineralization zones at domestic and abroad, while graphite is focused on domestic exploration and rare earths on overseas exploration. We are researching beneficiation and smelting to secure lithium from lapidolite, which is not commercialized globally, and DLE technology to extract lithium from low grade brine lithium, and developing eco-friendly and low-carbon beneficiation and smelting technologies to secure international competitiveness from an ESG perspective. KIGAM is playing an important role in strengthening the supply chain of Korea's battery industry through active technology transfer to domestic battery-related companies.

2024 Battery Workshop Session
Part 1. Battery Research Show Case

Speaker: Dr. Taik-Min Lee

Head, Department of Advanced Secondary Battery Manufacturing Systems, Korea Institute of Machinery and Materials, Republic of Korea

Dr. Taik-Min Lee serves as the Head of the Department of Advanced Secondary Battery Manufacturing Systems at the Korea Institute of Machinery and Materials (KIMM). He earned his B.S., M.S., and Ph.D. degrees from the Department of Mechanical Engineering at the Korea Advanced Institute of Science & Technology (KAIST). His research focuses on printing and coating processes, equipment development for batteries, flexible and printed electronic devices, and sensors including flexible displays, solar cells, bio-sensors, and IoT devices. Currently, his primary research involves the development of digital transformation technology for advanced secondary manufacturing systems. Additionally, he leads the Digital Twin Team at KIMM with the aim of promoting digital twin technology. He has authored approximately 80 international journal papers and holds 240 registered patents, including 57 international patents. He is dedicated to collaborative efforts with industries to secure cutting-edge technology in the field of secondary battery equipment.

KIMM's R&D Activities on Digital Transformation for Advanced Battery Manufacturing Systems

Taik-Min Lee*

Department of Advanced Secondary Battery Manufacturing Systems, Korea Institute of Machinery and Materials, Daejeon, Republic of Korea

The secondary battery market is predicted to grow by over 10% annually, while the digital twin market is forecasted to experience a high growth rate of over 20% annually. In response to this trend and the demands from both small and large enterprises in Korea, KIMM's Secondary Battery Equipment Research Laboratory is particularly focusing on digital transformation research in secondary battery equipment technology. Korean secondary battery industry has already established factories worldwide. However, due to the specialized nature of secondary battery manufacturing, dispatching skilled personnel incurs significant costs, posing challenges in cost reduction. Moreover, the departure of skilled personnel can have adverse effects, emphasizing the necessity of digital transformation technology for optimal equipment operation. Our laboratory has conducted research on digital transformation, including digital twin technology for roll-to-roll electrode manufacturing equipment, precise alignment, defect characterization, static/dynamic modeling of manufacturing equipment, and control parameter setting. KIMM is actively advancing practical technologies applicable to Korean small and medium-sized enterprises.

2024 Battery Workshop Session
Part 2. Battery Upstream

Speaker: Dr. Kwang-Seok You

Principal Researcher, Korea Institute of Geoscience and Mineral Resources (KIGAM)

Dr. You majored in materials science and engineering at Yamaguchi National University, Japan, and has achieved remarkable research results in mineral processing at KIGAM for 20 years. In particular, it has many research achievements in developing the flotation process of REE, and copper, zinc, and lead minerals. Recently, he was responsible for project management on R&D research to develop a SMART recognition and control system for grinding and flotation processes. He is also a professor in Dep. mineral Processing at the University of Science and Technology and an expert in Technology Level Evaluation, the Ministry of Science and ICT, Korea.

Design of Flotation Circuit for the Black Mass of a Spent Li-ion Battery

Kwang-Seok You

Resource utilization research div, Korea Institute of Geoscience and Mineral Resources (KIGAM), Daejeon, Korea

Recently, there has been an intensifying global competition among countries to secure strategic resources used in lithium-ion batteries. As part of that, many countries are showing interest in black mass, which is obtained through dismantling and shredding spent lithium-ion batteries. In this presentation, I aim to introduce the key technologies and research that were conducted for the development of this flotation process. The flotation process has been developed in KIGAM in order to secure battery materials from the black mass; Lithium nickel manganese cobalt oxide, which is a cathode material, and graphite which is an anode material. KIGAM possesses various floatation machines. Among them, four different types of floatation machines were used: the well-known Sub-A type by Denver and three types developed by KIGAM, namely Cone type, Tank type, and Column type. Through these experiments, we investigated the flotation machines that can effectively suppress the entrainment of cathode materials during flotation. And then, we obtained experimental data regarding the float kinetic coefficient and recovery of the cathode material during flotation. Using this data, we were able to derive the optimal flotation conditions and circuit that can produce cathode materials with a grade of 98% and a recovery of 99%. Based on this, we have designed the final flotation process circuit.
We transferred the flotation process to a domestic company in the Pohang region of South Korea, processing twenty thousand tons of black mass annually with completion targeted for 2025.

2024 Battery Workshop Session
Part 2. Battery Upstream

Speaker: Dr. Rina Kim

Senior Researcher, Korea Institute of Geoscience and Mineral Resources and Associate Professor at University of Science and Technology, Korea

Dr. Rina Kim is a Senior Researcher at the Korea Institute of Geoscience and Mineral Resources (KIGAM), and an Adjunct Associate Professor at Korea University of Science and Technology. She received her Ph.D. from the Department of Energy Systems Engineering at Seoul National University in 2016. Dr. Kim continued her research career at the Robert M. Buchan Department of Mining, Queen's University, Canada, as a Postdoctoral Fellow from 2016 to 2019. She has earned extensive experience in the field of extractive metallurgy, mainly hydrometallurgy and mineral processing, dedicating herself to research projects related to the recovery of critical minerals, precious metals, and base metals from primary and secondary resources. At KIGAM, Dr. Kim is mainly involved in projects regarding critical metals recovery, such as rare earth elements, nickel, lithium, vanadium, and titanium, and she is developing breakthrough metallurgical technology. Recently, Dr. Kim is expanding her research interest to hydrometallurgy using non-aqueous medium and biometallurgy that utilizes bacterial activity to extract metals from resources. Upon these research interests and experience, developing environmentally-friendly metal extraction and treatment processes is her long-term research goal.

Thermodynamic Speciation of Citric Acid Based-waste LIB's Leach Liquor in the Presence of Reducing Agents

Rina Kim[1,2]*, Ahmad Ghahreman[3]

[1]Resources Recycling Research Center, Resources Utilization Division, Korea Institute of Geoscience and Mineral Resources (KIGAM), Daejeon, Korea, [2]Resources Engineering, University of Science and Technology, Korea, [3]Robert M. Buchan Department of Mining, Queen's University, Kingston, ON, Canada

The study investigated the leaching behavior of cathode material (LiNi1/3Co1/3Mn1/3O2) from waste lithium-ion battery black mass using citric acid as a lixiviant. Specifically, it compared the effects of hydrogen peroxide and ascorbic acid as reducing agents and analyzed the influence of metallic copper contained in the black mass on the leaching of cathode metals. The leaching behavior was analyzed by utilizing thermodynamic data to understand the chemical species distribution under conditions of 25°C, 1 atm, and pH ranging from 1 to 10. The analysis revealed that without the addition of a reducing agent, leaching of LiNi1/3Co1/3Mn1/3O2 was possible only within a very narrow pH range of 1.0-1.8. With the addition of hydrogen peroxide as a reducing agent, the leaching range expanded to pH 1.0-4.6, while using ascorbic acid as a reducing agent extended the highest possible pH level for leaching to 7.0-10. Additionally, metallic copper contained in the black mass acted as a reducing agent for LiNi1/3Co1/3Mn1/3O2 leaching, with the leaching range calculated to be pH 1.0-5.4. Therefore, this thermodynamic analysis study concluded that in the leaching of cathode metals from the black mass, the reducing agents can enhance the leaching of cathode metals in the order of ascorbic acid > metallic copper > hydrogen peroxide, consistent with actual experimental results.

2024 Battery Workshop Session
Part 2. Battery Upstream

Speaker: Dr. Seong-Jun Cho

Principal Researcher, Korea Institute of Geoscience and Mineral Resources (KIGAM)

Dr. Cho has been a principal researcher of Korea Institute of Geoscience and Mineral Resources (KIGAM), Daejeon, Korea. He has over 28 years of experience in the research for the development of geophysical exploration technologies as well as in evaluating mineral projects and establishing policies to secure minerals. He served as the director of the Mineral Resources Division of KIGAM. Now he has been focusing on critical mineral exploration such as lithium, nickel, graphite, REE both domestically and abroad. He received the B.Eng. degree in petroleum and mineral resources engineering, the M.Eng. degree, and the Ph.D. degree in applied geophysics from the Seoul National University, Korea.

Risk in the global supply chain of battery minerals

Seong-Jun Cho

Mineral resource div, Korea Institute of Geoscience and Mineral Resources (KIGAM), Daejeon, Korea

The post-Paris Agreement transition to electric vehicles has been a necessary step towards carbon neutrality, which has led to an explosion in demand for battery minerals. Battery minerals are among the most important of the critical minerals, and they differ from minerals such as iron, copper, and coal, which were previously required for industrialization, in terms of their scarcity and the diversity of supply chain shortfalls for each mineral. For example, lithium and cobalt for cathode materials were mainly produced as by-products, nickel oxide requires high purity technology to be used as a battery material, and graphite for cathode materials requires high purity and spheroidization to be used as a cathode material, and most of these processing plants are located in China. KIGAM analyzed the supply chain from mineral to materialization for lithium, cobalt, nickel, and manganese for anode materials, graphite for cathode materials, and rare earths used in the motors of electric vehicles to identify deficiencies in the supply chain, and identified technologies needed in the supply chain for each mineral. KIGAM also proposed technologies to secure international competitiveness in terms of ESG.

2024 Battery Workshop Session
Part 2. Battery Upstream

Speaker: Chae-Ho Yim

Research Council Officer, Clean Energy Innovation Research Centre, National Research Council of Canada

Chae-Ho Yim is a Research Council Officer at the National Research Council of Canada, with 13 years of experience in Li-ion battery materials. He received his M.A.Sc. in Chemical Engineering from the University of Ottawa in 2011, after completing a BASc in Chemical Engineering and a BSc in Biochemistry in 2008. With over a decade of experience in the field, he has established as a leading expert in Li-ion battery materials, having worked on cathodes, anodes, and electrolytes. Chae-Ho's recent research has been focused on materials for Solid-State Li-ion batteries, which are widely considered to be the future of battery technology and scale-up production of cobalt free cathode active materials.
chae-ho.yim@nrc-cnrc.gc.ca

Cathode Active Materials from Canadian Resources: A Cost-Effective Solution for Li-ion Batteries

Chae-Ho Yim, Zouina Karkar, Andrew Hakim, Paul MacIver, Yaser Abu-Lebdeh*

Clean Energy Innovation Research Centre, National Research Council Canada, Ottawa, Ontario, Canada.

The increasing demand for Li-ion battery materials has highlighted the significance of cost and production rate of cathode active materials. As the most expensive component, accounting for 50% of the total cost, optimizing the production of cathode active materials has become crucial. Canada, ranked 4th in critical mineral reserves for Li-ion batteries globally, enjoys a geographical advantage with the United States as its neighbor, which has the second-largest vehicle sales worldwide. Leveraging this advantage, the production of pre-Cathode or Cathode Active Materials (pCAM or CAM) in Canada holds immense importance. This presentation aims to introduce a Co-free pCAM and CAM production method utilizing a Continuous-Stir-Tank Reactor. Additionally, the results and characteristics of the pCAM and CAM will be shared, highlighting their potential as a cost-effective solution for Li-ion batteries in Canada.

2024 Battery Workshop Session
Part 3. Battery Midstream

Speaker: Dr. Mike Fleischauer

Senior Research Officer, Quantum and Nanotechnologies Research Centre, National Research Council Canada, Edmonton, Alberta Canada and Adjunct Prof., Department of Physics, University of Alberta, Edmonton, Alberta Canada

Dr. Mike Fleischauer received his Ph.D. from Dalhousie University. He was a Postdoctoral Fellow at the University of Alberta prior to joining the National Research Council in 2007. He became an Adjunct Professor of Physics and a Professional Engineer in 2015. Mike's research and development contributions span a wide range of energy conversion and storage technologies including nanostructured thin films for organic photovoltaics, fuel cell catalysts, and rechargeable and primary batteries, with a focus on new, automated, and robust ex-situ, in-situ, and operando electrochemical, structural, and mechanical measurements. His current research and development is based on harnessing challenging environments (e.g. high temperature, variable pressure) to improve the field's understanding of energy storage materials and device performance in real-world conditions. E-mail: michael.fleischauer@nrc.ca

Operando measurements of battery materials in dynamic conditions

Mike Fleischauer

National Research Council – Quantum and Nanotechnologies Research Centre and Department of Physics, University of Alberta, Edmonton, Alberta, Canada

Understanding the combined electrochemical, physical, and structural properties of cell components is central to improved battery performance. There are many challenges: material properties (e.g. crystallography, conductivity, strength) can vary strongly with temperature, composition, time, and test / use history. Reaction pathways and products can be difficult to identify due to a lack of long-range order, complex solid-solutions, or underexplored material systems, and the reactive nature of alkali metals. Established methods like conductivity and mechanical measurements depend on dynamic measurement of sample geometry and contact area, which may vary with applied force / pressure, temperature, and time. Operando methods can provide a wealth of data over a wide range of conditions but require streamlined analysis for materials insight.

This talk will describe our integrated approach to operando measurements of battery materials. Briefly, Conflat-style ultra-high vacuum flanges and adapters are used as a modular platform for repeatable ex-situ, in-situ, and operando characterization of cell components over a wide range of temperatures (-50 to 150°C), applied mechanical pressure (0.2 – >4 MPa) and electrochemical conditions. Commercially available and customized flanges and adapters can be combined to enable electrochemical, optical, structural, and mechanical studies without compromising cell performance or measurement integrity. Conflat hardware is complemented with optimized measurement and extensive data processing and analysis routines, and an expanding suite of in-situ / operando electron microscopy methods. For example, thousands of X-ray patterns collected during operando measurements using laboratory and synchrotron diffractometers can be understood (correlating observed electrochemical potentials with crystallographic phases) via scripted collation, automatic peak detection, and semi-automatic space group indexing.

Results from operando measurements of negative electrode materials, solid-state electrolytes, and lithium foil will be presented as representative examples.

2024 Battery Workshop Session
Part 3. Battery Midstream

Speaker: Dr. Boyun Jang

Principal Researcher, Korea Institute of Energy Research – Energy Conversion and Storage Material Laboratory, and Joint Professor, Choongnam national University, Energy technology Graduate School

Dr. Boyun Jang has received his Bachelor, Master and Doctor's degree of Material science and engineering at Korea University and had post-doctorial position at Virginia tech. for 1 year at 2012. He has worked at Hyndae Electronics for 2 years from 2000 and joined Korea institute of energy research since 2006. He researches various nano-materials for secondary battery, solar cell, optical devices and bio-applications. Since 2008, He has also developed various new process applicable for synthesis of nanomaterials using plasma such as inductive coupled plasma, microwave plasma, and arc plasma. He has been working on specific analysis methods such as internal quantum efficiency of nanomaterials, quantification of core-shell ratio of nanoparticles by Raman and XPS, etc. He has transferred his nano material technologies to more than 3 companies, who still on nanoparticle business. He has been joint professor in Chungnam national university since 2011. A number of students received Master's degree and doctor's degree in his laboratory. He received technical innovation award twice from techconnect held in USA. He received commendation form Korean president at 2018. E-mail: byjang@kier.re.kr

Material issues for all solid-state Li-metal battery

Byol Han[1], Yeonjin Park[1], Jinwoo Joo[1], Boyun Jang[1]*, Daeil Kim[1], Jiheong Yu[2]

[1]Energy Storage Research Department, Korea Institute of Energy Research Energy, [2]Hydrogen Convergence Materials Laboratory, Korea Institute of Energy Research Energy

All solid-state Li-metal battery (LMB) is considered as the next generation battery due to its high energy density and safety. Nevertheless, there are lots of technical issues for replacement of current Li-ion battery with liquid electrolyte. First of all, solid electrolyte has relatively low ionic conductance with its considerable thickness and high material density. In case of cathode, unstable formation of ionic conduction path in cathode and low areal capacity hinder LMB's commercialization. Most of all, Li-metal causes various unexpected issues in spite of its critical role for the high energy density of LMB. All the issues are related to material properties, and new insight of materials is critically required for all solid-state LMB technology. KIER has experienced various materials for all solid-state LMB, and overcame some issues with our own ideas. In this talk, oxide-polymer composite solid electrolyte with specially designed multiple layer structure will be introduced to obtain not only electrochemical performances but also mechanical properties. Solid electrolyte for cathode to ensure ionic conductive path and artificial solid electrolyte interface (SEI) on Li-metal anode will be presented as well. Most of all, severe technical issues with ultra-thin Li-metal prepared by electroplating process will be given to discuss the future solutions. Brief experimental results and the related issues of the technologies including new topics will be given to find future collaborations with Canadian site-researchers.

*Corresponding author; E-mail byjang@kier.re.kr

2024 Battery Workshop Session
Part 3. Battery Midstream

Speaker: Dr. Jin Woo Yi

Principle Researcher, Korea Institute of Materials Science (KIMS), South Korea

Dr. Jin Woo Yi earned his BS degree in chemical engineering from Hanyang University, Seoul, South Korea in 1999. He joined the research group of Prof. Bae at the Gwangju Institute of Science and Technology (GIST), Gwangju, South Korea and received his MS in 2001. After working for LG chemical for five years, he joined the Korea Institute of Materials Science (KIMS) in 2006. While working at KIMS, he received his PhD degree in 2014 from the Korea Advanced Institute of Science and Technology (KAIST). He has been actively engaged in the development of high-energy density batteries, focusing not only on electrode materials but also on innovative process-based post-coating electrode development. He has published more than 80 research articles in SCI(E) journals. E mail: yjw0628@kims.re.kr

Development of electrode materials technology for sustainable secondary batteries

Jihee Yoon, Teahoon Park, Youngseok Oh, Jin Woo Yi*

Department of Carbon Composites, Composites Research Division, Korea Institute of Materials Science (KIMS), South Korea

The rapid development of electric vehicles has generated a recent demand for high energy density and sustainable secondary batteries such as lithium-ion batteries (LIBs), sodium-ion batteries (SIBs) and all solid secondary batteries. Our simple and effective strategies to obtain the batteries are to design electrodes with high energy density and to fabricate thick electrodes in order to improve the energy density of the next-generation batteries. One way to design electrodes with high energy density is the development of highly conductive additives and highly adhesive binders to increase the proportion of the active material in the electrode. The other is focusing on the fabrication of high-concentration slurry and dry electrode process (solvent-free) to improve electrode homogeneity resulting in high capacity and cell performance. Our distinct technologies of materials and process for the batteries include the utilization of high conductive CNT and the development of novel binder resins with high adhesion characteristic and dry process based on mixing-lamination. Key issues to achieve the goals with the technologies are as shown below;

- Goal 1 : Reduction of the proportion of conductive additives in the electrode by applying to CNTs with high conductivity and high specific area
  - ➔ Uniform dispersion of high conductive MWCNT and SWCNT with high specific surface area
  - ➔ Technology to improve solid content of CNT dispersion (MWCNT: 5 wt%, SWCNT : 0.8 wt% in organic/aqueous solvents): Application to fabrication high energy density electrode by reducing the proportion of conductive additives about 20-50% in the electrode
- Goal 2 : Application of thermosetting/thermoplastic polymer binders with high adhesion
  - ➔ Verification of electrode properties (adhesion, resistance, etc), processability, and electrochemical performance by applying to the battery the thermosetting/thermoplastic polymer binder : Reduction of binder proportion by 30% in the electrode compared to the existing PVDF
  - ➔ Application to fabricate thick electrode (> 8 mAh/cm2) based on high-concentration slurry (solid content > 80 wt%) fabrication technology and dry electrode process (mixing-lamination-rolling)

Through this presentation, we hope to provide a general introduction of our organization's secondary battery material technology and provide an opportunity for fruitful communication with attendees.

2024 Battery Workshop Session
Part 3. Battery Midstream

Speaker: Dr. Chaneel Park

CEO, Makesens Inc., Calgary, Alberta

Dr. Chaneel Park earned his Doctoral degrees in Mechanical and Manufacturing Engineering from the University of Calgary. In 2017, he co-founded MakeSens Inc. with his former supervisor, Dr. Simon Park, and colleague Dr. Allen Sandwell. Since then, Dr. Park has served as the company's CEO, focusing on developing the core manufacturing technology of photoelectromagnetic sintering for airborne nanoparticles, specifically for silicon anode fabrication. He has established a strategic partnership with a South Korean battery manufacturer and is actively developing silicon anode products. His goal is to create cost-effective, scalable silicon anode materials for high-capacity batteries used in electric vehicles.
E-mail: cpark@makesens.ca

Trends and Outlook for Silicon Anodes

Chaneel Park1, Allen Sandwell[1], Simon Park[2]

[1]*MakeSens Inc., Calgary, Canada, 2Univeristy of Calgary, Calgary, Canada*

The demand for high-capacity lithium-ion batteries is rapidly increasing due to the rising popularity of electric vehicles (EVs) which predominantly rely on lithium-ion batteries for power. Surveys have revealed that limited driving range (68%) and slow charging speed (22%) are the most concerning factors in purchasing EVs. While there have been improvements made in cathode materials of lithium-ion batteries, anode materials have been the same graphite anode, which has been limited by theoretical capacity of 372 mAh/g. Silicon is a prominent candidate as an alternative anode material due to its theoretical capacity of 4,200 mAh/g, more than ten times that of graphite anodes. However, silicon-based anodes have a critical problem regarding excessive volumetric expansion during charge-discharge cycles, leading to rapid degradation of batteries.

In this presentation, academically known methods of suppressing inherent challenges associated with silicon anode materials will be described, along with industrial approaches currently known via publicly available intellectual properties. Also, MakeSens' novel technologies for creating multi-layered silicon anode materials will be introduced, how its multi-layered structure of silicon-ceramic-carbon achieves both high capacity and stability, while minimizing its production time and GHG emission with novel photoelectromagnetic irradiation technologies.

2024 Battery Workshop Session
Part 3. Battery Midstream

Speaker: Dr. Jaehak Lee

Senior Researcher, Korea Institute of Industrial Technology, Korea

Dr. Jaehak Lee is a Senior Researcher at the Korea Institute of Industrial Technology since 2019. He earned both his Bachelor's and Ph.D. degrees from KAIST (Korea Advanced Institute of Science and Technology), in 2012 and 2018, respectively. From 2018 to 2019, he served as a senior researcher at Samsung Electronics' Semiconductor R&D Center, where he was involved in the development of dry etchers for flash memory production. His primary research areas include semiconductor and battery equipment design, battery electrode structure design and manufacturing process development, as well as the simulation and automation of machine tools and collaborative robotic processes. He has published 7 international papers and registered over 10 patents. Additionally, Dr. Lee currently serves as a board member of the Machine Tool Division at the Korean Society of Precision Engineering. He has also received the Young Engineer Award and Best Paper Presentation Award from the Korean Society of Precision Engineering (KSPE) and the Korean Society of Manufacturing Technology (KSMTE). E-mail ljh1125@kitech.re.kr

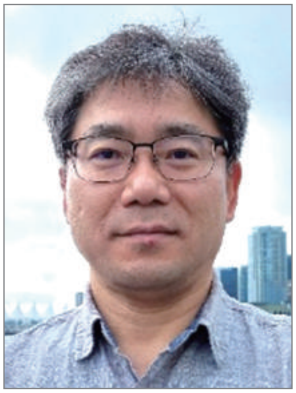
Development of Electrode Structures and Manufacturing Technologies for Eco-Friendly Battery Production

Jaehak Lee[1,*], Jae Young Seok[2]

[1]Autonomous Manufacturing & Process R&D Department, Korea Institute of Industrial Technology, [2]Department of Mechanical System Design Engineering, Seoul National University of Science and Technology

Due to the rapid global increase in the adoption of smart devices and electric vehicles, the demand for batteries required for these technologies is also growing significantly. Currently, batteries are manufactured by creating a slurry of electrode materials in NMP (N-Methyl-2-Pyrrolidone) solvent, which is then coated onto copper or aluminum current collector and dried. NMP has been widely used not only in the battery sector but also in various industries such as petrochemicals, semiconductors, dyes, and paints due to its high solvency for diverse materials. However, recent studies have shown that NMP can be absorbed through human skin and irritate the lungs and respiratory system. It is particularly harmful to children as it can interfere with their growth and development. The U.S. Environmental Protection Agency (EPA) has classified NMP as a developmental toxicant, and the Occupational Safety and Health Administration (OSHA) in the United States limits exposure to NMP to 1 ppm over a 10-hour workday. Therefore, many battery manufacturing companies have implemented systems to recover and purify NMP. However, a more fundamental solution involves eliminating the use of NMP in the battery manufacturing process altogether. This study approaches the creation of an NMP-free battery manufacturing process in two ways. Firstly, instead of the traditional electrode coating method, electrodes are manufactured using an electroplating technique. By electroplating high-capacity transition metal oxides onto copper nanostructures, such as copper nanopillar or nanopalm strurcture, on the anode's current collector (copper foil), the high electrical conductivity and increased surface area of the copper nanostructures can be utilized, enabling the production of high-performance battery anodes. Secondly, this study introduces the development of equipment for a dry electrode process, which is an alternative to the wet process. One of the greatest challenges in dry process development is the creation of mixing equipment that applies a stronger external force compared to traditional wet mixing processes. The research covers the conceptual design of this equipment and the results of preliminary tests.

2024 Battery Workshop Session
Part 3. Battery Midstream



Speaker: Jin Tak

Senior researcher, Bio-Industrial Services, InnoTech Alberta

Jin Tak has worked in the Bio-Thermo-Chemical Processing group (within the Bio-Industrial Services Division) at InnoTech Alberta in Vegreville, Alberta over 20 years. He holds a B.Eng. degree in chemical engineering from the Department of Chemical Engineering, Kyungil University, South Korea. He specializes in designing, and prototyping renewable electrode-grade carbon products and adsorbents for toxic organic compounds through hydrothermal carbonization/thermal Carbonization/activation/thermal modifications. He also has expertise in battery materials using lignin-based carbon electrodes such as supercapacitors, lithium-sulfur, lithium-ion, and sodium-ion batteries, and electrochemical performances including interfacial properties of electrodes, supercapacitor and battery assemblies, and cycling performance. Over the previous 7 years before joining InnoTech Alberta, Jin was responsible for laboratory research of all major environmental air pollution control projects at the Research Institute of Industrial Science & Technology (RIST) in Pohang, South Korea. Responsibilities included: budgeting and controlling costs for all assigned projects, developing a cost-effective adsorbent for the removal of chlorinated organic compounds (dioxins and furans) from municipal incinerators, and performing laboratory audit experiments to verify the validity of testing results. E-mail: jin.tak@InnoTechAlberta.ca

Lignin-based glassy carbon (LGC) products for alkali-ion batteries and supercapacitors

Lignin, one of the three basic components of most plants, is a high molecular mass-organic polymer with cross-linking phenolic precursors. Lignin, byproducts from the production of wood pulp, is available in amounts exceeding 300 billion tons (2012) worldwide and increasing annually by approximately 20 billion tons. Lignin is mostly consumed as a fuel in the pulp–paper industry to recover energy and chemical reactants. Lignin, with a high carbon content and molecular structure like bituminous coal, provides high yields of LGC such as glassy hard carbon and activated carbon products. LGC is non-graphitizable. The most important properties of LGC, combining glassy and ceramic properties with those of graphite, are high thermal stability, high thermal conductivity, low electrical resistance, and extreme resistance to chemical attack. CarbonIP Technologies and InnoTech Alberta are developing LGC products such as activated carbon for supercapacitors, sulfur-impregnated activated carbon for lithium-sulfur batteries, and hard carbon for lithium-ion and sodium-ion batteries. Our research, and early-stage production, has shown that renewable LGC, has equivalent, or better electrochemical properties than commercial activated carbon, and existing mined or manufactured (natural or synthetic) graphites.

2024 Battery Workshop Session
Part 3. Battery Midstream

Speaker: Dr. Yong Wun Jung

Principal Researcher, Korea Aerospace Research Institute

Dr. Jung received his Bachelor, Master and Doctor's degree of Aerospace Engineering at Korea Advanced Institute of Science and Technology (KAIST) and has been working at the Korea Aerospace Research Institute (KARI) since 2003. He has been involved in research on various aircraft development such as smart UAV, stratospheric airship, Korean multi-purpose helicopter, and regional turboprop aircraft, especially as the position in charge of propulsion system development. Since 2020, he has been conducting research as the head of development project, that is the docking-undocking compound unmanned vehicles for delivery service, in which a UAV capable of vertical takeoff and landing cooperates with an unmanned ground vehicle to deliver goods to the final destination. Through this project, he aims to develop a fuel cell and battery hybrid power-plant along with the development of an autonomous driving complex system and demonstrate it through flight tests. E-mail jyw@kari.re.kr

Battery Development of Hybrid Power-plant for Hydrogen Fuel-Cell UAV[1]

Yong Wun Jung[1]*, Min Woo Kim[1], Chang Hyeon Kim[2]

[1]Korea Aerospace Research Institute, Daejeon, Korea, 2UBATT Inc. Seoul/Daejeon, Korea

The global commercial drone market is expected to grow to $1.3B in '26, and urban air mobility (UAM) for passengers' transportation is expected to begin service in '25. Most of recent developed air mobility are electric propulsion using rechargeable batteries, but the current batteries have low energy density, which limits their range and flight time. Hydrogen fuel-cell power packs with high energy density are also being developed to increase payload and operating time, but for stable operation of air mobility, secondary batteries that can secure high power and high energy are required above all.
The largest market for drones is expected to be the package delivery sector, where a 130kg drone is required to deliver 20 kg packages, which requires 10 kW for cruise flight and roughly three times more power for takeoff and landing. To achieve this, the fuel-cell hybrid power system is designed to fly on fuel cells alone during cruise, and the fuel cells and batteries together provide the required power during takeoff and landing. In addition, in order to extend the flight time when operating with a battery, the technology is also being studied to operate with a high-energy battery during cruise and a high-power battery during takeoff and landing.
In this presentation, I will introduce the docking-undocking compound unmanned vehicle and the battery development intended to serve as the power source for the 130kg Lift+Cruise type unmanned aerial vehicle.

2024 Battery Workshop Session
Part 3. Battery Midstream

Speaker: Dr. Andriy Plugatyr

Research Officer, Clean Energy Innovation Research Centre, National Research Council of Canada

Dr. Andriy Plugatyr is a Senior Techno-Economics Analyst with the Clean Energy Innovation (CEI) Research Centre of the National Research Council (NRC) of Canada. Andriy's current research interests include lithium-ion battery recycling and ore sorting. In his role, Andriy also supports R&D initiatives within the CEI by assessing their value proposition and identifying directions for future research. Andriy received his Ph.D. in Physical Chemistry from Queen's University (Kingston, ON) in 2009. During his doctoral and post-doctoral studies, Dr. Plugatyr investigated the characteristics of supercritical aqueous fluids and contributed to developing a corrosion control strategy for the GEN IV Supercritical Water Cooled Reactor concept. In 2011, Dr. Plugatyr joined the Hydrometallurgy Group of Hatch Ltd., where he gained hands-on process engineering experience in the mining and non-ferrous metallurgy sectors. Andriy joined NRC in July 2016. E-mail: andriy.plugatyr@nrc-cnrc.gc.ca

Black Mass Recycling: Enhancing Battery Materials Circularity

A. Plugatyr, M. Dal-Cin, A. Nicalek, A. King, G. Robertson and B. Yu

Clean Energy Innovation Research Centre, National Research Council Canada, Ottawa, Ontario, Canada.

The practical implementation of robust and environmentally responsible technologies for recovering energy materials from end-of-life (EoL) batteries is an essential step toward establishing a circular battery economy. Efficient EoL battery recycling can significantly reduce raw materials dependence while minimizing the battery supply chain GHG footprint. This presentation will highlight current R&D activities of the Clean Energy Innovation Research Center in the domain of Black Mass (BM) processing, including graphite recovery via flotation, hydrometallurgical processing of black mass, separation and purification of battery metals using Supported Liquid Membrane (SLM) technology.

2024 Battery Workshop Session
Part 4.Battery Downstream

Speaker: Dr. Jung-Je Woo

Chief, Center at Korea Institute of Energy Research

Dr. Jung-Je Woo earned his Ph.D. in Environmental Science and Engineering from the Gwangju Institute of Science and Technology (GIST) in South Korea in 2011. Following his doctoral studies, he worked as a Post-Doctoral Researcher at Argonne National Laboratory, focusing on battery materials from 2011 to 2014. He then served as a Senior Research Engineer at Hyundai Motor's Research & Development Division, specializing in battery system development for EVs from 2014 to 2017. Currently, he is the Chief of the Gwangju Clean Energy Research Center at the Korea Institute of Energy Research (KIER), focusing on developing core technologies for recycling spent Li-ion batteries. He has published over 36 journal papers. In 2024, he was honored with the Minister's Award (Science and ICT) for his contributions to national strategic technology development.

Issues in the Current Battery Recycling Technology and Development of Eco-Friendly Technology

Jung-Je Woo*, Il-Chan Jang, Jinju Song, Joon Kyo Seo, Jiyoung Ma, Hayong Song, Jeong-Sun Park, Seok Hyun Song

Gwangju Clean Energy Research Center, Korea Institute of Energy Research, South Korea

The global lithium-ion battery (LIB) market is rapidly expanding, projected to reach 390 GWh by 2030, primarily driven by the growing electric vehicle (EV) market, which inherently generates a substantial volume of spent LIBs. With an assumption of an EV lifespan of approximately 10 years, the cumulative amount of spent LIBs is estimated to escalate to 1,000 GWh. These spent LIBs pose significant risks, including the potential release of hazardous chemicals and the risk of explosions. Consequently, there is an urgent and critical need for the development of effective post-processing methods for spent LIBs.

Typically, post-processing of spent LIBs revolves around the recovery of valuable metals through hydrometallurgy and pyrometallurgy approaches. While these methods exhibit a high level of maturity and are applied in practical recycling processes dealing with several tons of spent batteries, they are burdened by the generation of harmful pollutants and limited economic feasibility. Hence, a growing number of researchers are directing their efforts toward enhancing the economics of the recycling process. In this presentation, we introduce i) the current state of battery industry and recycling technologies, ii)advanced recycling technology, iii) our research activities on the development of core technology for eco-friendly and low-cost battery recycling.

2024 Battery Workshop Session
Part 4.Battery Downstream

Speaker: Dr. Taik-Min Lee

Head, Department of Advanced Secondary Battery Manufacturing Systems, Korea Institute of Machinery and Materials, Republic of Korea

Dr. Taik-Min Lee serves as the Head of the Department of Advanced Secondary Battery Manufacturing Systems at the Korea Institute of Machinery and Materials (KIMM). He earned his B.S., M.S., and Ph.D. degrees from the Department of Mechanical Engineering at the Korea Advanced Institute of Science & Technology (KAIST). His research focuses on printing and coating processes, equipment development for batteries, flexible and printed electronic devices, and sensors including flexible displays, solar cells, bio-sensors, and IoT devices. Currently, his primary research involves the development of digital transformation technology for advanced secondary manufacturing systems. Additionally, he leads the Digital Twin Team at KIMM with the aim of promoting digital twin technology. He has authored approximately 80 international journal papers and holds 240 registered patents, including 57 international patents. He is dedicated to collaborative efforts with industries to secure cutting-edge technology in the field of secondary battery equipment.

Core Technologies for Advanced Battery Manufacturing Systems and its Digitalization Technology

Taik-Min Lee*, Jeongdai Jo, Shin Kwon, Inyoung Kim, Yuonseok Jang, Seunghyun Lee, Dongwoo Kang, Kyouhee Woo, Hyunchang Kim, Kyongrok Kim, Jaeyoung Kim, Younkee Lee, Pyongwon Park, Hyuntae Kim

Department of Advanced Secondary Battery Manufacturing Systems, Korea Institute of Machinery and Materials, Daejeon, Republic of Korea

This presentation introduces the Secondary Battery Equipment Research Laboratory at the Korea Institute of Machinery and Materials (KIMM) and discusses the core technologies of secondary battery equipment. The laboratory possesses expertise in roll-to-roll process equipment, coating technology, and printing technology, along with precision components, control, and design techniques. Utilizing these capabilities, research is conducted on various aspects of secondary battery equipment, including electrode, mixing, roll-to-roll, calendaring, and measurement technologies. Additionally, research is underway on next-generation secondary battery manufacturing equipment and electrolyte membrane manufacturing, with a focus on digital transformation technology for control optimization and predictive maintenance. This seminar will discuss key technologies in solid-state battery manufacturing equipment, digital transformation technology for secondary battery manufacturing equipment, and various proprietary technologies such as slot die coating, furnace, calendaring, and inspection systems.

KIMST R&D Cooperation Session

Open Session

Time: 13:30–15:00, June 18 (Tuesday) Canada, Mountain Daylight Time (MDT)

Place: KC 202

Sponsor: Korea Institute of Marine Science & Technology Promotion (KIMST)

Organizer: KIMST & The Association of Korean Canadian Scientists and Engineers (AKCSE)

Contact: Dr. Gap Soo Chang, University of Saskatchewan (gapsoo.chang@usask.ca)
Dr. Sung Mi Lee, KIMST (smlee@kimst.re.kr)

Description: This session is to introduce diverse R&D programs of Korea Institute of Marine Science & Technology Promotion (KIMST) and to promote participation of Korean-Canadian scientists and engineers in R&D cooperation projects planned and managed by for better global cooperation.

Program:

Time	Place	Topic	Speaker	Affiliation
13:30–13:35	KC 202	Opening Remarks	Dr. Sung Mi Lee	KIMST
13:35–13:45		Overview of KIMST R&D programs	Dr. Sung Mi Lee	KIMST
13:45–13:55		R&D Project Presentation - Cooperation on the Arctic Circle & key achievements in the Canadian Beaufort Sea	Dr. Jong Kuk Hong	Korea Polar Research Institute (KOPRI)
13:55–14:20		Korea-Canada International Research Collaboration Demand (Part 1)	Marine Environment proposals	
14:20–14:45		Korea-Canada International Research Collaboration Demand (Part 2)	Fisheries proposals	
14:45–15:00		Q&A		
15:00		Closing & Photo time		

List of Participants:

Name	Position	Affiliation
Dr. Sung Mi Lee	General Manager	KIMST
Youn Wook Jung	General Manager	KIMST
Dr. Jong Kuk Hong	Senior researcher	KOPRI
Dr. Gap Soo Chang	Professor	University of Saskatchewan
Dr. Hyo-Jick Choi	Associate Professor	University of Alberta
Dr. Miyoung Suh	Professor	University of Manitoba
Dr. Jae-Hyeok Lee	Assistant Professor	University of Manitoba
Dr. Jonghun Park	Associate Professor	Toronto Metropolitan University
Dr. Patrick C. Lee	Associate Professor	University of Toronto

KIMST R&D Cooperation Session

Co-Chair: Dr. Gap Soo Chang

Professor, Physics and Engineering Physics, University of Saskatchewan

Dr. Chang is a Professor in the Department of Physics and Engineering Physics at the University of Saskatchewan. He received his B.Sc., M.Sc., and Ph.D. degrees in Experimental Condensed Matter Physics from Yonsei University, Seoul, Korea. He held postdoctoral researcher positions at Atomic-scale Surface Science Center, Korea and the University of Tennessee at Knoxville prior to joining the faculty at the University of Saskatchewan in 2003. His research interests encompass synchrotron-radiation X-ray spectroscopy and density functional theory (DFT) analysis for advanced electronics and energy materials, and the first-principles modeling for bio-molecular interaction. He has published over 130 research articles in peer-reviewed journals and delivered over 30 invited talks at international conference. Dr. Chang also served as the 21st President of Association of Korean Canadian Scientists and Engineers (AKCSE) in 2016 for 2-year term and is currently a Chair of Long-term Planning Committee and a ST&I Ambassador for National Research Council of Science and Technology Korea (NST). He was a board member of Canadian Association of Physicists (CAP), and Hydrographic Society of Korea, and a chair of International Activities Committee of Council, University of Saskatchewan. E-mail: gapsoo.chang@usask.ca

KIMST R&D Cooperation Session

Co-Chair: Dr. Sung Mi Lee

General Manager, Korea Institute of Marine Science & Technology Promotion (KIMST)

Dr. Sungmi Lee currently serves as the General Manager of the Korea Institute of Marine Science & Technology Promotion (KIMST). She earned her M.S. and Ph.D. degree in marine environmental sciences from Hanyang University in 2004 and 2008, respectively. During her doctoral studies, she was honored with the UNESCO MAB Young Scientist Award in 2006. Since joining KIMST in 2009, she has been actively involved in policy development and planning within the marine and fisheries sector. Recently, she led the project to create the 2nd Basic Plan for Promotion of Marine and Fisheries Science and Technology. In recognition of her significant contributions to marine and fisheries R&D, she was awarded the 2023 Minister of Oceans and Fisheries Award. E-mail: smlee@kimst.re.kr

KIMST R&D Cooperation Session

Speaker: Dr. Jong Kuk Hong

Senior Researcher, Korea Polar Research Institute (KOPRI)

Dr. Hong is a research scientist at the Korea Polar Research Institute (KOPRI). He received his B.Sc., M.Sc., and Ph.D. degrees in Geophysics from Seoul National University. He began his career at the Korea Ocean Research and Development Institute in 1992 and moved to KOPRI in 2024. In 2000, he served as a visiting scientist position at the Pacific Geoscience Centre, a division of the Geological Survey of Canada. He has twice served as the leader of an Antarctic research station, in 2008 and 2020, and was the vice president of KOPRI from 2016 to 2019. Dr. Hong's research interests focus on marine geophysics and understanding geological changes due to global climate change in polar regions. He has participated in five Arctic cruises aboard the Korean icebreaker Araon and is the project leader of an Arctic marine geological survey sponsored by the Korean government. Dr. Hong has published over 40 research articles in peer-reviewed journals. He is a member of the American Geophysical Union (AGU) and the European Geosciences Union (EGU), and he currently serves as the president of the Korean Society of Earth and Exploration Geophysics. E-mail: jkhong@kopri.re.kr

Scientific cooperation between Korea and Canada in the Arctic Circle and major achievements in the Canadian Beaufort Sea

Jong Kuk Hong*, Seung-goo Kang, and Young Keun Jin

Korea Polar Research Institute, Korea Institute of Ocean Science and Technology, Incheon 21990, Republic of Korea

The Korea Polar Research Institute (KOPRI), which oversees polar research in Korea, has been conducting research in the Antarctic since 1988, when it established the King Sejong Station on the Antarctic Peninsula. Additionally, research in the Arctic has been actively pursued since the establishment of the Dasan Arctic Research Station in the Svalbard Islands in 2002. Climate change in the Arctic directly affects the climate of the Korean Peninsula, and the Arctic's rich resources are vital for Korea's resource needs. KOPRI's joint research with Canada includes the use of a scientific base in Cambridge Bay and surveys in the Canadian Beaufort Sea using the Korean icebreaker Araon. The Canadian Beaufort Sea, one of the most evident areas of oceanic climate change, has been the focus of four joint expeditions since 2013. The main participants in this research are KOPRI, the Geological Survey of Canada, and the Monterey Bay Aquarium Research Institute (MBARI) in the United States. The research primarily investigates various geological phenomena caused by climate changes, such as seafloor topography changes and submarine slides due to the melting of submarine permafrost. The joint research has led to significant discoveries, including gas hydrates on the seafloor, identification of submarine landslides, and measurement of subsurface permafrost size and shape. The two countries plan to continue their joint exploration efforts in the future. *Corresponding author; E-mail: jkhong@kopri.re.kr

KERI R&D

Invitation Only

Time: 15:30–17:00, June 18 (Tuesday) Canada, Mountain Daylight Time (MDT)

Place: KC 202

Sponsor: Korea Electrotechnology Research Institute (KERI)

Organizer: KERI and The Association of Korean Canadian Scientists and Engineers (AKCSE)

Contact: Dr. Soo Jeon, University of Waterloo (soojeon@uwaterloo.ca)

Description: This session serves as a forum to report the research conducted by KERI-Waterloo AI Research Hub, and the preliminary results of the AKCSE-KERI project. Plans for future collaboration may also be discussed.

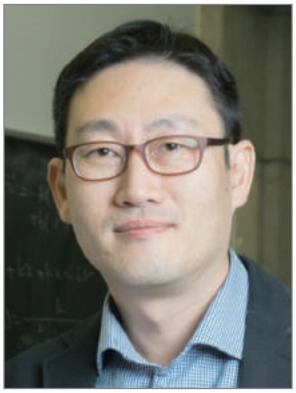
Program:

Time	Place	Topic	Speaker	Affiliation
15:30–15:35	KC 202	Opening Remarks	Dr. Seogjoo Kim	KERI
15:35–15:40		Greeting	Dr. Seonghwan Kim	AKCSE President
15:40–16:00		KERI-Waterloo AI Research Overview	Dr. Jongmoon Kim	KERI
16:00–16:20		KERI-Waterloo AI Hub - Application of AI to Advanced Manufacturing	Dr. Hyock-Ju Kwon	University of Waterloo
16:20–16:55		Midterm Presentation on 2024 AKCSE-KERI Project	Dr. Soo Jeon Dr. Seung-Ik Han	University of Waterloo University of Calgary
16:55–17:00		Q&A	All	
17:00		Closing & Photo time		

List of Participants (VIP & Speakers):

Name	Position	Affiliation
Dr. Seogjoo Kim	Vice President (Research)	KERI
Dr. Jongmoon Kim	Director, Innotown Planning Department	KERI
Dr. Hyock-Ju Kwon	Associate Professor	University of Waterloo
Dr. Soo Jeon	Associate Professor	University of Waterloo
Dr. Seung-Ik Han	Postdoctoral Researcher	University of Calgary

KERI R&D



Moderator: Dr. Soo Jeon

Associate Professor, Mechanical and Mechatronics Engineering, University of Waterloo

Soo Jeon received his BS and MS degrees from Mechanical & Aerospace Engineering at Seoul National University, Korea in 1998 and 2001 respectively, and his PhD from Mechanical Engineering at University of California, Berkeley in 2007. After graduation, he worked in Applied Materials Inc. until he moved to Department of Mechanical & Mechatronics Engineering at University of Waterloo in 2009 where he is currently an associate professor. His research interests include dynamic systems and control, mechatronic system design, friction-induced stability and machine learning for control of physical systems. Applications of his research cover robotics, industry automation, medical ultrasound, and transportation systems. He received Rudolf Kalman Best Paper Award from ASME in 2010, Best Robotics Paper Award from The Conference on Robots and Vision in 2022, and The Engineer of The Year Award from KOFST in 2022. He is a member of ASME, IEEE, CSME and PEO (Professional Engineers Ontario).

Email: soojeon@uwaterloo.ca

KERI R&D

Speaker: Dr. Jong Moon Kim

Director, Innotown Planning Department, KERI

Dr. Jong Moon Kim is the Director of Innotown Planning Department at KERI (Korea Electrotechnology Research Institute). Dr. Kim received his Ph.D. degree in Electrical Engineering at Busan National University in 2005. Dr. Kim has extensive experience in automatic control and artificial intelligence, and is currently leading the Changwon Innotown Projects and Korea-Canada AI Research Projects.

E-mail jmkim@keri.re.kr

KERI R&D

Speaker: Dr. Hyock Ju (HJ) Kwon

Associate Professor, Mechanical and Mechatronics Engineering, University of Waterloo
Director, KERI-Waterloo AI Hub

Dr. Kwon is an Associate Professor in the Department of Mechanical and Mechatronics Engineering at the University of Waterloo, and the Director of KERI-Waterloo AI Research Hub. He received his B.Sc. (1985) in Mechanical and Design Engineering from Seoul National University, M.Sc. (1988) in Production Engineering from KAIST in South Korea. and Ph.D. (2007) in Mechanical Engineering from the University of Alberta, Edmonton, Canada. Prior to joining University of Waterloo, he held a NSERC Postdoctoral Fellowship at Caltech in Pasadena, USA. Dr. Kwon also has over 10 years industry experience at Samsung Electronics, Korea and Texas Instruments, USA before he came to Canada. He is a Professional Engineer in Alberta and Ontario in Canada, and in Korea.
Dr. Kwon has expertise in AI for manufacturing, AI-based nondestructive testing (NDT), Smart Factory and Automation. His group at Waterloo is also developing hardware-based AI technology and non-invasive surgical platform using focused ultrasound (FUS).
E-mail hjkwon@uwaterloo.ca

KERI R&D

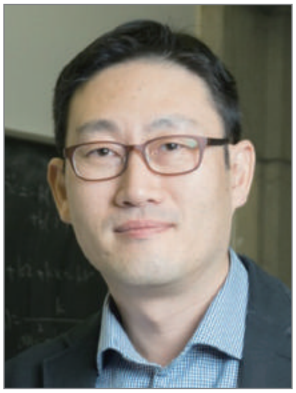
Speaker: Dr. Seung-Ik Han

Postdoctoral researcher, Dept. of Mechanical and Manufacturing Engineering, University of Calgary

Dr. S.-I. Han received his Ph.D. degree in 2023 from Energy Systems Research (Energy Materials Science) at Ajou University, Korea in 2023. Currently, He has worked in the Multifunctional Engineering Dynamics Automation Lab (MEDAL) and Dept. of Mechanical and Manufacturing Engineering of University of Calgary as a postdoctoral researcher since 2024. His research interests are the fabrication and optimization of Metal-oxide semiconducting functional composite materials and gas sensor devices.

E-mail seungik.han@ucalgary.ca

KERI R&D



Speaker: Dr. Soo Jeon

Associate Professor, Mechanical and Mechatronics Engineering, University of Waterloo

Soo Jeon received his BS and MS degrees from Mechanical & Aerospace Engineering at Seoul National University, Korea in 1998 and 2001 respectively, and his PhD from Mechanical Engineering at University of California, Berkeley in 2007. After graduation, he worked in Applied Materials Inc. until he moved to Department of Mechanical & Mechatronics Engineering at University of Waterloo in 2009 where he is currently an associate professor. His research interests include dynamic systems and control, mechatronic system design, friction-induced stability and machine learning for control of physical systems. Applications of his research cover robotics, industry automation, medical ultrasound, and transportation systems. He received Rudolf Kalman Best Paper Award from ASME in 2010, Best Robotics Paper Award from The Conference on Robots and Vision in 2022, and The Engineer of The Year Award from KOFST in 2022. He is a member of ASME, IEEE, CSME and PEO (Professional Engineers Ontario).

Email: soojeon@uwaterloo.ca

[KICT FORUM]
AI-Based Innovative Solutions for Climate Change and Future Society

Open Session

Time: 15:30–17:00, June 18 (Tuesday) Canada, Mountain Daylight Time (MDT)

Place: KC 210

Sponsor: Korea Institute of Civil Engineering and Building Technology (KICT)

Organizer: KICT

Contact: Dr. Yuhwa Lee, KICT (ylee@kict.re.kr)

Description: This session serves as a forum to present research conducted at KICT. Topics include climate crisis response technology, autonomous driving, AI-enhanced roads, and water resource management, as well as future prospects for construction technology. Additionally, potential cooperation between Korea and Canada will be discussed.

Program:

Time	Place	Topic	Speaker	Affiliation
15:30–15:35	KC 210	Opening Remarks	Dr. Yuhwa Lee	KICT Director
15:35–15:40		Greeting	Dr. Byung-Suk Kim	KICT President
15:40–15:55		Developing AR6-based Socio-economic Scenario Assessment Models at the Regional Scale in South Korea for Climate Change Adaptation	Dr. Minsu Son	KICT
15:55–16:10		Extreme floods and droughts in ‘The Era of climate crisis’: Application of KICT’s AI technology	Dr. Huiseong Noh	KICT
16:10–16:25		Leveraging AI and ITS Sensor suites for Improved Winter Road Condition Monitoring	Dr. Tae J. Kwon	University of Alberta
16:25–16:40		How will roads change in the future? Considering future AI-based mobility	Dr. Dukgeun Yun	KICT
16:40–16:55		General discussion	All	
16:55–17:00		Closing & Photo time		

List of Participants:

Name	Position	Affiliation
Dr. Byung-Suk Kim	President	KICT
Dr. Yuhwa Lee	Director of International Cooperation and Public Relations	KICT
Dr. Tae J. Kwon	Associate professor	University of Alberta

[KICT FORUM]
AI-Based Innovative Solutions for Climate Change and Future Society

Chair: Dr. Yuhwa Lee

Director, Korea Institute of Civil Engineering and Building Technology

Dr. Lee received her Ph. D. from Arizona State University in 2007. She, a research fellow, is currently serving as the Director of the International Cooperation and Public Relations Department since the end of 2022. Majoring in transportation engineering, she has over 30 years of experience and is interested in human-based road planning/design and road facility management/evaluation using cutting-edge technology. She's conducted research on the development of a carbon-neutral road greenhouse gas emissions calculation system and the design concept and network safety of urban roads in old industrial complexes. Externally, she serves as a member of the Metropolitan Transportation Committee of the Ministry of Land, Infrastructure and Transport as well as the Barrier-free Certification Steering Committee. E-mail ylee@kict.re.kr

[KICT FORUM]
AI-Based Innovative Solutions for Climate Change and Future Society

Speaker: Dr. Minsu Son

Research Fellow, Korea Institute of Civil Engineering and Building Technology

Dr. Son received his Ph.D. of Urban and Regional Planning from Yonsei University in 2012. He has been working as a research fellow at Korea Institute of Civil Engineering and Building Technology(KICT) which is government-funded research institute from 2017 and researching on Sustainable regional planning, Economic valuation modeling & Application, Risk analysis and, and Inter-Korean infrastructure cooperation & specialized technology development over 18 years. He has been serving as a board member of the Korean Regional Science Association(KRSA), the Korean chapter of the Regional Science Association International (RSAI). E-mail sonminsu@kict.re.kr

Developing AR6-based Socio-economic Scenario Assessment Models at the Regional Scale in South Korea for Climate Change Adaptation

Minsu Son[1]

[1]*Korea Institute of Civil Engineering and Building Technology, Goyang, Republic of Korea*

Following the publication of the IPCC's Sixth Assessment Report, it is recommended that future mitigation and adaptation reports to the UNFCCC and IPCC should be based on regional assessments using 'socio-economic scenarios'. In this regard, various Integrated Assessment Models (IAMs) are being developed, and the Integrated Assessment Model Consortium (IAMC) has been established to collaborate on various IAMs and analytical techniques. In Korea, socio-economic scenarios applicable to climate change policy analysis have been developed, and future adaptive capacity has been quantified based on the socio-economic scenarios derived by analyzing adaptation policy-specific socio-economic scenarios. However, although detailed adaptation policy implementation plans are being prepared at the local level, they are not being applied due to the lack of methodologies and data to apply climate change scenario assessment. In this study, the socio-economic-environmental scenario will be constructed at a resolution of 1kmx1km or more. It is divided into human, ecological and global environmental systems to estimate future population and economic scenarios using verified methodologies and to construct integrated scenarios in conjunction with system dynamics. This will enable the establishment of IAM simulators that will allow social and economic scenarios to be applied at the local government level. Finally, we intend to establish an integrated system that can be assessed from a policy perspective by simulating different scenarios, so that it can be applied to SDG goals and local government policy assessment.

[KICT FORUM]
AI-Based Innovative Solutions for Climate Change and Future Society

Speaker: Dr. Huiseong Noh

Senior Researcher, Korea Institute of Civil Engineering and Building Technology

Dr. Noh received his Ph.D. of water resources engineering from Inha University in 2015. He has worked at the Department of Hydro Science and Engineering Research as a senior researcher since 2015, and has been working at the Research Strategic Planning Department since the end of 2022. He is interested in the development and application of flood prediction technology and rain radar using advanced technology. He has conducted research on the establishment of flood management systems, real-time monitoring of road flooding, and operation technology. To date, he has published over 30 journal and conference papers, with a major focus on rain radar and AI-based flash flood monitoring, and water resources management. E-mail fafala@cau.ac.kr

Extreme floods and droughts in 'The Era of climate crisis': Application of KICT's AI technology

Huiseong Noh[1], Ilmoon Chung[2]

[1]*Research Strategic Planning Department, Korea Institute of Civil Engineering and Building Technology, Goyang, Republic of Korea,*
[2]*Department of Hydro Science and Engineering Research, Korea Institute of Civil Engineering and Building Technology, Goyang, Republic of Korea*

Recently, climate change such as murderous abnormal temperatures, flash floods, and droughts in various parts of the world caused numerous casualties and destroyed tangible and intangible civilizations that had been built up for hundreds of years. A sympathetic band has been formed in Korea for the crisis of climate change caused by global warming that is affecting the whole world, and floods and droughts in particular are recognized as serious environmental, ecological, social, and economic disasters. The Korea Institute of Civil Engineering and Building Technology (Department of Hydro Science and Engineering Research) searches for solutions to the most pressing issues involving the water environment, such as floods, droughts, climate change, water circulation, and coastal hazards, to preserve the value of our national territories. In this presentation, we will introduce the current water-related situation in Korea due to climate change and various water management technologies of KICT that combine AI and advanced technology, which have been attracting attention recently. These technologies include (1) the development of a real-time road flooding monitoring system using AI, (2) the development of AI flood analysis and forecasting method based on intelligent information technology, and (3) the development of Korea's first sand dam. By leveraging these technologies, KICT aims to realize water management that will protect people from flood and drought disasters and improve their quality of life.

[KICT FORUM]
AI-Based Innovative Solutions for Climate Change and Future Society

Speaker: Dr. Tae J. Kwon

Associate Professor, Transportation Engineering, University of Alberta

Dr. Tae J. Kwon is an Associate Professor in the Department of Civil and Environmental Engineering at the University of Alberta. He began his faculty tenure in 2016 as an Assistant Professor immediately after completing his Ph.D. at the University of Waterloo, where he received the prestigious Ph.D. dissertation award. Dr. Kwon's research focuses on optimizing the location allocation of Intelligent Transportation System (ITS) facilities as well as winter transportation and road maintenance. His expertise extends to geographic information sciences and remote sensing applications in transportation, and spatial and temporal analyses of road traffic and safety using spatial statistics, deep learning, and explainable AI. His contributions have earned him several accolades including the Great Supervisor Award from the Faculty of Graduate Studies and Research in 2019, and the Faculty of Engineering Early-Career Research Award in 2020 for his research excellence and influence at both national and international levels. Most recently in 2024, he was honoured with the ITS Canada Excellence in Research and Development Award for his continued dedication to advancing the field of transportation engineering in Canada and beyond. Dr. Kwon is currently serving on many international committees, notably as a standing member and communication coordinator of the TRB Road Weather Committee (AKR50).

Leveraging AI and ITS Sensor suites for Improved Winter Road Condition Monitoring

Tae J. Kwon[1]

[1]Department of Civil & Environmental Engineering Faculty of Engineering, University of Alberta, Canada

In regions experiencing severe winter conditions, maintaining equitable access to safe roadways presents significant challenges. Road Weather Information Systems (RWIS), a cornerstone of highway Intelligent Transportation Systems (ITS), play a crucial role in effective winter road maintenance by monitoring adverse road surface conditions. Traditionally, these conditions have been assessed manually through both stationary and mobile RWIS cameras, which remains a significant bottleneck in responsive winter road management. In this presentation, I will introduce a novel methodological framework that utilizes advanced AI, specifically Deep Learning, to analyze different types of RWIS images for monitoring winter road surface conditions. I will also discuss how integrating Explainable AI techniques can improve model reliability and transparency, thereby elevating stakeholder confidence for real-world deployment. Finally, I will showcase a recently developed prototype AI-powered tool designed for assessing winter road surface conditions. This decision support tool aims to optimize winter maintenance operations and ultimately enhance safety, mobility, and environmental sustainability for all winter travelers.

[KICT FORUM]
AI-Based Innovative Solutions for Climate Change and Future Society

Speaker: Dr. Duk Geun Yun

Senior Research Fellow, Korea Institute of Civil Engineering and Building Technology

Dr. Yun received his Ph.D. from Myongji University in 2009. He, Senior Research Fellow, is serving as the Head of the Research Evaluation Division since 2022. Additionally, He is a Professor in the Department Urban Engineering at University of Science and Technology. With a focus on Transportation Engineering for over 30 years, his research primarily encompasses various aspects of the field, including Road Safety, Highway Design, Highway Management, and the integration of technologies such as Sensors, GIS, and Vehicles. Currently, He is the Principal Investigator (PI) for the Future road design for the Cooperative-Autonomous vehicle project. Externally, he served as a member of the Winter Maintenance Committee of the Transportation Research Board in the US. E-mail dukgeun@kict.re.kr

How will Roads Change in the Future? – Considering AI-based Mobility

Dukgeun Yun[1]*

[1]*Division of Research Evaluation, Korea Institute of Civil Engineering and Building Technology, Goyang, Republic of Korea*

Many changes are predicted in future mobility. The representative behavior among AI-based mobility could be the autonomous vehicles on the road, and many experts predict that the occupancy of autonomous vehicle will gradually increase, and that autonomous vehicles will account for more than 60% of vehicles driving on the road by 2040. Meanwhile, autonomous vehicle technology has been developing in terms of vehicles, sensors, and computer programs, while road infrastructure technology has received relatively few research interests. However, Current road infrastructure is designed for human drivers and does not accommodate the perception or traffic characteristics of autonomous vehicles. As the Market Penetration Rate (MPR) of autonomous vehicles increase, it is essential for road infrastructure to adapt to support both autonomous and traditional vehicles safely and efficiently. This study aims to propose directions for road infrastructure changes that consider the perception and traffic characteristics of autonomous vehicles.

Research Showcase: KGRI

Open Session

Time: 9:00–10:30, June 19 (Wednesday) Canada, Mountain Daylight Time (MDT)

Place: KC 101/103/105

Sponsor: Korean Federation of Science and Technology Societies (KOFST)

Organizer: The Association of Korean Canadian Scientists and Engineers (AKCSE)

Contact: Dr. Il Yong Kim, Queen's University (kimiy@queensu.ca)

Description: This session is organized for the Korea Government Research Institutes (KGRI) to promote research collaboration between Canada and Korea. This year, five KGRIs (KRICT, KIER, KERI, KICT, KIST) have showcased their research projects with the aim of fostering cooperation, especially with Canada. They have provided comprehensive information on various aspects of the projects, including research topics, objectives, and anticipated outcomes.

Program:

Time	Place	Topic	Speaker	Affiliation
9:00–9:10	KC 101/ 103/105	Opening Remarks	Dr. Seonghwan Kim	AKCSE
9:10–9:25		KRICT: Chemical Research, Achievements, and Global Partnerships	Dr. Sung Cheol Yoon	KRICT
9:25–9:40		KIER's Role in leading Sustainable Energy Technologies and contributing to Solve Climate Solutions	Dr. Sang-jin Choi	KIER
9:40–9:55		KERI (Korea Electrotechnology Research Institute)	Jaehoon Seo	KERI
9:55–10:10		KICT's R&D achievements and future strategies	Dr. Yuhwa Lee	KICT
10:10–10:25		Towards World Class KIST	Dr. Joonyeon Chang	KIST

List of Participants:

Name	Position	Affiliation
Dr. Seonghwan Kim	President of AKCSE and Professor, University of Calgary	AKCSE and University of Calgary
Dr. Regina S.K. Lee	Professor	York University
Dr. Il Yong Kim	Professor	Queen's University
Dr. Sung Cheol Yoon	Director, National Strategic Technology Division	KRICT
Dr. Sang-jin Choi	Chief of Global R&D Strategy Team	KIER
Dr. Jaehoon Seo	Director, KERI Cooperation & PR Department	KERI
Dr. Yuhwa Lee	Director	KICT
Dr. Joonyeon Chang	Vice President	KIST

Research Showcase: KGRI

Speaker: Dr. Sung Cheol Yoon

Director, National Strategic Technology Division in Korea Research Institute of Chemical Technology

Dr. Yoon is a Principal Researcher at the Advanced Materials Division of KRICT in Daejeon, Korea. He earned his B.S. in Industrial Chemistry from Hanyang University in 1992 and both his M.S. and Ph.D. in Chemistry from Seoul National University in Seoul, Korea, in 1994 and 1997, respectively. He then served as a Senior Researcher at Samsung Total Co. from 1997 to 2001 and as a Principal Researcher at LG Elite from 2001 to 2004. From 2015 to 2016, he was a Visiting Scientist at the University of Illinois at Chicago (UIC). Since 2004, he has been with KRICT, where he assumed the role of Director of the National Strategic Technology Division in 2023. Previously, he was the Director of the Advanced Materials Division from 2020 to 2023. Additionally, he served as the Chair of the Machinery and Materials Committee for the Presidential Advisory Council on Science and Technology (PACST) from 2021 to 2022. Furthermore, he has held leadership roles in the Polymer Society of Korea. Since 2020, he has been leading the National Core Materials Research Center Project focused on soluble optoelectronic materials.

KRICT: Chemical Research, Achievements, and Global Partnerships

Korea Research Institute of Chemical Technology (KRICT) is a national chemical research institute founded in 1976. The Center for Advanced Specialty Chemicals were established in 2012 and the KRICT was recognized as one of the World's Most Innovative Research Institutions in the same year. The Center for Bio-based Chemistry was established in Ulsan in 2016, and the Carbon Neutral Demo-Plant Center was established in Yeosu in 2023.

For the fiscal year 2024, KRICT has a budget of 245,567 million KRW (Approx. 179 million USD) and employs about 623 staff members including 500 researchers.

KRICT is dedicated to reinforcing the competitiveness of the chemical industry and contributing to the resolution of national and societal problems. It focuses primarily on five research areas: chemical process technology, high value-added chemical materials, innovative drug discovery and biotechnology, bio-based and green fine chemical materials, and chemical platform infrastructure.

KRICT is developing eco-friendly chemical process technologies that support low-carbon societies and reduce fine dust emissions. It is also working on smart chemical materials for IoT devices and convergent materials for autonomous energy conversion and storage. Additionally, KRICT is developing core new drug biotechnologies, which include acquiring new drug pipelines, treatments for infectious diseases, and infectious disease control technologies. Development of industry-leading high-precision chemical materials and technologies for waste-reducing bioplastics are being conducted in Ulsan. Lastly, KRICT provides industrial R&D solutions through a data-based chemical research and industrial support platform that utilizes public infrastructure.

As a National Collaboration Center (NCC) designated by the Korea Institute for Advancement of Technology (KIAT), KRICT collaborates with research institutes, academia, and industries. Our goal is to enhance global network, foster technological collaborations, and conduct international R&D project, etc.

To strengthen global cooperation, KRICT runs an international R&D program, the KRICT-Global Research Collaboration (K-GRC) program, which fosters international R&D cooperation with partners.

Research Showcase: KGRI

Speaker: Dr. Sang Jin Choi

Principal Researcher, Chief of Global Strategy Team of Korea Institute of Energy Research

Dr. Choi earned his Ph.D. from the Dept. of Industrial Engineering at Pusan National University (2000). Before he joined the Korea Institute of Energy Research in 2002, he had his postdoctoral course in the Dept. of Manufacturing Engineering at the University of Calgary. In 2015, he was a visiting researcher at Brookhaven National Laboratory to study R&D quality assurance in the national laboratory of the USA. His research interests are Energy System Modeling and Analysis, R&D Quality Assurance, and Global R&D Strategy. As chief of the R&D Strategy Team for the last 7 years, he has developed a global R&D strategic process and enhanced the competitiveness of energy technology through collaboration. E-mail sjinchoi@kier.re.kr

KIER's Role in leading Sustainable Energy Technologies and contributing to Solve Climate Solutions

Sang-Jin Choi[1]

[1]*Global Strategy Team, Korea Institute of Energy Research*

Korea Institute of Energy Research (KIER), as a leading government-funded institution in energy sector, has been taking the lead in research activities to address both the nation's energy security and carbon neutral issues. In order to successfully conduct those roles, KIER has pioneered carbon-neutral innovations, including high-efficiency water electrolysis for green hydrogen production, energy storage solutions, and advanced batteries for electric vehicles. Furthermore, the institution is also dedicated to developing technologies that address global climate change and promote carbon neutrality. These include AI and data-driven energy management, ultra-high efficiency solar power, offshore wind, ammonia and carbon capture, utilization, and storage (CCUS), green hydrogen production, hydrogen refueling station technologies, and the development of new energy materials. Through global open innovation and active international cooperation, KIER aims to lead in the clean energy sector, committed to solving energy challenges and fostering a sustainable future.

Research Showcase: KGRI

Speaker: Jaehoon Seo

Director, KERI Cooperation & P.R. Department

Mr. Seo received his bachelor's degree (Indian Languages & Cultures in 2013) from Hankuk University of Foreign Studies. He has been with Korea Electrotechnology Research Institute(KERI), Changwon, Korea, since 2013. From 2019 to 2022 he served as the Team Leader of Cooperation & P.R. Department. In 2023, he was nominated as the Director of Cooperation & P.R. Department. Since then, he has been taking the leadership in the field of P.R. (dealing with the press) and Cooperation (national and international) of KERI.

KERI (Korea Electrotechnology Research Institute)

Korea Electrotechnology Research Institute (KERI, President: Kim Nam-Kyun) is a government-funded research institute under the Ministry of Science and ICT. In addition to the headquarters in Changwon, there are three branches (Ansan, Uiwang, and Gwangju) and around 700 full-time positioned personnel. KERI currently focuses on the following research areas ▲ Power Grid and Renewable Energy Integration ▲ High-Voltage Direct Current (HVDC) & Medium-Voltage Direct Current(MVDC) Electrical Apparatus ▲ Electric Propulsion, and Industry Applications Research (electric motors, robots, AI, mobility, etc.) ▲ Electrical Materials and Next Generation Batteries ▲ Power Semiconductor ▲ Electro-Medical Equipment Research, etc. In addition, KERI is one of the world's top three Testing and certification bodies for electric power equipment with acquired full Short Circuit Testing (STL) membership. With the 15th President Kim Nam-Kyun in 2023, KERI, as the hub of the electrified world, aims to become the research institute leading the future.

Research Showcase: KGRI

Speaker: Dr. Yuhwa Lee

Director, Korea Institute of Civil Engineering and Building Technology

Dr. Lee received her Ph. D. from Arizona State University in 2007. She, a research fellow, is currently serving as the Director of the International Cooperation and Public Relations Department since the end of 2022. Majoring in transportation engineering, she has over 30 years of experience and is interested in human-based road planning/design and road facility management/evaluation using cutting-edge technology. She's conducted research on the development of a carbon-neutral road greenhouse gas emissions calculation system and the design concept and network safety of urban roads in old industrial complexes. Externally, she serves as a member of the Metropolitan Transportation Committee of the Ministry of Land, Infrastructure and Transport as well as the Barrier-free Certification Steering Committee. E-mail ylee@kict.re.kr

KICT's R&D achievements and future strategies

Yuhwa Lee[1]*

[1]*International Cooperation and Public Relations Department, Korea Institute of Civil Engineering and Building Technology, Goyang, Republic of Korea*

The Korea Institute of Civil Engineering and Building Technology (KICT) focuses on five R&D programs to fulfill its missions and achieve its vision and goals. The first R&D program is to develop safe and secure land and infrastructure technologies to solve national and social problems. The second is to develop innovative construction technologies that lead new growth engines for the corresponding industry. The third is to develop regionally specialized technologies that promote balanced national development. The fourth is to develop international collaboration technologies that adapt to country-level climate and characteristics. The fifth is to develop technologies to improve small & medium-sized business innovation so that KICT's R&D outcomes can be disseminated within the corresponding industry. Through these programs, KICT conducts R&D projects, positioning itself as a leader in both domestic and international field applications and verifications. Notable research projects include 'Construction material production technology using lunar local resources', 'Hydrogen underground facilities safety technology', and 'Aging bridge management and maintenance platform'. These projects are linked to twelve strategic technologies required by Ministry of Science & ICT. Furthermore, KICT is committed to developing ultra-advanced technologies to ensure disaster. Examples of these efforts for the next year's projects include the development of digital urban flood control technology aimed at creating flood-safe cities and infrastructure disaster response technology utilizing SAR satellites.

*Corresponding author; E-mail ylee@kict.re.kr

Research Showcase: KGRI

Speaker: Dr. Joon Yeon Chang

Professor, Tier 1 Canada Research Chair in Microcellular Plastics

Dr. Chang is currently Vice-President at KIST. He received a Ph.D. in the Department of Materials Science & Engineering from Yonsei University, Seoul, in 1998, preceded by an M.S. in Metallurgical Engineering in 1989 and a B.S. in the same field in 1987, both from Yonsei University as well. Since joining KIST in 1990, he has served as Director-General of the KIST Gangneung Institute of Natural Products (2020-2024), Director-General of the Post-Silicon Semiconductor Institute (PSI) (2015-2020), Head of the Spin Convergence Research Center (2011-2014), and Head of the KIST-MIT on-site lab, MIT, USA (2008-2011). He also performed post-doctoral research at UCLA from 2000 to 2002. His research interests lie primarily in the areas of spintronics, Nanoelectronic Devices, Nanomaterials. E-mail: presto@kist.re.kr

Toward World Class KIST

Joon Yeon Chang[1]

[1]*Vice-President, Korea Institute of Science and Technology, Seoul, South Korea*

The Korea Institute of Science and Technology (KIST) has been a leading research institute of South Korea, driving the nation's scientific and technological advancements as well as economic growth. Since its establishment in 1966, KIST has kept evolving to meet the demands of the times. During the 1960s and 70s, KIST led South Korea's industrialization by acting as a think tank, guiding industrial planning and providing relevant technologies. In the 1980s and 90s, KIST contributed to the nation's economic catch-up by developing technologies that help advancing its industrial structure. From the 2000s onwards, KIST has focused on securing fundamental technologies in high-tech fields, laying the foundation for South Korea to be a developed nation.

Recognizing the importance of science and technology today, KIST is preparing to become a world-class research institute. Aiming to address the most fundamental questions and the greatest challenges with the best solutions, KIST is implementing the following three strategies: (1) Expanding its scope through 'mission-oriented' research to address national and societal issues. To achieve this goal, KIST is adopting a mission-oriented R&D system primarily operated by Program Managers (PMs). (2) Enhancing cooperation systems with leading domestic and foreign institutions (e.g., universities, firms, and GRIs) to secure global frontier technologies in national strategic technology fields. (3) Clarifying the roles and visions of each global unit to strengthen its strategic international cooperation. KIST will keep striving to become a world-class research institute that contributes to the prosperity of human society and the nation's economic development.

*Corresponding author; E-mail : presto@kist.re.kr

Title of the abstract: upper and lower case, bold, centered, font Times New Roman 14 pt. Enter one clear line before the authors.
Author(s') name(s): first name (full), middle name (or initials, if used), last name (surname, family name), and without title or occupation, bold, centered, font Times New Roman, 11 pt. For multiple authors, type superscript numbers after the last letter of the author's names. Enter one clear line after the authors.
Affiliation: italic, upper and lower case, centered, Times New Roman, 11 pt. Provide the complete mailing address of affiliation, including the province and country names of each affiliation. For multiple authors at different affiliations, type superscript numbers in front of the first letter of each author's address. Enter one clear line after the affiliation.
Corresponding author: Clearly indicate who will handle correspondence at all stages of publication for CKC 2019 proceeding booklet.

KIMM-AKCSE Joint Session for the Collaborative Research Project

Invitation Only

Time: 10:30–12:00, June 19 (Wednesday) Canada, Mountain Daylight Time (MDT)

Place: KC 202

Sponsor: Korea Institute of Machinery and Materials (KIMM)

Organizer: KIMM and Association of Korean-Canadian Scientists and Engineers (AKCSE)

Contact: Dr. Jihyun Lee, University of Calgary (jihyun.lee@ucalgary.ca),
Ji Hyeon Seo, KIMM (san@kimm.re.kr)

Description: This session will evaluate the results of research proposal projects funded by KIMM-AKCSE from August 1, 2023 to February 29, 2024.

Program:

Time	Place	Topic	Speaker	Affiliation
10:30–10:40	KC 202	Opening	Dr. Bong Ki Kim	KIMM
10:40–10:55		Presentation 1	Dr. Mi-Young Kim	University of Alberta
10:55–11:10		Presentation 2	Dr. Chunghyuk Lee	Toronto Metropolitan University
11:10–11:25		Presentation 3	Dr. Chul Min Yeum	University of Waterloo
11:25–11:40		Presentation 4	Dr. Simon Park	University of Calgary
11:40–12:00		Closing	Ji Hyeon Seo	KIMM

List of Participants:

Name	Position	Affiliation
Dr. Bong Ki Kim	Vice President	KIMM
Dr. Dong Keun Song	Director of the Eco-friendly Energy & Environment Research Division	KIMM
Dr. Taik Min Lee	Head of the Department of Advanced Battery Manufacturing Systems	KIMM
Dr. Yong Gyun Bae	Senior Researcher in the Department of Carbon-free Power Generation	KIMM
Ji Hyeon Seo	Head of the Department of External Relations	KIMM
Dr. Mi-Young Kim	Associate Professor (Online)	University of Alberta
Dr. Chunghyuk Lee	Assistant Professor	Toronto Metropolitan University
Dr. Chul Min Yeum	Assistant Professor	University of Waterloo
Dr. Simon Park	Professor	University of Calgary

KIMM-AKCSE Joint Session for the Collaborative Research Project

Chair: Dr. Jihyun Lee

Assistant Professor, University of Calgary

Dr. Jihyun Lee is an expert in manufacturing, mechatronics, artificial intelligence (AI), robotics, and sensors, and has contributed her expertise to the aerospace, automotive, and oil industries. Her research is directly related to improving manufacturing performance and automation based on robots and sensors. Her research has resulted in two knowledge and technology translations and twenty-five journal papers. Dr. Lee serves as the PI for many domestic and international research projects for robotic systems, manufacturing automation, and sensors. Dr. Lee has collaborated with many industry partners in Canada and Korea. Dr. Lee received a B.S. from Yonsei University and an M.Sc. & Ph.D. from the University of Michigan-Ann Arbor. After graduation, she worked for 2.5 years as a senior researcher in the department of ultra-precision machines and systems at the Korea Institute of Machinery and Materials in Korea, where she contributed to manufacturing and mechatronics. Dr. Lee joined the University of Calgary in 2019 then is leading a research group, the intelligent automation research laboratory (iAR Lab).

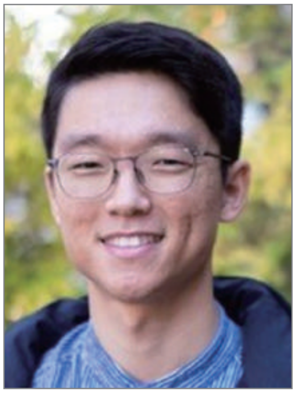
KIMM-AKCSE Joint Session for the Collaborative Research Project

Speaker: Dr. Mi-Young Kim

Associate Professor in Computing Science, Augustana Faculty, University of Alberta

Dr. Kim is currently an Associate Professor in Computing Science, Augustana Faculty, University of Alberta. Her research interests are in Natural Language Processing, Artificial Intelligence, and Machine Learning. Currently, she is researching information extraction from two specific domains: medical and legal domains. Since 2014, she has been serving as a co-organizer of the International Competition on Legal Information Extraction and Entailment (COLIEE). In the annual international competition of the legal bar exam question answering, her team's legal AI assistant had been ranked No.1 from 2014 to 2019, and 2022. She is also interested in Explainable AI, and currently developing an AI system that can perform automated health assessment for a patient, and provide a rationale (explanation) on the prediction. In addition, she is analyzing Alberta radiology reports to extract information about inflammatory bowel disease and explain it.

KIMM-AKCSE Joint Session for the Collaborative Research Project



Speaker: Dr. Chunghyuk Lee

Assistant Professor, Toronto Metropolitan University

Dr. Lee received his Ph.D. in mechanical engineering from the University of Toronto. Prior to his professorship, he worked as a postdoctoral fellow at Los Alamos National Laboratory (LANL), and as a research associate at National Research Council Canada. He is currently an Assistant Professor at the department of chemical engineering at Toronto Metropolitan University. His research group (Fluids and Electrochemical Engineering Laboratory) focusses on the area of electrochemical energy systems such as fuel cells and electrolyzers. He received awards including the 2022 Canadian Light Source Young Investigator Excellence Award and the US Department of Energy Hydrogen and Fuel Cell Technologies Office Postdoctoral Recognition Award. He is an editorial board member of Scientific Reports (Nature Publishing Group) and InterPore Journal, and a member of H2CAN2.0 (Canada Strategic Hydrogen R&D Network). He is currently serving as the local chapter president of the Greater Toronto-Lake Ontario Chapter of the Association of Korean-Canadian Scientists and Engineers.

KIMM-AKCSE Joint Session for the Collaborative Research Project

Speaker: Dr. Chul Min Yeum

Assistant Professor, University of Waterloo

Prof. Yeum is an assistant professor who joined the Department of Civil and Environmental Engineering (CEE) at the University of Waterloo in 2018. He received a B.S. and M.S. from CEE at the Korea Advanced Institute of Science & Technology (KAIST) and Ph.D. from CEE at Purdue University. His principal research focuses on developing novel implementations of computer vision, robotics, and deep learning methods that enable visual assessment by analyzing large volumes of images. Since 2015, he has made significant progress in vision-based structure inspection methods that can sift through large volumes of images to identify and classify critical structural components and damage. To date, he has published over 50 journal and conference papers, with a major focus on vision-based structural health monitoring and post-disaster assessment for civil infrastructure (Google Scholar, H-index 17 since 2011). He currently holds a Discovery Grant and Alliance from NSERC, CFI-JELF, Mitacs Accelerate, HIIFP from Ministry of Transportation of Ontario, and a research partnership with Rogers to develop 5G-enabled smart city applications.

KIMM-AKCSE Joint Session for the Collaborative Research Project

Speaker: Dr. Simon S. Park

Professor, Mechanical Engineering, University of Calgary

Dr. Park is a professor at the Schulich School of Engineering, Dept. of Mechanical and Manufacturing Engineering, University of Calgary, Canada. He is a Schulich School of Engineering Industrial Research Chair in sensing and monitoring. He is a professional engineer in Alberta and is an associate member of CIRP (Int. Academy of Production Engineers) from Canada. Dr. Park received bachelor and master's degrees from the University of Toronto, Canada. He then continued his PhD at the University of British Columbia, Canada. He has worked in several companies including IBM manufacturing where he was a procurement engineer for printed circuit boards and Mass Prototyping Inc. dealing with 3D printing. His research interests include nanocomposites, printed electronics, sensors, IoTs, batteries and advanced manufacturing. He has also founded several start-up companies in sensing, batteries, and advanced manufacturing. He has received several awards including Young Innovator's Award, Schulich School of Engineering Teaching Award, Schulich School Research Excellence Award, CFI New Faculty Grant, Alberta Innovates New Faculty award, NSERC scholarships, etc. He is also serving as associate editors of several journals. Currently, he is directly supervising over 30 students and scholars at Multifunctional Engineering, Dynamics and Automation Lab (MEDAL, www.ucalgary.ca/medal). E-mail simon.park@ucalgary.ca

KEIT Global Technology Strategy Forum

Open Session

Time: 10:30–12:00, June 19 (Wednesday) Canada, Mountain Daylight Time (MDT)

Place: KC 205

Sponsor: Korea Evaluation Institute of Industrial Technology (KEIT)

Organizer: KEIT and The Association of Korean Canadian Scientists and Engineers (AKCSE)

Contact: Dr. Jihyun Lee, University of Calgary (jihyun.lee@ucalgary.ca)

Description: This forum is to promote participation of Korean-Canadian scientists and engineers in the planning of Korea Government R&D projects for improving productivity and global cooperation.

Program:

Time	Place	Topic	Speaker	Affiliation
10:30–10:35	KC 205	Opening Remarks	Dr. Seung Youb Han	KEIT Vice President
10:35–10:40		Greeting	Dr. Seonghwan Kim	AKCSE President
10:40–11:00		Introduction to KEIT Organizations and Global Strategy	TBD	KEIT
11:00–11:20		KEIT-Mitacs collaboration	Hyelim Juliana Kim	
11:20–11:55		2024-2025 R&D plan for 5 industrial tech	PDs	KEIT
11:55–12:00		Photo time	Everyone	
12:00		Closing Remarks	Byunghun Choi	

KEIT Global Technology Strategy Forum

Dr. Jeong Woo Han

Program Director (PD) of Chemical Engineering

Dr. Jeong Woo Han received the B.S., M.S., and Ph D degrees in Chemical Engineering from Yonsei University in Seoul, Korea in 1984, 1986 and 1992 respectively. Dr. Han worked in Research Center of Hanwha Chemical Corporation from 1992 to 2013. After 2 more years in Hanwha Chemical as an Advisor, he worked for 2 years as a professor at Han-Nam University. From 2015 till now, he joined KEIT and has been working as the Chemical Engineering PD (Program Director).

KEIT Global Technology Strategy Forum

Dr. Kwang Seok Lee

Program Director (PD) of Metallic Materials

Dr. Kwang Seok Lee is currently working for the Korea Planning & Evaluation Industrial Technology (KEIT) as a Program Director (PD) of Metallic Materials from July 2023. He received his BS, MS, and Ph.D in Materials Science and Engineering from the POSTECH in Pohang, Republic of Korea. He spent for about 3 years from 2004 to 2007 as a post-doc. Researcher in Center of Advanced Aerospace Materials from POSTECH, Republic of Korea, in FG Physikalische Metallkunde from TU Darmstadt, Germany, and in Institute of Complex Materials from IFW Dresden, Germany. After joining Korea Institute of Materials Science in November 2007, he had been working more than 15 years as a senior or principal researcher at the Department of Materials Processing, and serving as Head of the same Department from March 2022 before joining KEIT. His research interests include fabrication, deformation, forming and evaluation for 1. non- and quasi-equilibrium alloys (ex. bulk metallic glasses, high entropy alloys, and magnetocaloric materials), 2. dissimilar metallic materials (clad sheets), and 3. Heat-resistant steels and superalloys. His researches led to about 75 SCI journal publications having h-index above 19.

KEIT Global Technology Strategy Forum

Dr. Seok Han Yoon

Program Director (PD) of Fiber & Textile

Dr. Seok Han Yoon is currently the Fiber & Textile PD of Korea Planning & Evaluation Institute of Industrial Technology (KEIT) (KEIT). He obtained Ph.D., Master, and Bachelor’s degrees in Fiber Engineering from Kyung-pook National University. He started his career as a Senior Researcher at Planning at Korea Dyeing & Finishing Technology Institute in 2000. Held positions as Head of Device Analysis Team, Director of Research and Development, and Director of Planning at Korea Dyeing & Finishing Technology Institute. Since 2019, at KEIT on the role of Textile Product Director. Over the past 24 years, involved in R&D and strategic support for the textile industry’s research and development

KEIT Global Technology Strategy Forum

Dr. Hyun Soo Woo

Program Director (PD) of Robot

Dr. Hyun Soo Woo is the Program Director (PD) of Robot in Korea Evaluation Institute of Industrial Technology (KEIT). He, as the PD, initiates, manages, and evaluates robot R&D programs and also works with policy makers to promote robot industries. He received B.S., M.S. and PhD degrees from Dept. of Mechanical Engineering at KAIST (Korea Advanced Institute of Science and Technology) in 2000, 2002, and 2009, respectively. Dr. Woo has been a senior and then principal researcher in Korea Institute of Machinery and Materials (KIMM) since 2010, primary research interest being development of medical and rehabilitation robots.

KEIT Global Technology Strategy Forum

Dr. Do Hyun Kim

Program Director (PD) of Smart Manufacturing

Dr. Do Hyun Kim is currently the Program Director of Smart manufacturing of the Korea Planning & Evaluation Industrial Technology (KEIT). He received his B.S., M.S. and Ph.D. degrees in computer science and engineering from Pusan National University, Rep. of Korea, in 1995, 1997, and 2016, respectively. He started his career as a Research Engineer at LS ELECTRIC Co., Ltd in 1997. Since 2000, he has been a Senior Research Engineer at the Electronics and Telecommunications Research Institute (ETRI) and joined KEIT in 2022. His research interests include AI, database, smart and autonomous manufacturing system, and Human Computer Interaction.

KEIT Global Technology Strategy Forum

Speaker: Hyelim Juliana Kim

Senior Advisor, Major Accounts (Robotics, Cybersecurity, Korea National Lead), Mitacs

Hyelim Juliana Kim, a proud Korean Canadian and an innovation enabler. Her career is marked by a passion for fostering both international and national partnerships that yield sustainable and inclusive outcomes. With experience working with multinationals and startups across the globe, she now serves as the Senior Advisor, National Korea/Robotics/ Cybersecurity Lead at Mitacs, a pan-Canadian not-for-profit that finances R&D projects in Canada and internationally. Beyond her role in innovation, Hyelim is deeply committed to EDI, social justice, ethical practices, and environmental issues, as well as strengthening Korea Canada relations. She is the proud Founder and President of the Quebec Korea Business Association (QKBA), which includes over 20 strategic corporate members. Her leadership extends to her active involvement and previous regional presidency at the Association of Korean Canadian Scientists and Engineers (AKCSE), and her former advisory position at the Peaceful Unification Advisory Council of Korea (PUAC).

KEIT Global Technology Strategy Forum

Speaker: Byunghun Choi

Representative of KEIT Boston Office, Korea Planning & Evaluation Institute of Industrial Technology (KEIT)

Byunghun Park is a representative of Korea Planning & Evaluation of Institute of Industrial Technology (KEIT) at Boston Office. He earned a master's degree in textile engineering from Konkuk University in Korea. He joined KEIT in 2015 and currently is serving as representative of KEIT Boston since January 2023.

Marine Science & Technology Cooperation for Carbon Neutrality

Open Session

Time: 10:30–12:30, June 19 (Wednesday) Canada, Mountain Daylight Time (MDT)

Place: PDC 103

Sponsor: Blue Carbon Research Center

Organizer: Blue Carbon Research Center and
The Association of Korean Canadian Scientists and Engineers (AKCSE)

Contact: Dr. Gap Soo Chang, University of Saskatchewan (gapsoo.chang@usask.ca)

Description: This session serves as a forum to introduce the project on "Development of living shoreline technology based on blue carbon science toward climate change adaptation" conducted by Blue Carbon Research Center and to explore the collaboration opportunities between Canada and Korea.

Program:

Time	Place	Topic	Speaker	Affiliation
10:30–10:40	PDC 103	Opening Remarks	Dr. Jong Seong Khim	Seoul National University
10:40–10:55		Keynote – Blue Carbon Strategy in Republic of Korea	Sang Keun Song	Seoul National University
10:55–11:10		Development of living shoreline technology based on blue carbon science toward climate change adaptation	Dr. Jongmin Lee	Seoul National University
11:10–11:25		Emerging Blue Carbon Research in Korea	Dr. Bong-Oh Kwon	Kunsan National University
11:25–11:40		Blue Carbon-based Climate Adaptive Coastal Building Technologies	Chang-Wook Park	Oceanic C&T co.
11:40–11:55		Study on the Development of Blue Carbon Database System in South Korea	Sujin Son	Sundosoft, LTd.
11:55–12:25		Panel Discussion	Dr. Jong Seong Khim	Seoul National University
12:25–12:30		Closing Remarks		

List of Participants:

Name	Position	Affiliation
Dr. Jong Seong Khim	Professor	Seoul National University
Sang Keun Song	Visiting Professor	Seoul National University
Dr. Jongmin Lee	Project Coordinator	Seoul National University
Dr. Bong-Oh Kwon	Professor	Kunsan National University
Chang-Wook Park	CEO	Oceanic C&T co.
Sujin Son	Director	Sundosoft, LTd.
Dr. Changkeun Lee	Research Professor	Seoul National University
Donghoon Kim	Senior Researcher	Seoul National University

Name	Position	Affiliation
Dr. Taewoo Kim	Post-doctoral Researcher	Seoul National University
Dr. Dong-U Kim	Post-doctoral Researcher	Seoul National University
Inha Kwon	Ph.D Student	Seoul National University
Dr. Myoungju Lee	Professor	Myongji University
Dr. Ho Kyung Ha	Professor	Inha University
Dr. Gyung Soo Park	Professor	Anyang University
Seong Eun Kim	CEO	ARA Consulting & Technology
Dr. Soonyoung Wang	Research Director	E&C Technology Co., Ltd
Soonwoo Lee	Managing Director	E&C Technology Co., Ltd
Dr. Young Ryun Kim	General Manager	Marine Eco-technology Institute
Dr. Tae Won Kim	Division Manager	Marine Eco-technology Institute
Eunpyo Lim	Executive Director	Sekwang Engineering Consultants Co.,LTD
Jihye Lee	Senior Manager	Sundosoft, LTd.
Wonhyeok Jeong	Senior Assistant	Sundosoft, LTd.
Jongyoung Lee	Assistant	Sundosoft, LTd.

Marine Science & Technology Cooperation for Carbon Neutrality

Co-Chair: Dr. Gap Soo Chang

Professor, Physics and Engineering Physics, University of Saskatchewan

Dr. Chang is a Professor in the Department of Physics and Engineering Physics at the University of Saskatchewan. He received his B.Sc., M.Sc., and Ph.D. degrees in Experimental Condensed Matter Physics from Yonsei University, Seoul, Korea. He held postdoctoral researcher positions at Atomic-scale Surface Science Center, Korea and the University of Tennessee at Knoxville prior to joining the faculty at the University of Saskatchewan in 2003. His research interests encompass synchrotron-radiation X-ray spectroscopy and density functional theory (DFT) analysis for advanced electronics and energy materials, and the first-principles modeling for bio-molecular interaction. He has published over 130 research articles in peer-reviewed journals and delivered over 30 invited talks at international conference. Dr. Chang also served as the 21st President of Association of Korean Canadian Scientists and Engineers (AKCSE) in 2016 for 2-year term and is currently a Chair of Long-term Planning Committee and a ST&I Ambassador for National Research Council of Science and Technology Korea (NST). He was a board member of Canadian Association of Physicists (CAP), and Hydrographic Society of Korea, and a chair of International Activities Committee of Council, University of Saskatchewan. E-mail: gapsoo.chang@usask.ca

Marine Science & Technology Cooperation for Carbon Neutrality

Co-Chair: Dr. Jong Seong Khim

Professor, Seoul National University and Blue Carbon Research Center

Dr. Khim is a Professor in the School of Earth and Environmental Sciences at Seoul National University. His research interests encompass a broad spectrum of ecological and environmental topics with research keywords of biodiversity, biological assay, ecological quality, marine pollution, sediment assessment, and ecosystem services. He published about 300 peer-reviewed SCI journal articles, with citations of >11,000 and Hirsch (h)-index of 54 at present. He is a recipient several research awards including 2014 International Cooperation Award for Young Scientist awarded by the Chinese Academy of Sciences, China. He was selected as a World Expert in Environmental Monitoring, Top 0.01% in 2021, and awarded the Medal of Honor in 2023 by the Government of the Republic of Korea in recognition of his contributions to the advancement of marine science. He is currently co-Editor-in-Chief of the Regional Studies in Marine Science. E-mail: jskocean@snu.ac.kr

Marine Science & Technology Cooperation for Carbon Neutrality

Keynote Speaker: Sangkeun Song

Visiting professor, Naval Architecture and Ocean Engineering, Seoul National University

Mr. Song is currently a Visiting Professor in the Department of Naval Architecture and Ocean Engineering at the Seoul National University. He received his B.Sc. degree from Seoul National University and M.Sc. degree from Korea Maritime and Ocean University.
Mr. Song is the former Vice Minister and Deputy Minister of Oceans and Fisheries of Korea (MOF) and a marine environmental expert in sustainable development in the ocean. With over 30 years at the Ministry of Oceans and Fisheries, he has focused on the establishment and delivery of policies through various projects in Climate Change, Marine Spacial Planning, reduction of marine pollution and many other issues. He is the former Alternate Permanent Representative to IMO in London. E-mail: sangksong77@gmail.com

Blue Carbon Strategy in Republic of Korea

Sangkeun Song[1,*], Jong Seong Khim[2]

[1]Department of Naval Architecture and Ocean Engineering, Seoul National University, Seoul, Korea, [2]School of Earth and Environmental Sciences & Blue Carbon Research Center, Seoul National University, Seoul, Korea

Ministry of Oceans and Fisheries (MOF) of Republic of Korea established a roadmap for carbon neutrality in the marine and fisheries sector by 2050. A reduction in emissions by 730 million tons was aimed to be achieved, compared to the 406 million tons emitted in 2018, with a target reduction of 324 million tons by 2050. Specifically, by 2050 a reduction of 136 million tons through blue carbon initiatives is aimed to be achieved. Concrete methods include; 1) restoring tidal flats and habitats of marine plants, as well as cultivating sea forests to enhance carbon absorption capacity, 2) excavating new blue carbon sources, 3) implementing policies such as the 'Living Shoreline' initiative to redesign coastal and marine areas as carbon-neutral spaces. To achieve this, through scientific research, international discussions facilitated by IPCC revisions are necessary to recognize new blue carbon sources such as non-vegetated tidal flats and seaweed as new carbon sinks.
*Corresponding author; E-mail: sangksong77@gmail.com

Marine Science & Technology Cooperation for Carbon Neutrality

Speaker: Dr. Jongmin Lee

Postdoctoral Researcher, Project Coordinator in Blue Carbon Research Center

Dr. Lee received his Ph.D. from Seoul National University in 2022. His Ph.D major was marine benthic ecology, specifically identifying carbon dioxide sink capacity in tidal flats of the Yellow Sea. He is a post-doctoral researcher and project coordinator in Blue Carbon Research Center at Seoul National University (2022–present), Republic of Korea. He has published 14 peer-reviewed journal articles in the field of Marine Ecology and Blue Carbon. Currently he is carrying out government (Ministry of Oceans and Fisheries) R&D project, which is 'Development of living shoreline technology based on blue carbon science toward climate change adaptation'. E-mail: jongmin8358@gmail.com

Development of living shoreline technology based on blue carbon science toward climate change adaptation

Jongmin Lee[1], Dong-U Kim[1], Taweoo Kim[1], Inha Kwon[1], Bong-Oh Kwon[2] , Jong Seong Khim[1]*

[1]School of Earth and Environmental Sciences & Blue Carbon Research Center, Seoul National University, Seoul 08826, Republic of Korea,
[2]Department of Marine Biotechnology, Kunsan National University, Kunsan 54150, Republic of Korea

Countries around the world that declared Carbon neutrality by 2050 are making an effort to secure carbon reduction sources. The top priority of the Korean government is reducing carbon emissions by ~35% below 2018 level in 2030 and ultimately reaching net-zero emissions by 2050. The Ministry of Oceans and Fisheries of Korea recently acknowledged the 'Blue Carbon' as a promising solution for natural carbon reduction in marine environments. We proposed a new project of softening artificial coastlines by expanding the blue carbon concept, primarily targeting tidal flats, say "Development of living shoreline technology based on blue carbon science toward climate change adaptation", which adopts the US 'Living shorelines' perspectives. In brief, the new project includes four key directions; 1) develop technique on enhancement and assessment of blue carbon, 2) excavate new carbon reduction resources, 3) develop technique on the construction of living shoreline, and 4) develop technique on the management of blue carbon and living shoreline. The Korean government will invest about 33 million US dollars for five years starting the year 2022 and we hope that the project shall bring new insight into the 'Blue Carbon' science towards 'Carbon Neutrality' globally.
*Corresponding author; E-mail jskocean@snu.ac.kr

Marine Science & Technology Cooperation for Carbon Neutrality

Speaker: Dr. Bong-Oh Kwon

Professor, Marine Biology, Kunsan National University

Dr. Bong-Oh Kwon is a Professor in the Department of Marine Biology at Kunsan National University (2020-present) and a Dean of Graduate School of Kunsan National University (2024-present), Republic of Korea. He obtained B.Sc. degree in Oceanography and Ph.D. in Environmental Science (Major in Marine Benthic Ecology) from Seoul National University in 2003 and 2012, respectively. He worked as a senior researcher, research professor in the Research Institute of Oceanography at Seoul National University (2012-2020). He has published 90 peer-reviewed journal articles in the fields of Marine Ecology and Marine Pollution. Currently, he is carrying out five government projects related to his research interests as the principal investigator and participating researcher and supervises a total of 7 graduate students. He is currently the focal point of the CEARAC of the NOWPAP. He is leading blue carbon research in Korea. E-mail: bongkwon@kunsan.ac.kr

Emerging Blue Carbon Research in Korea

Bong-Oh Kwon[1,*], Jong Seong Khim[2]

[1]Department of Marine Biology, Kunsan National University, Gunsan, Korea, [2]School of Earth and Environmental Sciences & Blue Carbon Research Center, Seoul National University, Seoul, Korea

The ocean acts as a carbon sink, absorbing approximately 45% of greenhouse gases emitted into the atmosphere. Blue carbon, referring to carbon stored in coastal ecosystems such as mangroves, salt marshes, and seagrasses, is internationally recognized as a crucial source of marine carbon sequestration. Recent research indicates that tidal flats, seaweeds, and benthic sediments are also emerging as new forms of blue carbon. In response, the Korean Ministry of Oceans and Fisheries initiated support for new blue carbon research starting in 2022. The present study investigated the amount of carbon stored in benthic sediments from regional areas on the west and south coasts of South Korea. A total of 375 sediment core samples within 30 cm were collected using a box corer and analyzed from a total of 64 sites. The carbon stock per unit area in the entire subtidal zone in the study area was estimated at 4.4 Mg C ha-1, and the carbon sequestration per unit area was 0.31 Mg C ha-1 yr-1. The average carbon stock and sequestration per unit area in this study were slightly lower than the values reported in China (5.9 Mg C ha-1, 1.84 Mg C ha-1 yr-1). In addition to benthic sediment, research is underway on the carbon storage capacity and absorption potential of seaweed forests, coral reefs, shellfish reefs, and phytoplankton. Upon completion of this research, a comprehensive assessment of carbon storage capacity in the Korean marine environment will be provided.

*Corresponding author; E-mail bongkwon@kunsan.ac.kr

Marine Science & Technology Cooperation for Carbon Neutrality

Speaker: Chang-Wook Park

CEO, OCEANIC C&T Co. Ltd.

Mr. Park majored in physical oceanography at Seoul National University in Korea and received his master's degree in 2000. He has been working as a marine environment specialist in the ocean engineering industry for more than 25 years and obtained the qualification of the professional engineer in 2011. Currently, he is in charge of the second subproject in the Blue Carbon Research Group of the Ministry of Oceans and Fisheries of Korea. He is an active researcher who is a member of professional societies such as the Korean Oceanographic Society, the Korean Coastal Ocean Engineering Society, and the Korean Society of Marine Environment and Energy, and is also a leading engineer in the Korean business field of the coastal and ocean, including marine environmental impact assessment, metocean study, wave & circulation numerical simulation, and AI data analysis. E-mail cwpark@oceaniccnt.com

Blue Carbon-based Climate Adaptive Coastal Building Technologies

Chang-Wook Park[1]*, Sung-Eun Kim[2], Yeong-Seok Han[3], Soon-Yeong Wang[4]

[1]Oceanic C&T Co., Seoul, Korea, [2]Ara Consulting & Technology Co., Incheon, Korea, [3]NEB Co., Bucheon, Korea, [4]E&C Technology Co., Seoul, Korea

With global warming of about 1.0°C compared to pre-industrial times, the response to the climate crisis is gaining international attention as an immediate issue, with an increase in natural disasters and the occurrence of climate refugees. Blue carbon is an unexplored field compared to land (forests) and scientific research is in its early stages, so it has high potential in various fields such as future research, restoration, and protection. The international community, including the UN, is paying attention to the potential of blue carbon in realizing carbon neutrality, and major countries around the world are seeking to utilize blue carbon in their policies. Currently, 74 countries have specified blue carbon in their NDCs, and research and R&D, etc. are being actively conducted to utilize blue carbon in the future. The IPCC recognized mangroves, salt marshes (vegetated tidal flats), and seagrass beds as blue carbon that can be used in national GHG statistics ('13), and discussions on new marine carbon sinks such as non-vegetated tidal flats, algae, and continental shelf sediments are expected to be activated in the future.

Our Blue Carbon Research Group is researching blue carbon-based coastal development technology to strengthen natural coastlines to ensure resilience against climate change. We categorize the methods into green, blue, and soft, depending on the characteristics and location of the coast, and are working to increase their applicability by including testbeds.

*Corresponding author; E-mail cwpark@oceaniccnt.com

Marine Science & Technology Cooperation for Carbon Neutrality

Speaker: Sujin Son

Director, GIS Solution Department, Sundosoft Ltd.

Mr. Son majored in urban and environmental engineering from the Handong University in 2010. He is currently studying for his PhD in urban and regional planning under Yong Un Ban at Chung Buk National University. He has been engaged in the GIS field for more than 15 years and currently working in GIS databases building and development of data analysis and visualization platforms for the marine environment and ecosystem. He received a ministerial commendation from the Ministry of Environment and the Ministry of SMEs and Startups in recognition of his contributions in his field. He is the author or co-author of over 10 publications including 5 patents and 5 journal papers. E-mail sjson@sundosoft.co.kr

Study on the Development of Blue Carbon Database System in South Korea

Hoon Joo Yoon[1], Jihye Lee[1], Wonhyeok Jeong[1], Jongyoung Lee[1], Jong Seong Khim[2], Kyu Hee Son[3]*

[1]GIS Solution Department, Sundosoft Ltd., Seoul, Korea, [2]School of Earth and Environmental Sciences & Research Institute of Oceanography, Seoul National University, Seoul, Korea, [3]Policy Research Lab, Sekwang Engineering Consultants, Seoul, Korea

To develop a blue carbon database system using GIS, we designed it by analyzing various domestic and international major preceding research result related to information systems related to blue carbon and marine ecosystems. The GIS-based blue carbon database system has been constructed as a spatial database with location information of blue carbon survey and observation data of vegetated and non-vegetated mudflats in South Korea. The database was built with its metadata by consideration of the standard of national marine and fisheries bigdata system. The blue carbon database system visualizes the blue carbon database in the form of a GIS layer and provides aggregated data by sea area and administrative district.

In addition, we have built a comprehensive dataset that combines various marine environment and ecosystem information on a 30 second grid mesh basis and are using it as a basic database for site exploration for blue carbon coastal creation such as blue living, green living, and soft living. And programmed decision-making support tool will be provided by use of that databases. The database built in this system will be used in connection with the national blue carbon inventory system, and the system architecture has been constructed based on Korea's eGovFrame to ensure smooth data exchange between systems. Based on the results of this study, the current blue carbon database and system are being continuously updated and developed, and the enhancement is scheduled to be completed by 2026.

*Corresponding author; E-mail scuba89@naver.com

This research was supported by “Development of living shoreline technology based on blue carbon science toward climate change adaptation” of Korea Institute of Marine Science & Technology Promotion (KIMST) funded by the Ministry of Oceans and Fisheries (20220526)

Marine Science & Technology Cooperation for Carbon Neutrality

Poster Presentation: Dr. Ho Kyung Ha

Professor, Inha University

Dr. Ha received his B.S. and M.S. from Department of Oceanography, Seoul National University. He earned Ph.D. from Virginia Institute of Marine Science, College of William and Mary, USA in 2008. He has been appointed as Inha Fellow Professor in 2023. His research interests center on (1) the ocean circulation and (2) associated particle transport in water column. Research has included the study of such diverse areas as rivers, estuaries, continental shelf, and open oceans. He is the author or co-author of over 80 journal papers and 2 textbooks in the field of Ocean Sciences. He is currently serving as a Review Board, National Research Foundation of Korea, and an Associate Editor of the Journal of Regional Studies in Marine Science. E-mail hahk@inha.ac.kr

Typhoon-induced Physical and Biological Disturbances in the Tidal Flat

Seong Woon Jeong[1], Hosang Kim[2], Beomgi Kim[2], Jong Seong Khim[2], Ho Kyung Ha[1,*]

[1]Department of Ocean Sciences, Inha University, Incheon 22212, Republic of Korea, [2]School of Earth and Environmental Sciences & Research Institute of Oceanography, Seoul National University, Seoul 08826, Republic of Korea

The tidal flat of Korea shows a distinctive geographic feature because of high tidal range (> 9 m) and high suspended sediment concentration (SSC). High tidal range with semidiurnal submergence and riverine input of suspended sediments make possible for tidal flat to function as a habitat and food source for diverse organisms. Sediment dynamics of tidal flat is hard to understand because it is easy to be affected under various weather conditions. To reveal the effect of typhoon on the sediment resuspension and tidal flat productivity, two mooring systems were deployed during two consecutive typhoons (Maysak and Haishen). Both typhoons increased wind shear stress and current velocity up to about 0.5 Pa and 0.44 m s-1, respectively. The SSC drastically increased to 614 mg l-1 at the end of the typhoon. The Chl-a, a proxy of phytoplankton, maintained low during the typhoons. Under fair-weather conditions, it drastically increased to 19 mg l-1, which was three times higher than that under typhoon period. This study suggests that typhoons from late summer to early fall could severely disturb benthic boundary layer and reduce photosynthesis of phytoplankton on the tidal flat.

*Corresponding author; E-mail: hahk@inha.ac.kr

Marine Science & Technology Cooperation for Carbon Neutrality

Poster Presentation: Dr. Taewoo Kim

Postdoctoral Researcher, Seoul National University

Dr. Kim received his Ph.D from Seoul National University in 2022. He is a postdoctoral researcher in Blue Carbon research center of Seoul National University, Korea. His major topics of research are chemistry, in vitro/in silico toxicology, and fate of chemicals in marine environment. He conducted many collaborative researches with Prof. Gap Soo Chang at the University of Saskatchewan (U of S) and awarded the fund from national research fund (NRF in Korea) and MITACS program (in Canada) in 2021. Through collaborative research with U of S, the cause of toxicity mechanism was proved as a biophysical factor, which was recognized as a national excellence. Currently, he researches a technology that can predict the change of environmental factor (distribution of chemicals, physico-chemical factor, etc.), and toxicity through artificial intelligence. E-mail taewoo0716@gmail.com

Prediction of macrozoobenthic species distribution in the Korean coast based on a logistic regression model of environmental parameters

Taewoo Kim[1], Soonwoo Lee[2], Soonyoung Wang[2], Kyuhee Son[3], Jong Seong Khim[1, *]

[1]School of Earth and Environmental Sciences & Research Institute of Oceanography, Seoul National University, Seoul, Republic of Korea, [2]Environmental Engineering and Consulting Co., LTd., Gyeonggi 16006, Korea, [3]Sekwang Engineering Consultant Company Limited, Seoul 08381, Republic of Korea

Changes in the marine environment have a significant impact on the communities of macrobenthic animals living nearby. This study contributes to the development of heuristic statistical models designed to predict the responses of benthic macrofauna to environmental gradients in coastal tidal flat areas. We derived ecological response surfaces for various intertidal macrobenthic species by employing logistic regression analyzes based on over three environmental parameters—shore level, mud content, and organic content—observed on the tidal flats of the southwestern coast of Korea. The models successfully predicted the presence or absence of these macrofaunal species with an accuracy ranging between 71% and 92%. A comparison of the probability surfaces generated by the models with actual species occurrence maps revealed that the models for different species varied significantly in form, suggesting a diverse range of responses to changes in habitat conditions, even among species with similar trophic types. Despite the inability to fully determine the ecological processes influencing the distribution of intertidal macrobenthic species, the models demonstrated high predictive accuracy. The strong alignment between the model predictions and field observations across various species underscores the utility of this modeling approach for managing ecosystems in tidal flat regions.

*Corresponding author; E-mail jskocean@snu.ac.kr

Marine Science & Technology Cooperation for Carbon Neutrality

Poster Presentation: Dr. Dong-U Kim

Postdoctoral Researcher, Blue Carbon Research Center, Seoul National University

Dr. Kim received his Ph.D. from Seoul National University in 2022. His Ph.D. major was the Antarctic benthic ecosystem, which studied the responses of benthic megafauna communities to glacial retreat caused by climate change in terms of structural and functional aspects. Currently, he is a post-doctoral researcher at Blue Carbon Research Center, researching the responses of benthic communities to climate change and the carbon absorption capacity of tidal flats. E-mail kimduocean@gmail.com

Changes in the diet of limpet according to topography

Dong-U Kim[1], Jeongsoo Kim[2], Hanna Bae[3], Taewoo Kim[1], Jongmin Lee[1], In Ok Lee[1], Junsung Noh[4], Jong Seong Khim[1,*]

[1]Seoul National University, Seoul, 08826, Republic of Korea, [2]Korea Fisheries Resources Agency, Busan, 46041 Republic of Korea, [3]Geosystem Research Corporation, Gyeonggi-do, 15807, Republic of Korea, [4]Department of Environment & Energy, Sejong University, Seoul, 05006, Republic of Korea

The limpet is a key taxon that regulates the density of macroalgae and invertebrates through feeding and serves as an energy pathway for coastal ecosystems by becoming prey to various predators including invertebrates and seabirds. Although limpet is usually regarded as a non-selective scraper, it is still not clear whether the diet changes depending on the environment. To identify the environmental factors determining the diet of limpet, carbon and nitrogen stable isotopes of limpets and potential food sources were analysed at typical topography of islands in three seas (West, South, and East Sea of Korea) with different environmental characteristics. δ13C and δ15N values of limpets and food sources differed according to the islands ($p<0.001$). However, the diet of limpet varied by topography. Sediment organic matter had the largest contribution to the limpet diet in bedrock around tidal flats with abundant sediment supply, due to the inflow of terrestrial matter and resuspension (86%). Microphytobenthos and macroalgae were major food sources (57% and 20%, respectively) for limpets around beach, which is abundant in benthic flora owing to the depositional topography with low wave energy. Limpets in bedrock with high wave energy mainly consumed phytoplankton (33%) and microphytobenthos (28%), which were relatively abundant. Overall, the results of this study showed that, in contrast to previous studies, the habitat topography rather than latitude or characteristics of sea was the major factor determining the diet of limpet. The results also suggest that limpet is a non-selective scraper that primarily feed on high-supply food sources.

*Corresponding author; E-mail jskocean@snu.ac.kr

Marine Science & Technology Cooperation for Carbon Neutrality

Poster Presentation: Inha Kwon

PhD student, Seoul National University

Mr. Kwon received his Bachelor's degree from the University of Southampton in 2018. He is currently studying for his PhD under Professor Jong Seong Khim at BENTHOS Lab, Seoul National University. E-mail: inhakwon@gmail.com

Natural purification capacity of marine sediments for organic nutrients along the coast of South Korea: A mesocosm study

Inha Kwon[1], Shin Yeong Park[1], Taewoo Kim[1], Changkeun Lee[1], Jongmin Lee[1], Junghyun Lee[2], Hyeong-Gi Kim[3], Bong-Oh Kwon[4], Jong Seong Khim[1]*

[1]School of Earth and Environmental Sciences, Seoul National University, Seoul, Korea, [2]Department of Environmental Education, Kongju National University, Gongju, Korea, [3]Department of Marine Environmental Sciences, Chungnam National University, Daejeon, Korea, [4]Department of Marine Biotechnology, Kunsan National University, Kunsan, Korea

The regulatory ecosystem services offered by natural tidal flats for organic pollutant removal are gaining increasing recognition; however, quantitative evaluations remain limited. We conducted a mesocosm study utilizing tidal flat sediments from five coastal regions in South Korea to gauge the efficacy of organic pollutant removal. Across all regions, negative flux values for total nitrogen (TN) and ammonium (NH_4+) indicated nitrogen movement within the water-sediment interface. While, nitrite and nitrate (NO_2- + NO_3-) flux displayed variations with both positive and negative values across all regions, suggesting dynamic nutrient exchanges between the overlying water and sediment. Variations in organic pollutant removal rates were noted among different regions and sediment compositions, with Incheon sediments demonstrating the highest purification capacity, achieving notable reductions in waterborne TN (81%) and TP (78%). Employing Thiessen polygon techniques, we mapped the results and estimated the TN (0.29 Tg N yr-1) and TP (0.15 Tg P yr-1) purification capacities along South Korea's coastal tidal flats. Additionally, we estimated the environmental value of TN (8.3 Billion $ yr-1) and TP (8.2 Billion $ yr-1) removal in tidal flats. This study highlights the potential for organic pollutant removal in tidal flats across the entirety of South Korea's coastline, offering a quantitative assessment of nitrogen and phosphorus removal within these environments.

*Corresponding author; E-mail: jskocean@snu.ac.kr

Marine Science & Technology Cooperation for Carbon Neutrality

Poster Presentation: Dr. Changkeun Lee

Research Professor, Seoul National University

Dr. Lee received his Ph.D. in Marin Biology from the Seoul National University in 2020. He is currently researching for Marine biology & ecosystem at Marine Environmental Impact Statement Institute at Seoul National University.
E-mail: leechangkeun88@gmail.com

Nationwide assessment of nitrogen and phosphorous purification capacity in coast sediments of South Korea

Changkeun Lee[1], Inha Kwon[1], Taewoo Kim[1], Bong-Oh Kwon[2], Jong Seong Khim[1]*

[1]School of Earth and Environmental Sciences & Research Institute of Oceanography, Seoul National University, Seoul, Korea, [2]Department of Marine Biotechnology, Kunsan National University, Kunsan, Korea

Human activity is assumed to impair the regulating function required to maintain the marine ecosystem viz. coastal protection, prevention of erosion, water purification and carbon storage. Despite the significance of the marine ecosystem service, the complex interactions with human disturbance remain poorly understood. Here, using an artificial tide control system, we test how human activities impact the water purification value of Korean coastal areas.
Intertidal flats of South Korea were extensively surveyed in 2018–21. The sediment textural type (sand, mixed, and mud) classified from satellite images were significantly correlated to that identified from field data, warranting a nationwide estimate of total N and P purification values.
Our results suggest that water purification amount of nitrogen and phosphorus in the tidal flat was confirmed to be 1,557 Mg N yr-1 and 4,633 Mg P yr-1, respectively. The purification of total N and P varied significantly depending on the region, province, morphology, and population size of the adjacent tidal flats. Finally, we confirmed that population density had a particularly damaging effect on the regulating services in Korea. We find that food web and service robustness are highly correlated, but that robustness varies across services depending on their trophic level and redundancy. Overall, our results confirmed the valuable ecosystem service of tidal flat's cost-efficient N and P purification abilities, highlighting marine ecosystem service.
*Corresponding author; E-mail: jskocean@snu.ac.kr

KOFWST Session: Strategies for achieving gender equity in STEM

Open Session

Time: 13:15–15:15, June 19 (Wednesday) Canada, Mountain Daylight Time (MDT)

Place: KC 205

Sponsor: The Korean Federation of Women's Science and Technology Associations (KOFWST)

Organizer: KOFWST and The Association of Korean-Canadian Scientists and Engineers (AKCSE) in collaboration with The Korea Center for Gendered Innovations for Science and Technology Research (GISTeR)

Contact: Dr. Miyoung Suh, University of Manitoba (miyoung.suh@umanitoba.ca)
Dr. Sunmee Kim, University of Manitoba (sunmee.kim@umanitoba.ca)
Ms. Younyoung Lee, University of Calgary (youngyoung.lee@ucalgary.ca)

Description: The aim of this session is to foster a collaborative approach to achieve gender equity in STEM at individual, team, research content, and institutional levels in Canada and Korea. We'll discuss strategies to empower women researchers and academics to excel as leaders, propelling scientific and technological advancements worldwide. Our discussion will include input from both female and male participants, creating an inclusive environment for all stakeholders dedicated to this ongoing endeavor.

Program:

Time	Place	Topic	Speaker	Affiliation
13:15–13:45	KC 205	Opening by Chair	Dr. Miyoung Suh	University of Manitoba
		Opening remarks I: Bridging Gaps, Building Futures: The Journey Towards Gender Diversity in Korea's Science and Technology	Dr. Oh Nam Kwon	KOFWST President
		Opening remarks II:	Dr. Lakshmi Krishnan	Vice-President, Life Sciences, NRC
13:45–15:00		STEM Fields at the Intersection of Gender Inequity	Dr. Bukola O. Salami	University of Calgary
		Gendered Innovations for Science and Technology in Korea: Progress and Challenges	Dr. Heisook Lee	GISTeR President
		Implementing EDI in Research and Education	Dr. Sofia Ahmed	University of Alberta
		Understanding EDI culture in Canadian STEM: Insights from a Male scientist	Dr. Bum Soo Kim	Defense R&D, Canada/ University of Ottawa
15:00–15:15		Q & A	Dr. Eunyoung Suh (moderator)	Seoul National University

KOFWST Session: Strategies for achieving gender equity in STEM

Chair: Dr. Miyoung Suh

Professor, Human Nutrition, University of Manitoba

Dr. Miyoung Suh is a Professor in the Department of Food and Human Nutritional Sciences at the University of Manitoba and a Principal Investigator in two departments at the St. Boniface Hospital Research Centre: the Division of Neurodegenerative Disorders and the Canadian Centre for Agri-Food Research in Health and Medicine. Dr. Suh plays a crucial role as the nutrition lead in a global leadership initiative known as Canada Israel International Fetal Alcohol Consortium (CIFFAC). This initiative focuses on mitigating the impact of fetal alcohol spectrum disorders through perinatal nutrition strategies. Her research efforts have garnered significant support from various sources, including Research Manitoba and CIHR to further her work on prenatal nutrition strategies. Moreover, Dr. Suh is actively involved as a UM Health Research Liaison with Opaskwayak Cree Nation (OCN) in northern Manitoba. Here, she has contributed to establishing a Smart Vertical Farm aimed at enhancing access to affordable and nutritious fresh food. Her collaborative efforts with OCN involve research on developing anti-diabetic functional vegetables, a critical step in promoting community health and addressing chronic diseases like diabetes. This project has received funding from NSERC-Horizon and is part of the broader 'Implementing Smart Cities Interventions to Build Healthy Cities (SMART) Training Platform.'' The SMART Training Platform is funded by CIHR-NSERC-SSHRC Healthy Cities Research Initiative and is co-led by Dr. Suh along with Drs. Ma from the University of Guelph and Dube from McGill University. E-mail: miyoung.suh@umanitoba.ca

KOFWST Session: Strategies for achieving gender equity in STEM

Opening Remarks I: Dr. Oh Nam Kwon

President, Korea Federation of Women's Science and Technology Associations (KOFWST)

Dr. Oh Nam Kwon is the President of the Korean Federation of Women's Science and Technology Associations and a Professor of Mathematics Education at Seoul National University. She joined Seoul National University in 2003 after teaching at Ewha Womans University for ten years. She has led over 30 grants as the Principal Investigator and has authored approximately 150 articles in the fields of mathematics education and mathematics. She serves on the editorial boards of top-tier journals such as Education Studies in Mathematics, Journal for Research in Mathematics Education, and Advances in Mathematics Education published by Springer. Additionally, she has been a member of the National Committee of the Korean Institute of Curriculum and Evaluation and the OECD/PISA Mathematics Expert Group. She received the Best Teaching Award from Seoul National University in 2009 and has served as a jury member for the Mathematics of Planet Earth 2013 UNESCO Virtual Modules Competition and as a committee member for the Leelavati Prize 2014. In 2021, she received the Svend Pedersen Lecture Award from Stockholm University, becoming the first Asian recipient of this honor. She has served as the President of the Korean Society of Mathematics Education and is the Chair of the 2025 East-Asian Regional Conference on Mathematics Education. E-mail: onkwon@snu.ac.kr

KOFWST Session: Strategies for achieving gender equity in STEM

Opening Remarks II: Dr. Lakshmi Krishnan

Vice-President, Life Sciences, National Research Council (NRC), Canada

Dr. Lakshmi Krishnan was appointed as Vice President of Life Sciences on a continuing basis as of April 1, 2022. In this capacity, she oversees the Human Health Therapeutics, Aquatic and Crop Resource Development and Medical Devices research centres.

As a globally recognized Life Sciences researcher, Dr. Krishnan has been a leader for driving innovation in the area of vaccine technologies and novel biologics for the improvement of human health. Over the course of her career, she has represented the NRC and the Government of Canada at various national and international joint committees and has been invited as a guest speaker on many occasions. In her current role, she is committed to health innovation and sustainable bio-economy.

Dr. Krishnan joined the NRC in 1997 and, as a scientist, built expertise in immunology research at the Institute for Biological Sciences (IBS), in the areas of vaccine adjuvants and host pathogen interactions. Prior to her current appointment, she was the Director General (DG) of the Human Health Therapeutics (HHT) Research Centre (2018-2022), Program Lead for Vaccines and Immunotherapy (2015-2018), Director of R&D for Immunobiology at HHT (2016-2018), and a research officer (1997-2014) at IBS and HHT. Over the course of her career, Dr. Krishnan has been the recipient of numerous competitive research grants from various agencies including the Ontario Institute for Cancer Research (OICR), the Canadian Institutes of Health Research (CIHR) and the National Institutes of Health (NIH – USA). She has published over 75 primary research articles in peer-reviewed journals in the field of vaccine technologies, host-pathogen and cancer immunity, and is listed as an inventor on several patents. She has significant experience in technology transfer to industrial clients and at the same time has a strong academic background, having mentored several graduate students who have all gone on to have successful research careers. She is member of the board of the Canadian Cancer Research Alliance, National Synthetic Biology Steering Committee and also chaired the Federal Vaccine Research Innovation and Development DG committee, which consists of membership from 13 different federal departments across the Government of Canada.

Dr. Krishnan received her Master's Degree in Bio-medical Genetics from the University of Madras (India) and Ph.D. in Immunology from the National Institute of Immunology in India, following which, she completed post-doctoral studies at the University of Alberta through an Alberta Heritage Foundation scholarship. In her spare time, Dr. Krishnan enjoys travel and outdoor activities with her family and she also volunteers with several not-for-profit organizations for mentoring leadership skills among youth. E-mail: Lakshmi.Krishnan@nrc-cnrc.gc.ca (https://nrc.canada.ca/en/biography-lakshmi-krishnan, accessed on May 12th, 2024)

KOFWST Session: Strategies for achieving gender equity in STEM

Speaker: Dr. Bukola O. Salami

Professor, Department of Community Health Sciences, Cumming School of Medicine, University of Calgary

Professor Bukola Salami currently holds the rank of Full Professor and Tier 1 Canada Research Chair in Black and Racialized Peoples' Health in the Department of Community Health Sciences, Cumming School of Medicine, University of Calgary. Prior to this role, she was Director of Intersections of Gender Signature Area in the Office of Vice President Research, University of Alberta, where she led the establishment of the Institute for Intersectional Studies. Dr. Salami received her Bachelor of Science in Nursing from the University of Windsor, Master of Nursing from the University of Toronto and PhD in Nursing from the University of Toronto. Professor Salami's research program focuses on policies and practices shaping migrant as well as Black and racialized people's health. She has been involved in over 90 funded studies totalling over $230 million. She has published around 140 papers in peer review journals. She has presented her work to policy makers (including to the House of Commons Standing Committee on Health). Her work has contributed to policy change. She is an Editor for the Canadian Journal of Nursing Research and Associate Editor of the Canadian Medical Association Journal (CMAJ). She is an advisory board member of the CIHR Institute for Human Development, Child and Youth Health and Scientific Advisory Committee on Global Health to the Government of Canada. E-mail: bukola.salami@ualberta.ca

KOFWST Session: Strategies for achieving gender equity in STEM

Speaker: Dr. Hyesook Lee

President, The Korea Center for Gendered Innovations for Science and Technology Research (GISTeR)

Dr. Heisook Lee, the inaugural President of the Korea Center for Gendered Innovation for Science and Technology Research (GISTeR) and Professor Emeritus at Ewha Womans University, has been a trailblazer in promoting gender equality in STEM fields. Previously, she spearheaded the establishment of the Center for WISET (Women in Science, Engineering, and Technology) until March 2016. Dr. Lee has been instrumental in organizing pivotal events such as the Gender Summit Asia Pacific in 2015 and the Gender Summit Global for SDGs in 2020. She earned her B.S., M.Sc., and Ph.D. degrees in Mathematics from Ewha Womans University, Korea, the University of British Columbia, and Queen's University, Canada, respectively, in 1971, 1974, and 1978. Throughout her career, Professor Lee held various leadership positions at Ewha Womans University, including Dean of the College of Natural Sciences, Dean of Research Affairs, and Dean of the Graduate School. She made significant contributions as the Chief Editor of Communications of the Korean Mathematical Society (1986-1988) and as Chief Editor of the Journal of the Korean Mathematical Society (1994-1996). Furthermore, Lee served as the founding director of the WISE Center in Korea (2001-2010), focusing on girls' HRD (Human Resource Development) in STEM fields. She also held the position of President of the Korea Federation of Women Scientists Associations (2006-2007). Her expertise led to her involvement in prestigious organizations like the Presidential Advisory Council on Science & Technology and the National Science & Technology Commission. E-mail: hslee@gister.re.kr

KOFWST Session: Strategies for achieving gender equity in STEM

Speaker: Dr. Sofia Ahmed

Professor, Faculty of Medicine and Dentistry, University of Alberta, Canada

Dr. Ahmed is a clinician-scientist with a focus on sex and gender differences in human kidney/cardiovascular outcomes and the University of Alberta Chair in Sex and Gender. Her program of research is supported by the Canadian Institutes of Health Research and the Heart and Stroke Foundation of Canada. She is the Chair of the Canadian Institutes of Health Research Institute of Gender and Health Advisory Board, Chair of the Canadian Medical Association Journal Governing Council and the President of the Organization for the Study of Sex Differences.

Dr. Ahmed completed her MD and internal medicine residency at the University of Toronto and a nephrology fellowship at Brigham and Women's and Massachusetts General Hospitals in Boston, USA. She completed her Master's in Medical Sciences at Harvard University. The recipient of the 2022 Hypertension Canada Senior Investigator Award, the 2021 Canadian Medical Association May Cohen Award for Women Mentors and a 2020 American Society of Nephrology Distinguished Mentor Award, Dr. Ahmed is strong proponent of the importance of mentorship and fostering excellence in the next generation of researchers.

KOFWST Session: Strategies for achieving gender equity in STEM

Speaker: Dr. Bumsoo Kim

Defence Scientist at the Defence R&D Canada, Ottawa Research Centre
Professor, University of Ottawa

Dr. Bumsoo Kim is a Defence Scientist at the Defence R&D Canada, Ottawa Research Centre and a part-time professor at the University of Ottawa. He had been an adjunct professor at the department of Mechanical engineering, the University of Ottawa and at the Aerospace engineering, Ryerson University in Toronto. His research areas include the autonomous control of unmanned vehicles, heterogeneous swarm robotics, and Space systems autonomy. He has been worked on autonomous vehicle control using MPC (Model Predictive Control), Impedance Control, Swarming Unmanned Aerial Vehicles (UAVs), Autonomous RPO (Rendezvous and Proximity Operation) Space system, Robot vehicles for Hazardous environment, and Complex systems. He is a senior member of IEEE. He has published in various international robotics and control systems conferences and journals including International Journal of Control, Electromotion, Transactions of CSME, IEEE Transactions on Robotics, AMOS conference, NATO Symposium of Military Sensing, International conference on Methods and Models in Automation and Robotics, European Conference on Complex Systems, IFAC World Congress, IFAC conference on Intelligent Autonomous Vehicles, International conference of the IEEE/IECON, etc. He has been teaching Autonomous Mobile Robots, Robot Design and Control, and Control systems at the University of Ottawa for last 25 years. He holds Ph.D. degree in Mechanical Engineering from the University of Ottawa.
Dr. Kim served the Korean Canadian community as the 17th president, and Chair of Advisory Committee for the Association of Korean-Canadian Scientists and Engineers (AKCSE), the principal of Ottawa Korean Community School (OKCS), and the president of Korean Community of Ottawa (KCAO), not to mention many other functions he’s been held so far. Dr. Kim received the Korean Presidential Award in 2014 in recognition of serving the Korean Canadian community.

KIMS R&D

Invitation Only

Time: 13:30–15:00, 19 June (Wednesday) Canada, Mountain Daylight Time (MDT)

Place: KC 202

Sponsor: Korea Institute of Materials Science (KIMS)

Organizer: KIMS and The Association of Korean Canadian Scientists and Engineers (AKCSE)

Contact: Dr. Dongyi Seo, National Research Council Canada (NRC) (dongyi.seo@nrc-cnrc.gc.ca)

Description: This KIMS R&D Session is to promote participation of Korean-Canadian scientists and engineers in the planning of collaborating R&D projects with researchers at KIMS for expanding global cooperation. Especially, participants will share their R&D progress and discuss technical findings.

Program:

Time	Place	Topic	Speaker	Affiliation
13:30–13:35	KC 202	Opening remarks	TBD	KIMS
13:35–13:40		Greeting	Dr. Seonghwan Kim	AKCSE President
13:40–13:50		Effective Design of Thin EMI Shielding Materials with Low Reflectivity and High Absorptivity Using Conductive Polymer Composites and Foams	Dr. Chul Bum Park	University of Toronto
13:50–14:00		Development of Layered Polymer Composite with Graded Cellular Structures for Absorption Dominated EMI Shielding Capability	Dr. Byeongjin Park	KIMS
14:00–14:10		Development of Solid Electrolyte Separator	Dr. Simon Park	University of Calgary
14:10–14:20		Development of thin film material to induce stabilization of electrode-electrolyte interface for all-solid-state batteries	Dr. Jin Woo Yi	KIMS
14:20–14:30		Permittivity simulation and optimal 3D structure design	Dr. Woo Soo Kim	Simon Fraser University
14:30–14:40		Development of high-temperature ceramic temperature sensor through ceramic dielectric 3D printing	Dr. Yeong Jin Choi	KIMS
14:40–14:50		Q&A	All	All
14:50–15:00		Presenting of appreciation plaque ceremony to the S&T ambassador and photo time	Dr. Dongyi Seo, All	NRC, All

List of Participants:

Name	Position	Affiliation
Dr. Dongyi Seo	Senior Research Officer	NRC
Dr. Seonghwan Kim	President of AKCSE and Professor, University of Calgary	AKCSE and University of Calgary
Sanghyeon Park	Department for External Affairs and Public Relations	KIMS
Dr. Byeongjin Park	Senior Researcher	KIMS

Name	Position	Affiliation
Dr. Jin Woo Yi	Principal Researcher	KIMS
Dr. Yeong Jin Choi	Senior Researcher	KIMS
Dr. Chul Bum Park	Professor	University of Toronto
Dr. Simon Park	Professor	University of Calgary
Dr. Woo Soo Kim	Professor	Simon Fraser University

KIMS R&D

Chair: Dr. Dongyi Seo

Senior Research Officer, Aerospace Research Centre of National Research Council Canada

Dr. Dongyi Seo is a senior research officer at the high temperature materials group, Aerospace Research Centre of National Research Council Canada. He received his Ph.D. degree in Materials Science from Michigan State University in 1998. He manages several significant projects on assessment of high-temperature materials and coatings and repair technology of metallic materials with the gas turbine OEMs and international research organizations. As an Adjunct Professor at Carleton University, he has been working and supervising students on the development of joining technology and evaluation of mechanical and environmental properties of various metallic materials as collaborative projects between NRC, and international research organizations such as Korea Institute of Materials Science, Korea Institute of Industrial Technology-South Korea, Australia's Nuclear Science and Technology Organization-Australia, IHI/Tohoku University-Japan, and Los Alamos National Lab., Michigan State University, and University of Tennessee-USA. He has authored and co-authored 76 peer-reviewed journals, 34 conference proceedings, 55 internal technical reports, and 103 technical presentations at international and national conferences including 22 invited papers and plenary talks. E-mail: dongyi.seo@nrc-cnrc.gc.ca

KIMS R&D

Speaker: Dr. Chul Bum Park

Distinguished Professor, Microcellular Engineered Plastics at University of Toronto

Prof Chul Bum Park received his PhD from MIT in 1993. He is Distinguished Professor of Microcellular Engineered Plastics at University of Toronto. He has an international recognition in the areas of polymer foam, conductive polymer composites and nanofiber composites. He has published more than 2500 papers, including 550 journal papers and four books with 95 Scopus H-index. Prof Park serves as Editor-in-Chief for Journal of Cellular Plastics. He has been inducted as an Academician Fellow into 6 academies including the Academy of Science of the Royal Society of Canada, the Canadian Academy of Engineering, the Korean Academy of Science and Technology, the National Academy of Engineering of Korea, the European Academy of Sciences, and the Chinese Academy of Engineering. He is also a Fellow of 6 other professional societies including the Canadian Society for Mechanical Engineering and the American Society of Mechanical Engineers. He has completed training of 85 PhDs and 72 postdocs, and 45 became a professor. He is currently supervising 30 PhD students and postdoctoral fellows at University of Toronto. E-mail: park@mie.utoronto.ca

KIMS R&D

Speaker: Dr. Byeongjin Park

Senior Researcher, Korea Institute of Materials Science (KIMS)

Dr. Byeongjin Park received the B.S. and Ph.D. degrees in civil and environmental engineering from KAIST (Korea Advanced Institute of Science and Technology), Daejeon, Republic of Korea in 2011 and 2017 respectively. Currently, he is with the Composites Research Division at Korea Institute of Materials Science, Changwon, Republic of Korea, as a senior researcher from 2017. While he had studied on automated noncontact ultrasonic structural health monitoring systems during his degrees, his current research interest is in the area of electromagnetic wave shielding/absorbing materials. He has published more than 30 refereed journal articles, 30 conference proceedings, and three book chapters. E-mail: b.park@kims.re.kr

KIMS R&D

Speaker: Dr. Simon S. Park

Professor, Mechanical Engineering, University of Calgary

Dr. Park is a professor at the Schulich School of Engineering, Dept. of Mechanical and Manufacturing Engineering, University of Calgary, Canada. He is a Schulich School of Engineering Industrial Research Chair in sensing and monitoring. He is a professional engineer in Alberta and is an associate member of CIRP (Int. Academy of Production Engineers) from Canada. Dr. Park received bachelor and master's degrees from the University of Toronto, Canada. He then continued his PhD at the University of British Columbia, Canada. He has worked in several companies including IBM manufacturing where he was a procurement engineer for printed circuit boards and Mass Prototyping Inc. dealing with 3D printing. His research interests include nanocomposites, printed electronics, sensors, IoTs, batteries and advanced manufacturing. He has also founded several start-up companies in sensing, batteries, and advanced manufacturing. He has received several awards including Young Innovator's Award, Schulich School of Engineering Teaching Award, Schulich School Research Excellence Award, CFI New Faculty Grant, Alberta Innovates New Faculty award, NSERC scholarships, etc. He is also serving as associate editors of several journals. Currently, he is directly supervising over 30 students and scholars at Multifunctional Engineering, Dynamics and Automation Lab (MEDAL, www.ucalgary.ca/medal). E-mail simon.park@ucalgary.ca

KIMS R&D

Speaker: Dr. Jin Woo Yi

Principle Researcher, Korea Institute of Materials Science (KIMS)

Dr. Jin Woo Yi earned his BS degree in chemical engineering from Hanyang University, Seoul, South Korea in 1999. He joined the research group of Prof. Bae at the Gwangju Institute of Science and Technology (GIST), Gwangju, South Korea and received his MS in 2001. After working for LG chemical for five years, he joined the Korea Institute of Materials Science (KIMS) in 2006. While working at KIMS, he received his PhD degree in 2014 from the Korea Advanced Institute of Science and Technology (KAIST). He has been actively engaged in the development of high-energy density batteries, focusing not only on electrode materials but also on innovative process-based post-coating electrode development. He has published more than 80 research articles in SCI(E) journals. E mail: yjw0628@kims.re.kr

KIMS R&D

Speaker: Dr. Woo Soo Kim

Professor, Mechatronic Systems Engineering at Simon Fraser University

Dr. Woo Soo Kim is a Professor at Simon Fraser University (SFU) in British Columbia, Canada. Prior to joining SFU, Dr. Kim worked as a Senior Research Scientist at Xerox Corporation (XRCC) for two years, following his tenure as a Post-doctoral Research Associate at the Massachusetts Institute of Technology (MIT) for two and a half years. Dr. Kim holds a BSc degree from Yonsei University (2001) and MSc and PhD degrees from the Korea Advanced Institute of Science and Technology (KAIST) in the Department of Material Engineering. He was recognized with the Quadrant Award 2007 and received Hanwha Corporation's New Faculty Award in 2016. Recently, he received the SFU Graduate Study's Excellence Award 2023 for Graduate Leadership. He is a senior member of IEEE and serves on the editorial boards of journals such as the IEEE Transactions on Electron Devices, IEEE Journal on Flexible Electronics, IOP Flexible and Printed Electronics, and Advanced Sensor Research. His research interests revolve around the broad field of Advanced 3D printing of architectured structures for diverse sensing applications. Webpage: http://www.sfu.ca/~woosook , Email: woosook@sfu.ca

KIMS R&D

Speaker: Dr. Yeong-Jin Choi

Senior Researcher at Korea Institute of Materials Science (KIMS)

Dr. Yeong-Jin Choi earned his PhD in Division of Integrative Biosciences and Biotechnology from Pohang University of Science and Technology (POSTECH) in Pohang, Korea, in 2018. He has been serving as a senior researcher at the Ceramic Materials Division at the Korea Institute of Materials Research in Changwon, Korea, since 2018. Dr. Choi was honored with the ISBF Young Investigator Award by the International Society for Biofabrication in 2017. His research focuses on the development of bioinks for 3D bioprinting and the regeneration of large-area muscle, nerve, and vascular tissues. Recently, he has broadened his expertise to include conductive and insulating ceramic 3D printing for the fabrication of electrodes for atmospheric pressure plasma and ceramic insulators for gas insulated switchgear. In collaboration with Simon Fraser University in Canada, he is working on developing temperature sensors through the manipulation of the geometry of dielectric materials. Dr. Choi is also the division director of the Bio-health section of the Korean Society for Precision Engineering and has authored 47 peer-reviewed journal articles. E-mail: jinchoi@kims.re.kr

KRICT-Canada Data-Driven Materials Design Session

Open Session

Time: 13:30–15:00, 19 June (Wednesday) Canada, Mountain Daylight Time (MDT)

Place: KC 206

Sponsor: Korea Research Institute of Chemical Technology (KRICT)

Organizer: KRICT

Contact: Dr. Jung Ho Shin, KRICT (jungho@krict.re.kr)

Description: This session is to present recent progress on data-driven materials research conducted in KRICT and Canada. Specifically, it will cover topics including data explorer (DX) platform, AI-assist materials design, self-driving laboratory, and so on.

Program:

Time	Place	Topic	Speaker	Affiliation
13:30–13:35	KC 206	Opening Remarks	Dr. Young Kuk Lee	KRICT
13:35–13:50		DX technology for plastic compounds	Dr. Woo Jin Choi	KRICT
13:50–14:05		Web-based Research Platform for Experimental and Calculation data: ChemDX and MatDX	Dr. Jung Ho Shin	KRICT
14:05–14:20		Beyond the computational predictions from learning structure-synthesis relations	Dr. Juhwan Noh	KRICT
14:20–14:35		Orchestration for self-driving laboratories	Dr. Sergio Pablo-Garcia	University of Toronto
14:35–14:50		Materials discovery using AI: solid-state electrolytes and high entropy alloys	Dr. Homin Shin	NRC
14:50–15:00		Closing & QnA	All	

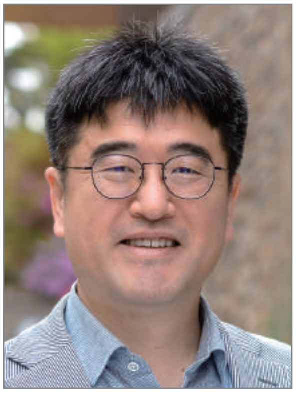
KRICT-Canada Data-Driven Materials Design Session

Chair: Dr. Juhwan Noh

Senior researcher, Chemical Data-Driven Research Center in Korea Research Institute of Chemical Technology

Dr. Juhwan Noh is a senior researcher in Chemical Data-Driven Research Center in Korea Research Institute of Chemical Technology (KRICT) from 2023. He received a B.S. from Department of Mechanical Engineering (ME) at the Sungkyunkwan University in 2016, M.Sc. in the graduate school of Energy, Environment, Water and Sustainability (EEWS) at the Korea Advanced Institute of Science and Technology (KAIST) in 2018, and Ph.D. in the department of Chemical & Biomolecular Engineering (CBE) at KAIST in 2022 under the supervision of Prof. Yousung Jung. During Ph.D., his principal research focuses on developing machine learning models for new materials design or predicting synthesizability of the computationally designed materials. Now, his principal research focuses on developing various data-driven materials design framework combining both computational and experimental databases as well as developing web-based platform for materials research.

KRICT-Canada Data-Driven Materials Design Session



Speaker: Dr. Woo Jin Choi

Principal Researcher, Chemical Materials Solutions Center, Korea Research Institute of Chemical Technology, Korea

Woo Jin Choi is a principal researcher of Chemical Materials Solutions Center and a director of Chemical Platform Technology Division, KRICT. His current research focuses on the mechanical properties of polymer materials, materials database, and formulation-property prediction technology. He has served as a committee manager of ISO TC61/SC2 (Mechanical Behavior, 2018 – 2020), a chair of the materials data standardization sub-committee, MOTIE, Korea (2021 – Present), and a member of Asian Materials Data Committee (AMDC, 2014 – Present). He received his Ph.D. in Chemical Engineering from Korea Advanced Institute of Science and Technology (KAIST, 2004). He was a researcher at GS Caltex Corp. (2004 – 2009) and joined KRICT in 2009

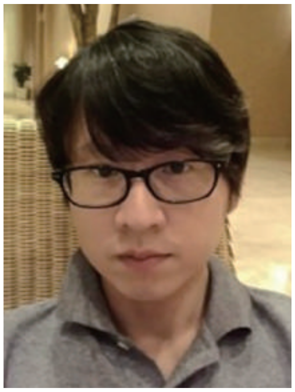
Digital transformation technologies of plastic compounds

Namjung Cho, Jae Seong Park, In Kim, Kwan Soo Yang, Yo Seph Han, Jin Suk Myung, Sun Woo Kim, Minseon Byun, Su Jin Kim, Jae Heung Lee, Woo Jin Choi*

Chemical Materials Solutions Center, Chemical Platform Technology Division, Korea Research Institute of Chemical Technology (KRICT), Korea

Plastic compounds are very versatile materials that have been widely used in automobiles, home appliances, and so on. Plastic compounds are composed of neat resin, functional filler, elastomer, and additives to show performance such as high strength, stiffness, impact resistance, electrical and thermal conductivity, etc. To develop the compounds, researchers have tried many combinations of raw materials and processing conditions. This procedure, however, required a long period and considerable money and reduced competitiveness. To strengthen the competitiveness and effectiveness of R&D for the compounds, we have researched the digital transformation technologies of plastic compounds. First, we standardized vocabulary, unit, classification system, and database schema. Second, data generation infrastructures (so-called, miniature data factory, MDF) and a data collection system to get a large dataset were equipped. Finally, we gathered the dataset of plastic compounds which consisted of data related to raw materials, composition, processing conditions, and properties of compounds; and applied machine learning technology to build the property prediction models of plastic compounds. In this presentation, we will introduce our activities related to the digital transformation of plastic compounds R&D that we have carried out for the last several years.

KRICT-Canada Data-Driven Materials Design Session



Speaker: Dr. Jungho Shin

Head at Chemical Data-Driven Research Center, Korea Research Institute of Chemical Technology

Dr. Jungho Shin is a researcher at the Korea Research Institute of Chemical Technology (KRICT), where he has been serving since 2019. He currently holds the position of Head of the Center for Chemical Data-Based Research at KRICT. He obtained his undergraduate and master's degrees in Chemistry from Sejong University (Korea) in 2007 and 2009, respectively. In 2015, he received his Ph.D. in Chemical Engineering from Yonsei University, specializing in computational and chemical research on catalytic materials.

Dr. Shin has been actively involved in the NOMAD project of the Horizon 2020 initiative in Europe, collaborating with the Fritz Haber Institute and Humboldt University in Germany since 2015. His research focuses on material data processing, platformization, and related areas. Alongside his work at KRICT, he continues to contribute to advancements in the field of chemical research.

Web-based Research Platform for Experimental and Calculation data: ChemDX and MatDX

Jungho Shin[1†], Yea-Lee Lee[1], Jino Im[1], Gyoung S. Na[1], Seunghun Jang[1], Hyunju Chang[1*]

[1]*Chemical Data-Driven Research Center, Korea Research Institute of Chemical Technology, 141 Gajeong-ro, Daejeon 34114, Korea*

For the data-driven material science, combining computational and experimental data has become essential for discovering new materials. This progress has been driven by data infrastructures that follow FAIR principles (findable, accessible, interoperable, and reusable), such as NOMAD, OPTIMADE, Materials Project, AFLOW, and OQMD. Integrating and classifying diverse metadata is crucial for leveraging these resources and enhancing predictions through artificial intelligence.

MatDX (Materials Data eXplorer) addresses this need by focusing on the integration and classification of materials metadata. These cover various aspects like material names, compositions, structures, properties, and applications. By employing a data warehouse approach, MatDX connects multiple databases, facilitating efficient data retrieval with material tags. Its interactive "Analysis" feature visually highlights significant data relationships.

The objective of MatDX is to support researchers in identifying materials with specific desired properties. It incorporates published data (PubDX), experimental data (ExpDX), and calculated data (CalcDX). Researchers can explore MatDX at http://materials.chemdx.org.

KRICT-Canada Data-Driven Materials Design Session

Speaker: Dr. Juhwan Noh

Senior researcher, Chemical Data-Driven Research Center in Korea Research Institute of Chemical Technology

Dr. Juhwan Noh is a senior researcher in Chemical Data-Driven Research Center in Korea Research Institute of Chemical Technology (KRICT) from 2023. He received a B.S. from Department of Mechanical Engineering (ME) at the Sungkyunkwan University in 2016, M.Sc. in the graduate school of Energy, Environment, Water and Sustainability (EEWS) at the Korea Advanced Institute of Science and Technology (KAIST) in 2018, and Ph.D. in the department of Chemical & Biomolecular Engineering (CBE) at KAIST in 2022 under the supervision of Prof. Yousung Jung. During Ph.D., his principal research focuses on developing machine learning models for new materials design or predicting synthesizability of the computationally designed materials. Now, his principal research focuses on developing various data-driven materials design framework combining both computational and experimental databases as well as developing web-based platform for materials research.

Beyond the computational predictions from learning structure-synthesis relations

Jidon Jang[1†], Juhwan Noh[2†] and Yousung Jung[3*]

[1]Data Convergence Drug Research Center, Korea Research Institute of Chemical Technology, 141 Gajeong-ro, Daejeon 34114, Korea, [2]Chemical Data-Driven Research Center, Korea Research Institute of Chemical Technology, 141 Gajeong-ro, Daejeon 34114, Korea, [3]Department of Chemical and Biological Engineering (BK21 four), Seoul National University, 1 Gwanak-ro, Gwanak-gu, Seoul 08826, Korea

The developments of large-scale computing technology as well as electronic-structure-calculation methods enabled the computational screening and significantly helped to guide the materials design. However, one major challenge in these approaches is that many of the computationally predicted materials are not experimentally feasible even if they are either energetically or thermodynamically stable. Here, we propose a data-driven model based on positive-unlabeled (PU) learning to guide synthesis experiments by predicting, for any given elemental stoichiometries, the likelihood of synthesizing inorganic materials. The ability of our model to treat arbitrary elemental combinations allows one to construct the continuous synthesizability phase map in good agreement with the available synthetic data. Furthermore, we use our model to guide experimental exploration of the quaternary oxide compositional space comprising CuO, Fe2O3, and V2O5, resulting in the discovery of a new phase, Cu4FeV3O13. We expect that our approach could aid the synthesis of new inorganic compositions by suggesting synthetically more accessible stoichiometries.

KRICT-Canada Data-Driven Materials Design Session

Speaker: Dr. Sergio Pablo-García

Postdoctoral researcher, The Matter Lab (UofT). Affiliate Postdoctoral Researcher at vector Institute

Dr. Sergio Pablo-García is a postdoctoral researcher in Alan's Aspuru-Guzik The Matter Lab. He earned his B.Sc. in Chemistry, his M.Sc. in computer modeling for physics and chemistry at the University of Barcelona (UB), and his PhD in the application of automation and machine learning techniques in computational heterogeneous catalysis, under the supervision Prof. López at the Institut Català d'Investigació Quimica (ICIQ). Currently, he specializes in development for SDL, integrating his computational/experimental experience in ChemOS 2.0 and building cheap devices to create more affordable self-driving laboratories.

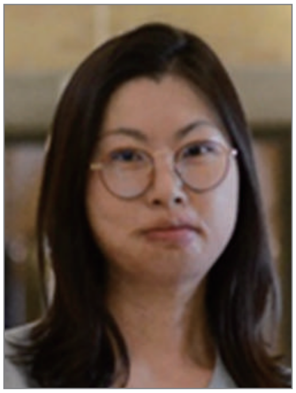
Self-driving laboratories and digital chemistry: From orchestration to electrochemical applications

Malcolm Sim[1], Mohammad Ghazi Vakili[1], Felix Strieth-Kalthoff[1], Han Hao[2], Riley Hickman[1,3], Santiago Miret[4], Yang Cao[2], Naruki Yoshikawa[2], Gun Deniz Akkoc[6], Sergio Pablo-García[1,3], Alán Aspuru-Guzik*[1,2,3,5]

[1]University of Toronto, Toronto, Ontario, Canada. [2]Acceleration Consortium, Toronto, Ontario, Canada. [3]Vector Institute, Toronto, Ontario, Canada. [4]Intel Labs, Santa Clara, California, USA. [5]Lebovic Fellow, Canadian Institute for Advanced Research (CIFAR), Toronto, Ontario, Canada. [6]riedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen, Germany

Self-driving laboratories (SDLs) combine automated hardware and artificial intelligence experimental planners to accelerate materials discovery. The cornerstone of an SDL is the orchestration manager, a pivotal software component responsible for facilitating communication and administration among diverse laboratory components. To address these challenges, we have recently presented ChemOS 2.0, an architecture design for orchestration that facilitates the combination of chemical experiments and simulations to rapidly explore chemical spaces. To demonstrate the capabilities of our design, we have used ChemOS 2.0 to automate the synthesis and characterization of organic laser molecules. Additionally, it has also been used to orchestrate electrochemical experiments performed on cheap open-source automated platforms built from scratch. As such, we demonstrate the capabilities of SDL in improving the speed of chemical research.

KRICT-Canada Data-Driven Materials Design Session



Speaker: Dr. Homin Shin

Senior Research Officer, National Research Council Canada

Dr. Shin is a Senior Research Officer at National Research Council Canada. Trained as a theoretical physicist, Dr. Shin has developed an understanding of a large variety of materials, such as colloids, polymers, liquid crystals, and bio/nano/energy materials, aiming to discover new materials with properties beyond those of currently existing materials. To this end, she uses a combination of analytic theory, numerical simulations, and machine learning, often in close collaboration with experimental groups and AI experts. Dr. Shin's publications have garnered a total of 1401 citations and she has an h-index of 14 (Google Scholar), which includes high-impact journal publications, such as Nat. Commun., ACS Nano, Physical Review Letters and PNAS. E-mail Homin.Shin@nrc-cnrc.gc.ca

Materials discovery using AI: solid-state electrolytes and high entropy alloys

Homin Shin[1]

[1]*Quantum and Nanotechnologies Research Centre, National Research Council Canada, 100 Sussex Drive, Ottawa, ON K1N 5A2, Canada*

Discovery of novel materials has driven technological innovation in various sectors such as electronics, sensing, energy and environment, and quantum technology. Recently, there has been an explosion of studies using machine learning and artificial intelligence for expedited discovery of new materials. In this talk, I will briefly discuss the recent state-of-the-art ML/AI methods applied to crystallographic material discovery and introduce current research efforts within NRC as well as in its collaboration with Mila-Quebec AI institute on the discovery of emerging classes of crystal materials, such as solid-state electrolytes and high entropy alloys.

NIMS R&D

Invitation Only

Time: 13:30–15:00, June 19 (Wednesday) Canada, Mountain Daylight Time (MDT)

Place: KC 204

Sponsor: National Institute for Mathematics Sciences, Korea (NIMS)

Organizer: NIMS and The Association of Korean Canadian Scientists and Engineers (AKCSE)

Contact: Dr. Jeong Woo Kim, University of Calgary (jw.kim@ucalgary.ca)

Description: In this invitation-only session, collaboration research conducted by NIMS and UCalgary on "Installation and operation of iGrav superconducting gravimeter in Yemi Underground Research Lab in Korea" will be discussed.

Program:

Time	Place	Topic	Speaker	Affiliation
13:30–13:35	KC 204	Opening Remarks	Dr. John J. Oh	NIMS
13:35–13:55		Status and Future of Yemi Micro-Gravity Observatory	Dr. John J. Oh	NIMS
13:55–14:15		Gravity-based Earthquake Analysis	Dr. Jeong Woo Kim	University of Calgary
14:15–14:50		Investigating Co-Seismic Gravity Changes Using Underground YemiLab SG	Dehghan / Dorjsuren	University of Calgary
14:50–14:55		Q&A - Intensive Discussions	All	
14:55–15:00		Closing Remarks and Photo Time	Dr. Seonghwan Kim	AKCSE President

List of Participants:

Name	Position	Affiliation
Dr. John J. Oh	Leader, Gravity Research et Application Team	NIMS
Dr. Edwin J. Son	Gravity Research et Application Team	NIMS
Dr. Jeongcho Kim	Gravity Research et Application Team	NIMS
Hwansun Kim	Gravity Research et Application Team	NIMS
Dr. Seonghwan Kim	Professor, Dept. of Manufacturing Engineering	AKCSE and University of Calgary
Dr. Jeong Woo Kim	Professor, Dept. of Geomatics Engineering	University of Calgary
Dr. M. Javad Dehghan	Dept. of Geomatics Engineering	University of Calgary
Ankhaa Dorjsuren	Dept. of Geomatics Engineering	University of Calgary

NIMS R&D

Speaker: Dr. John J. Oh

Senior Research Scientist, Lead of the GReAT Team, NIMS

Dr. Oh received his Ph.D. in Astrophysics from Sogang University in 2004. He then worked as a postdoctoral researcher in the Department of Physics at the University of Waterloo in Canada (2004-2006), followed by another postdoctoral position in the Department of Physics and Applied Physics at Yonsei University (2006-2008). Since 2008, he has been employed at the National Institute for Mathematical Sciences (NIMS). One of the first-generation researchers in Korea pioneering gravitational wave physics, he contributed, along with 13 other Korean researchers, to the detection of the first gravitational wave signal by the LIGO Observatory in 2015. Recently, he has collaborated with the University of Calgary in Canada to establish a microgravity observatory in Jeongsun, Gangwon Province, at an underground depth of 1008 meters and an elevation of -118 meters. This observatory aims to measure the Earth's microgravity for early earthquake detection and dark matter research. This microgravity research has expanded into an international collaborative research initiative called the East-Asian Network Initiative for Gravity Measurement Alliance (ENIGMA), which aims to build a giant observation belt utilizing superconducting gravimeters in East Asia. (E-mail: johnoh@nims.re.kr)

Status and Future of Yemi Micro-Gravity Observatory

John J. Oh, Edwin Son, Hwansun Kim, Jeongcho Kim, SeungMi You, Ik Woo, Jeong Woo Kim

Gravity Research et Application Team, Division of Basic Researches on Public Agenda, National Institute for Mathematical Sciences, 34047, Daejeon, South Korea

This presentation introduces the current status and prospects of the superconducting gravimeter installed at the Yemi Observatory in Jeongsun, Gangwon Province. Since its official operation began in November 2022, the world's only microgravity observation device, installed at a depth of about 1,008 meters underground and approximately -118 meters below sea level, has been acquiring data. The presentation outlines the status of the Yemi Micro-Gravity Observatory (YeMiGO), including various environmental factors, operations, and management necessary to obtain high-quality data from the underground facility. It discusses surrounding factors for preprocessing and analyzing the data. Furthermore, it discusses the introduction of the ENIGMA Collaboration, aiming to expand international cooperation using this data, along with its scientific objectives.

NIMS R&D

Speaker: Dr. Jeong Woo Kim

Professor, University of Calgary

Dr. Kim is a Professor with the Dept. of Geomatics Engineering at the University of Calgary, Canada. He received his Ph.D. in geophysics from the Ohio State University in Columbus, Ohio. His professional experiences include professor at Sejong University in Korea and researcher at NASA Goddard Space Flight Center. He has pioneered some new areas of research including earthquake early detection with superconducting gravity and achieved novel results that have attracted public attention even beyond academia. His unique research has been featured in The Canadian Press, CBC News, etc, and the results have been published in the journals such as Nature Communications E&E in 2022. He has been collaborating with governments and industries of Korea, Canada, the U.S., and the UAE on various projects including CCS. To date, Dr. Kim has published more than 80 papers in top-notch journals. He won the US National Research Council research award and IEEE paper award. He served as National Delegate of Canada to IAG and IUGG, and the 22nd President of the AKCSE. (https://profiles.ucalgary.ca/jeong-woo-kim; E-mail: jw.kim@ucalgary.ca)

Gravity-based Earthquake Analysis

Jeong Woo Kim, M.J. Dehghan Ankhaa Dorjsuren

Department of Geomatics Engineering, 2500 University Dr NW, Calgary, AB T2N 1N4, Canada

Challenges and breakthrough of micro gravity-based earthquake detection are presented. Current status of development of methods with YemiLab iGrav superconducting gravity data is updated.

NIMS R&D

Speaker: Mohammad Javad Dehghan

Graduate student, University of Calgary

Javad is a graduate student in Geomatics Engineering at the University of Calgary, Canada. He also holds a Ph.D. in Geophysics, specializing in Gravimetry and Magnetometry, from the University of Tehran, Iran. With over a decade of experience in the field of gravimetry, he has contributed to several research projects focused on gravimetry, tectonics, and geodynamics. His expertise extends beyond academic research; he has played a pivotal role in various deep and near-surface geophysical exploration projects as a specialist in applied geophysics. Javad's scholarly contributions include involvement in 11 publications and presentations. His dual expertise in both theoretical and applied aspects of geophysics make him a valuable asset in interdisciplinary research and practical applications in geosciences. He works on earthquake early detection using superconducting gravimeters as a member of Dr. Kim's group.
(https://www.linkedin.com/in/mohammadjavad-dehghan/; Email: Dehghan.mohammadjava@ucalgary.ca)

NIMS R&D

Speaker: Ankhaa Dorjsuren

Graduate student, University of Calgary

Ankhaa Dorjsuren is a graduate student in Geomatics Engineering at the University of Calgary, Canada, with an MSc. in geophysics from Ulaanbaatar State University of Mongolian Academy of Sciences. With over 20 years of experience in seismology, she excels in seismic data interpretation, seismicity statistical analysis, earthquake source characterization, seismotectonic, and probabilistic seismic hazard analysis. She has led over 30 scientific and seismological research projects, notably contributing to key initiatives in Mongolia, such as seismic hazard assessments for the capital Ulaanbaatar, the Oyu-Tolgoi mining site, Power Plant sites, and various infrastructure projects. Her remarkable work includes producing seismic hazard and micro zoning maps for 12 provinces and contributing to Mongolia's seismic zoning map for the Ministry of Construction and Urban Development of Mongolia. Ms. Ankhaa Dorjsuren has authored over 30 articles and presented at eight conferences, showcasing her dedication to advancing academic discourse in seismology. (Email: ankhaa.dorjsuren@ucalgary.ca)

Investigating Co-Seismic Gravity Changes Using Underground YemiLab Superconducting Gravimeter

Mohammad Javad Dehghan, Ankhaa Dorjsuren, Jeong Woo Kim

Department of Geomatics Engineering, University of Calgary, 2500 University Dr NW, Calgary, Canada

Earthquakes are among the most devastating natural disasters, inflicting severe damage and resulting in significant loss of life and property. Mega earthquakes are usually accompanied by mass redistribution and crustal deformation. The redistribution of mass carried on by crustal deformation can cause changes in the gravity field. Therefore, gravimetric methods can detect the co-seismic, inter-seismic, and post-seismic effects of deformation. However, investigating these changes requires precise instrumentation and noise-free conditions, challenges that typical spring-type gravimeters face due to their substantial drifts. In October 2022, the iGrav Superconducting Gravimeter (SG) (serial #001) was installed in YemiLab, which is in South Korea and located ~1,008 below the surface. It's the deepest gravimeter that has ever been deployed for continuous operation. After six months of operation, SG's data were used for calibration and correction. Its calibration factor was calculated to be -92.17 μGal·v^(-1)using the tidal analysis method and was slightly updated by parallel measurement with an absolute FG-5 gravimeter. The SG data were used to investigate co-seismic gravity changes for several earthquakes, ranging in magnitude from 4 to 6.5 and occurring within 100 to 800 km of the SG. The result shows co-seismic gravity changes up to 0.561 μGal, which was associated with the earthquake from 765 km away, with a magnitude of M6.2. These changes were not permanent and gradually decreased and compensated within half an hour after the first arrival at the SG.

NST Recruitment & Information Session

Open Session

Time: 15:30–17:30, June 19 (Wednesday) Canada, Mountain Daylight Time (MDT)

Place: KC 201

Sponsor: National Research Council of Science and Technology (NST)

Organizer: NST and The Association of Korean Canadian Scientists and Engineers (AKCSE)

Contact: Dr. Gap Soo Chang, University of Saskatchewan (gapsoo.chang@usask.ca)
Seoyoung Kim, National Research Council of Science and Technology(sduddl@nst.re.kr)

Description: This session is organized to provide an overview of the career opportunities for Korean-Canadian graduates, students, and/or prospective researchers about various Government-funded Research Institutes in Republic of Korea

Program:

Time	Place	Topic	Speaker	Affiliation
15:30–15:35	KC 201	Welcome Speech	Dr. Bok Chul Kim	NST Chairperson
15:35–15:45		NST and its affiliated research institutes: History and Future	Seoyoung Kim	NST
15:45–16:00		KITECH Recruitment & Information	Seheon Song	KITECH
16:00–16:15		ETRI Recruitment & Information	Young Wan Kim	ETRI
16:15–16:30		KIGAM Recruitment & Information	Chanung Park	KIGAM
16:30–16:45		Networking		
16:45–17:00		Career Opportunities at KRICT	Seunghwan Youn	KRICT
17:00–17:15		KAERI Recruitment & Information	SeungHun Lee	KAERI
17:15–17:30		KIMS Recruitment & Information	Sang-hyun Park	KIMS

List of Participants:

Name	Position	Affiliation
Dr. Bok Chul Kim	Chairperson of NST	National Research Council of Science and Technology (NST)
Seoyoung Kim	Senior	National Research Council of Science and Technology (NST)
Seheon Song	Administrator	Korea Institute of Industrial Technology (KITECH)
Young Wan Kim	Administrator	Electronics and Telecommunications Research Institute (ETRI)
Sang Yeop Lee	Senior Administrator	Electronics and Telecommunications Research Institute (ETRI)
Chanung Park	Administrator	Korea Institute of Geoscience and Mineral Resources (KIGAM)
Dr. Young Kuk Lee	President of KRICT	Korea Research Institute of Chemical Technology (KRICT)
Seunghwan Youn	Senior	Korea Research Institute of Chemical Technology (KRICT)
SeungHun Lee	Senior Administrative Officer	Korea Atomic Energy Research Institute (KAERI)
Sang-hyun Park	Principal	Korea Institute of Materials Science (KIMS)

KWSE & AKCSE Session: Achieving Sustainability for a Better Future

Open Session

Time: 15:30–17:30, June 19 (Wednesday) Canada, Mountain Daylight Time (MDT)

Place: KC 205

Sponsor: The Association of Korean Woman Scientists and Engineers (KWSE)

Organizer: KWSE and Association of Korean-Canadian Scientists and Engineers (AKCSE)

Contact: Dr. Miyoung Suh, University of Manitoba (miyoung.suh@umanitoba.ca)
Dr. Mi-Young Kim, University of Alberta (miyoung2@ualberta.ca)
Younyoung Lee, University of Calgary (youngyoung.lee@ucalgary.ca)

Description: In this session, our objective is to explore the research and development (R&D) status and content in Canada and Korea concerning a sustainable future. More specifically, we intend to present research findings related to Healthy & Smart Cities and hydrogen energy technology.

Program:

<table>
<tr><th>Time</th><th>Place</th><th>Topic</th><th>Speaker</th><th>Affiliation</th></tr>
<tr><td rowspan="2">15:30–15:40</td><td rowspan="10">KC 205</td><td>Opening by Chair</td><td>Dr. Regina Lee</td><td>York University</td></tr>
<tr><td>Opening remarks</td><td>Dr. Hyewhon Rhim</td><td>President of KWSE/
Korea Institute of Science and Technology (KIST)</td></tr>
<tr><td rowspan="4">15:40–16:40</td><td colspan="3">Topic 1: Healthy & Smart Cities for a Sustainable Future</td></tr>
<tr><td>Development of bio-measurement standards of KRISS</td><td>Dr. Sook-Kyung Kim</td><td>Korea Research Institute of Standards and Science (KRISS)</td></tr>
<tr><td>Food as an entry point in building healthy cities: SMART Training Platform</td><td>Dr. Miyoung Suh</td><td>Univ. of Manitoba</td></tr>
<tr><td>Personalized healthcare based on Korean medicine toward a healthy society</td><td>Dr. Jinseok Moon</td><td>Korea Institute of Oriental Medicine (KIOM)</td></tr>
<tr><td rowspan="3">16:40–17:20</td><td colspan="3">Topic 2: Hydrogen Energy for a Sustainable Future</td></tr>
<tr><td>Towards Developing Ionomer-free Porous Transport Electrodes for Proton-Exchange-Membrane Water Electrolyzers</td><td>Dr. Keonhag Lee</td><td>University of Victoria</td></tr>
<tr><td>Gas-phase synthesis of single-atomic to nanosized catalysts for hydrogen Production</td><td>Dr. Heeyeon Kim</td><td>Korea Institute of Energy Research (KIER)</td></tr>
<tr><td>17:20–17:30</td><td>Open discussion & Group photo</td><td></td><td></td></tr>
</table>

KWSE & AKCSE Session: Achieving Sustainability for a Better Future

Chair: Dr. Regina Lee

Professor, York University, Canada

Regina Lee, PhD, PEng is Professor at the Department of Earth and Space Science and Engineering, York University, Toronto, Canada. Prof. Lee received her Ph.D. from the University of Toronto in 2000. It has been a focus of Prof. Lee's research to develop a series of satellite technologies that will lead to scientific nanosatellite missions. Currently, she's investigating several areas including MEMS based attitude sensors and actuators to incorporate their low-grade characteristics; and optical payloads including a star tracker for Resident Space Object (RSO) detection, identification and characterization with light curve analysis. To date, Dr. Lee has raised over $10M in independent funding, working with over 13 industry partners and trained over 100 HQPs. Currently, Dr. Lee serves as the director of York Microfabrication Facility (YMF). E-mail: reginal@yorku.ca

KWSE & AKCSE Session: Achieving Sustainability for a Better Future

Opening remarks: Dr. Hyewhon Rhim

President, the Association of Korean Woman Scientists and Engineers (KWSE)
Director-General of Future Convergence Strategy Center, Korea Institute of Science and Technology (KIST)

Dr. Hyewhon Rhim earned her M.S. in Chemistry from Seoul National University and her Ph.D. in Neurophysiology from the University of Chicago. She began her professional career as a research associate at the University of Chicago in 1995 before transitioning to a researcher at the Korea Institute of Science and Technology (KIST) in 1997. Leveraging her expertise in brain research, Dr. Rhim assumed the role of Director at the Center for Neuroscience, Brain Science Institute of KIST in 2016. The following year, she was appointed the Director-General of the International Cooperation Division. Since then, she has held key leadership positions at KIST. Her significant contributions to convergence research and her advocacy for women in science have notably influenced policies within the field. Dr. Rhim served as the Director of the National Research Foundation (NRF), Korea from 2014 to 2016, and was elected President of the Korea Society of Brain and Neural Science in 2018. Currently, she is the President of the Association of Korean Women Scientists and Engineers (KWSE). Her contributions have been recognized with several prestigious awards, including the Presidential Citation in 2007 and the Science and Technology Merit Medal in 2016, highlighting her significant impact on science and society. E-mail: hrhim@kist.re.kr

KWSE & AKCSE Session: Achieving Sustainability for a Better Future

Speaker: Dr. Sook-Kyung Kim

Director, Korea Research Institute of Standards and Science (KRISS) Academy
Head of Center for Senior Women in Science & Technology (SWiST), KWSE

Dr. Kim is a principal research scientist who joined the Korea Research Institute of Standards and Science in 2002. She received a B.S., M.S. and Ph.D. from Department of Pharmacy at Seoul National University. Her principal research focuses on developing measurement standards of nucleic acids, peptide & proteins and cells including microorganisms. Developing analytical methods and certified reference materials (CRM) to provide measurement traceability in bio-industry & laboratory medicine etc. She also is a director of KRISS Academy, which contribute to the development of global measurement experts. Korea Woman Scientists and Engineers (KWSE) recently launched a center for senior women in science and technology. SWiST is establishing policies and activity plans to support the activities of senior women scientists after retirement. E-mail: kimsk@kriss.re.kr

Development of Bio-Measurement Standards of KRISS/ Introduction of Center for Senior Women in Science and Technology, KWSE

Sook-Kyung Kim

Korea Research Institute of Standards and Science/ Korea Woman Scientists and Engineers, Daejeon, South Korea

KRISS, a national metrology institute (NMI) of Korea, maintains and disseminates standards at the highest level of precision and accuracy. Bio-metrology group establishes bio-standards and develops measurement technologies for biomaterials constituting living organisms. We focus on the measurements and analyses of various biomaterials such as nucleic acids (DNA, RNA), proteins, cells, microorganisms, viruses, and bio-particles. We pioneer top-tier measurement methods for international measurement standards, develop analytical methods for diverse life science research, and conduct research for international equivalence. Our goal is to support and improve the reliability of measurements in molecular genetic testing, infectious disease diagnosis, and quality control of bio-pharmaceuticals, ultimately enhancing the national quality of life.
In the era of low birth rates, senior women scientists and engineers are valuable asset to support R&D value chain in Korea. More than 45.3% of KWSE members are over 55 years old, they have an intend to contribute to society using their experienced expertise even after retirement.

KWSE & AKCSE Session: Achieving Sustainability for a Better Future

Speaker: Dr. Miyoung Suh

Professor, Human Nutrition, University of Manitoba

Dr. Miyoung Suh is a Professor in the Department of Food and Human Nutritional Sciences at the University of Manitoba and a Principal Investigator in two departments at the St. Boniface Hospital Research Centre: the Division of Neurodegenerative Disorders and the Canadian Centre for Agri-Food Research in Health and Medicine. Dr. Suh plays a crucial role as the nutrition lead in a global leadership initiative known as Canada Israel International Fetal Alcohol Consortium (CIFFAC). This initiative focuses on mitigating the impact of fetal alcohol spectrum disorders through perinatal nutrition strategies. Her research efforts have garnered significant support from various sources, including Research Manitoba and CIHR to further her work on prenatal nutrition strategies. Moreover, Dr. Suh is actively involved as a UM Health Research Liaison with Opaskwayak Cree Nation (OCN) in northern Manitoba. Here, she has contributed to establishing a Smart Vertical Farm aimed at enhancing access to affordable and nutritious fresh food. Her collaborative efforts with OCN involve research on developing anti-diabetic functional vegetables, a critical step in promoting community health and addressing chronic diseases like diabetes. This project has received funding from NSERC-Horizon and is part of the broader 'Implementing Smart Cities Interventions to Build Healthy Cities (SMART) Training Platform.'' The SMART Training Platform is funded by CIHR-NSERC-SSHRC Healthy Cities Research Initiative and is co-led by Dr. Suh along with Drs. Ma from the University of Guelph and Dube from McGill University. E-mail: miyoung.suh@umanitoba.ca

Food as an entry point in building healthy cities: SMART Training Platform

Miyoung Suh[1]*, David Ma[2], Laurette Dube[3]

[1]Department of Food and Human Nutritional Sciences, University of Manitoba, Canada, [2]Department of Human Health and Nutritional Sciences, University of Guelph, Ontario, [3]Desautels Faculty of Management, McGill University, Montréal, Québec

Food has evolved beyond mere production and consumption, becoming a complex network of systems intertwined with various urban challenges such as food security, health, sustainability, equity, Indigenous issues, and big data. Through implementation science, which studies methods for evaluating, planning, and promoting knowledge uptake and practice mobilization, we have developed the Implementing Smart Cities Interventions to Build Healthy Cities (SMART) training platform to address these societal issues. By focusing on food as a central theme within the SMART training platform, we aim to equip our Canadian future leaders with versatile knowledge and skills to confront numerous challenges faced by Healthy Cities. For instance, these leaders will understand that food security and resilient food systems are multifaceted and require collaboration and a systems thinking approach that acknowledges the interconnectedness of issues in building healthy cities. As an example, we can examine how SMART Vertical Farm technology can revolutionize the economic and health landscapes of northern disadvantaged communities in Canada.

KWSE & AKCSE Session: Achieving Sustainability for a Better Future

Speaker: Dr. Jinseok Moon

Director, R&D Strategy Division, Korea Institute of Oriental Medicine

Dr. Moon is a director of R&D strategy division at the Korea Institute of Oriental Medicine. She has a B.S. and M.S. from Biomedical Engineering of Korean Medicine at Kyung Hee University and Ph.D. from Management of Technology at Daejeon University. She researched on developing medical device and medical informatics, and received the Excellence Award from the Korean Society of Medical Informatics. She conducted for international standardization activities on the Quality and safety of medical devices as a secretary of ISO/TC249/WG4 from 2011 to 2020. And she received the Ministry of Trade, Industry and Energy's Award for Excellence in standardization of public sector in 2013. Recently, she has been working on planning and strategy for convergence research between Korean medicine and other fields. She was awarded the Ministry of Science and ICT Award in 2017 for her contribution to enhancement in the field of policy and strategy. She has been serving as a member of steering committee of the Association of Korean Woman Scientists and Engineers. E-mail moonstone2@kiom.re.kr

Personalized healthcare based on Korean medicine toward a healthy society

Jinseok Moon[1]*, Ho Kyoung Kim[2]

[1]R&D Strategy Division, Korea Institute of Oriental Medicine, Daejeon, Korea, [2]Vice President, Korea Institute of Oriental Medicine, Daejeon, Korea

Since its foundation in 1994, the Korea Institute of Oriental Medicine (KIOM) has made sustained efforts to lead the scientific verification, globalization, and standardization of Korean medicine as well as conservation and further development of the field while creating new values and contributing to the healthy living of people. The main research functions are the development of advanced technologies for digitalization, scientific verification, new values of herbal medicines, and information platforms of Korean medicine. In addition, the KIOM plans to establish a convergence research building with brain science and digitalization to globalize acupuncture and meridian research, and to secure research equipment such as fMRI, to conduct open innovation research cooperated with global industry-academia-research institutes.

The KIOM established the 'Korean Medicine 2050 Future Vision' to proactively respond to future social changes and realize a healthy future for the people. Based on scientific prediction methodology, major drivers of future change were selected, and scenarios were derived by actively collecting opinions from the general public as well as discussions with experts in various fields such as science fiction, futurology, bio, healthcare, finance, anthropology, and global culture. The future vision is a 'Super Health Korea', which means lifelong health for 150 years, and a healthy, safe, and happy society through a 'Health Guard' that protects people through preventive, lifestyle, and personalized medicine based on Korean medicine.

As key research technologies for the future healthy society, 1) a Longevity society for a disease-free entire life cycle (Digital twin simulation, Precision medicine linked to genes constitution, customized Medi-food), 2) a New healthcare era without time and space constraints (Medical Cube, AI doctor using lifelog, Telemedicine with smart hospital), 3) Healthy Mind and body society (Sports medicine with human augmentation, biofeedback-based Meditation system) were proposed.

We hope that various healthcare technologies based on Korean medicine can be combined to build a smart city in the future.

KWSE & AKCSE Session: Achieving Sustainability for a Better Future

Speaker: Dr. Jason Keonhag Lee

Assistant Professor, University of Victoria

Dr. Jason Keonhag Lee serves as an Assistant Professor in the Department of Mechanical Engineering at the University of Victoria. His research focuses on advancing clean hydrogen production technologies through electrochemical energy conversion, collaborating closely with Accelerating Community Energy Transformations (ACET) and Institute for Integrated Energy Systems (IESVic) at the University of Victoria. He earned his Ph.D. from the Department of Mechanical and Industrial Engineering at the University of Toronto and obtained his M.A.Sc. and B.Eng. from the Department of Mechanical Engineering at the University of Victoria. Dr. Lee worked as a postdoctoral researcher at Lawrence Berkeley National Laboratory where he contributed to the development of electrolyzers for reducing the cost of clean hydrogen. His efforts were acknowledged with a runner-up recognition for the Department of Energy Hydrogen Fuel Cell Technology Office's Postdoctoral Award. Dr. Lee has an impressive publication record of 40 peer-reviewed publications 19 conference proceedings and abstracts, and a textbook chapter. E-mail: jasonklee@uvic.ca

Toward Developing Ionomer-free Porous Transport Electrodes for Proton-Exchange-Membrane Water Electrolyzers

Jason Keonhag Lee[1]

[1]Department of Mechanical Engineering, University of Victoria, Victoria, BC V8P 5C2, Canada

The demand for clean hydrogen, generated through water electrolysis using renewables, is rapidly increasing due to its potential to decarbonize hard-to-abate sectors such as transportation and industry. Proton-exchange-membrane (PEM) water electrolyzers stand out among various types of electrolyzers available today due to their compact design and rapid response time, aligning well with the requirements of renewable energy integration. However, despite efforts to upscale PEM water electrolyzer capacity to gagawatt (GW) scale, cost remains a major challenge. In particular, the high cost and limited availability of iridium catalysts used in oxygen evolution reaction are predicted to become the primary cost driver at GW scale, necessitating catalyst loading reduction and recycling processes. In this work, we present the development of ionomer-free porous transport electrodes (PTEs) as a viable alternative to reduce the cost of PEM water electrolyzers. The ionomer-free PTEs prepared by physical vapor deposition coating demonstrate superior performance (< 600 mV at 1.8 A/cm2) compared to the traditionally prepared PTEs at low catalyst loading of 0.10 mgIr/cm2. Moreover, the ionomer-free PTEs offer remarkable durability, evidenced by a voltage degradation of 29 mV at average rate of 0.58 mV per 1000-cycles after 50,000 cycles of accelerated-stress tests. Eliminating ionomers from the catalyst layer facilitate component recycling, with reapplication of Ir coating on a degraded PTE showing promise in restoring performance lost during degradation tests. The ionomer-free PTEs presented in this work not only enhances performance and durability of PEM water electrolyzers but also provides multiple avenues for cost reduction in their large-scale deployment, thus advancing towards GW-scale production of clean hydrogen.

KWSE & AKCSE Session: Achieving Sustainability for a Better Future

Speaker: Dr. Heeyeon Kim

Principal researcher, Hydrogen Energy Institute, Korea Institute of Energy Research
Professor, Hydrogen Energy Engineering, University of Science and Technology

Dr. Kim received her Ph.D. from chemical engineering department in Seoul National University. She has worked in Korea Institute of Energy Research (KIER) since 2004. She has focused on the development of noble processes to synthesize high-performance catalysts ranging in size from single atoms to nanometers. Also, for the development of cost-effective process which would improve the catalytic performance and concurrently maintain the long-term stability, she has designed and developed a new type of chemical vapor deposition (CVD) system. Using this noble process, she has developed catalysts for various energy systems such as dry reforming of methane (CH4), polymer electrolyte fuel cell (PEMFC), secondary battery and methane coupling, etc. She has been serving as a board member and executive committee member of the Korean Institute of Chemical Engineers and the Korean Carbon Society, and as an evaluation committee member of the Ministry of Science and ICT and the Ministry of Trade, Industry and Energy. E-mail: heeyeon@kier.re.kr

Gas-phase synthesis of single-atomic to nanosized catalysts for hydrogen Production

Heeyeon Kim

Hydrogen Energy Research Division, Korea Institute of Energy Research, Daejeon, Korea

With the recent escalation of concerns regarding climate change, global attention has been directed towards research aimed at converting the greenhouse gases such as methane (CH4) and carbon dioxide (CO2) into valuable chemical compounds. We have developed a noble synthetic process for the development of high-performance catalysts for dry reforming of methane (DRM). Despite prolonged research efforts, serious deactivation of catalysts in DRM process has impeded their commercialization. In our research team, we have developed the chemical vapor deposition (CVD) technology for single-atomic catalyst synthesis which show prominent performance in the DRM, secondary battery, and PEMFC. Single atomic catalysts can also overcome the catalyst deactivation due to coking, and also effective for improving mass activity of the catalyst. Ni/γ-Al2O3 catalyst prepared by CVD method shows uniformly dispersed single-atom sized Ni particles, as revealed by TEM results. This catalyst exhibited a catalytic activity (hydrogen yield) per catalyst unit mass at least ten times higher than that of nano-catalysts (particle size 2-3 nm) prepared by conventional impregnation methods. The ultimate goal of this study is to apply the single-atom catalyst manufacturing process to various catalytic conversion processes and electrode materials for PEMFC and secondary battery, and proceed with commercialization.

KIER-KIMM-NRC Joint Session on Ammonia As Hydrogen Carrier

Open Session

Time: 15:30–17:40, June 19 (Wednesday) Canada, Mountain Daylight Time (MDT)

Place: KC 206

Sponsor: Korea Institute of Energy Research (KIER), Korea Institute of Machinery & Materials (KIMM)

Organizer: KIER, KIMM

Contact: Dr. Sangjin Choi, Korea Institute of Energy Research (sjinchoi@kier.re.kr)

Description: This session serves as a forum to discuss the international collaboration opportunities on ammonia as hydrogen carrier among the related research groups.

Program:

Time	Place	Topic	Speaker	Affiliation
15:30–15:35	KC 206	Opening Remarks	Dr. Seong Ok Han	KIER
15:35–15:40		Welcoming Remarks	Dr. Bong Ki Kim	KIMM
15:40–16:00		Cost-Effective Production and Utilization of Green Ammonia	Dr. Hyung Chul Yoon	KIER
16:00–16:20		Comprehensive study of carbon-neutral direct ammonia solid oxide fuel cell from electrode catalyst to stack in KIMM	Dr. Yongyun Bae	KIMM
16:20–16:40		Green steel production using ammonia: the future of steel making	Dr. Se-Ho Kim	Korea University
16:40–17:00		Synthesis of high-entropy alloy nanoparticles	Dr. Kenu Su Kim	NRC
17:00–17:20		Computational alchemical method for fast screening of catalytic high-entropy alloys	Dr. Mauricio Ponga	University of British Columbia
17:20–17:40		Eggshell-structured catalyst for ammonia decomposition	Dr. Shin-Kun Ryi	KIER
17:40		Closing & Photo time		

List of Participants:

Name	Position	Affiliation
Dr. Hyung Chul Yoon	Principal Researcher, Chief of Clean Fuel Research Laboratory	KIER
Dr. Yonggyun Bae	Senior Researcher	KIMM
Dr. Se-Ho Kim	Associate Professor	Korea University
Dr. Keun Su Kim	Senior Research Officer	NRC
Dr. Maurico Ponga	Associate Professor	University of British Columbia
Dr. Shin-Kun Ryi	Principal Researcher	KIER

KIER-KIMM-NRC Joint Session on Ammonia As Hydrogen Carrier

Chair: Dr. Shin-Kun Ryi

Principle researcher, Korea Institute of Energy Research

Dr. Ryi received his Ph.D. from Korea University in 2008 and worked at University of British Columbia (UBC) in Canada as a post-doc. fellow. He is a principal researcher in the Hydrogen Convergence Materials Lab. at Korea Institute of Energy Research (KIER). His research interests are in the development of Pd-based hydrogen selective membrane and its application, such as membrane reactors. Recently, his research has been focused on the egg shell type catalysts for ammonia decomposition, natural gas steam reforming and abasement of Non-CO2 greenhouse gas such as N2O, HFCs, PFCs, NF3 and SF6. He published 75 international journals and ~120 patents. E-mail h2membrane@kier.re.k

KIER-KIMM-NRC Joint Session on Ammonia As Hydrogen Carrier

Speaker: Dr. Hyung Chul Yoon

Principle researcher, Korea Institute of Energy Research

Dr. Yoon is a chief and principal researcher in the clean fuel laboratory at KIER and a group leader of green ammonia synthesis. His primary research interests are in the area of electrochemical- and thermochemical- catalysts and processes for low-pressure and low-temperature synthesis of green ammonia. More than 60 peer-reviewed papers have been published in Appl. Catal., Catal, Chem Eng J, Energy Environ Sci., and other journals. He received his Ph.D. in mechanical engineering department from the University of California Davis in 2008. After his Ph.D., he joined the dept. of mechnical and process engineering at ETH Zurich, Switzerland as a postdoctoral reseacher. Before joining KIER in 2011, his main research areas were hydrogen production via steam/authtothermal reformation of hydrocarbon fuels and thermochemical production of solar fuels. E-mail: hyoon@kier.re.kr

Cost-effective Production and Utilization of Green Ammonia

Hyung Chul Yoon[a]

[a]*Korea Institute of Energy Research (KIER), 152 Gajeong-ro, Yuseong-gu, Daejeon 34129, Republic of Korea*

Green ammonia, recognized as a carbon-free chemical, is drawing substantial interest as both a hydrogen carrier and a carbon-neutral fuel. It boasts a hydrogen content of 17.6 wt% and a volumetric energy density of 3.2 kWh/L at a mere 8 bar pressure. Remarkably, it remains liquid at ambient temperature under 10 bar or at -33°C at atmospheric pressure, enabling it to store 1.7 times more hydrogen than the equivalent volume of liquid hydrogen at -253°C. Globally, the annual production of ammonia surpasses 180 million tons, with over 20 million tons transported by sea. This underscores the well-established land and maritime infrastructure for ammonia transport, highlighting its pivotal role in facilitating the trade of green hydrogen and fostering a carbon-neutral society. Its advantageous volumetric hydrogen content and energy density, when compared to liquid hydrogen, further emphasize its importance. Additionally, the requisite infrastructure for ammonia's storage and transport is already in place. To seamlessly integrate green ammonia into the current energy frameworks, it is imperative to focus on the development of technologies that allow for its cost-effective production, decomposition, and utilization. This presentation will delineate the Korea Institute of Energy Research (KIER)'s ongoing achievements and forward-looking views on devising economical methods for the production and application of green ammonia.

KIER-KIMM-NRC Joint Session on Ammonia As Hydrogen Carrier

Speaker: Dr. Yonggyun Bae

Senior Researcher, Dept. of Carbon-free Power Generation, KIMM

Dr. Bae received his Ph.D. degree of mechanical engineering from Yonsei University in 2021. He is a senior researcher of the department of carbon-free power generation (Eco-friendly energy conversion research division) at Korea Institute of Machinery and Materials (KIMM) since 2022. His research focuses on the multi-physical phenomena of electrochemical device, especially solid oxide fuel cell (SOFC), and the enhancement of performance and durability of electrochemical device using novel thermochemical design. Dr. Bae is conducting research on an integrated length scale ranging from nano-scaled reaction mechanism of reforming catalyst to meter-scaled heat and mass transfer phenomena of SOFC stacks. His research goal is to serve as a bridgehead that can overcome the difference between lab scale results and actual field devices based on mechanical engineering transfer phenomena. He authored 19 SCI(E) journal papers and 5 international registered patents. E-mail: ygbae@kimm.re.kr

Comprehensive study of carbon-neutral direct ammonia solid oxide fuel cell from electrode catalyst to stack in KIMM

Yonggyun Bae*[1], Dongkeun Lee[1], Jinyoung Park[1], Youngsang Kim[1], Sunyoup Lee[2]

[1]Department of carbon-free power generation, Korea Institute of Machinery and Materials(KIMM), [2]Department of eco-friendly mobility power, Korea Institute of Machinery and Materials(KIMM)

Unlike fossil fuels that emit carbon during combustion or energy conversion, ammonia is recognized as a fuel that is attracting attention as a carbon-free energy carrier. The Korea Institute of Machinery and Materials has selected high-temperature fuel cells as an energy conversion technology to efficiently convert ammonia, and is conducting research to develop original technology accordingly. Solid oxide fuel cells (SOFC), which are receiving great attention as a power source for distributed power generation, show potential as a next-generation eco-friendly power generation system based on their excellence in high electrical efficiency, fuel flexibility, and high-quality waste heat utilization. In particular, this technology has the great advantage of being able to directly utilize ammonia, a carbon-free hydrogen carrier, due to its high operating temperature (700-800°C). However, in the case of ammonia SOFC, not much is known about the fundamental phenomenon that occurs at the electrode catalyst, cell, and actual stack level. In this presentation, we will introduce the direct ammonia solid oxide fuel cell stack development currently being carried out at the Korea Institute of Machinery and Materials, and will share the basic data obtained to date.

KIER-KIMM-NRC Joint Session on Ammonia As Hydrogen Carrier

Speaker: Dr. Se-Ho Kim

Assistant Professor, Korea University

Dr. Se-Ho Kim is an emerging researcher in the field of advanced characterization, currently holding the position of assistant professor at Korea University. He obtained his doctoral degree from RWTH Aachen University in 2021, graduating summa cum laude, and completed his master's at KAIST in 2018 after finishing his undergraduate studies at the UBC in 2016. Dr. Kim has served as a project and deputy group leader at the Max-Planck-Institut für Eisenforschung, focusing on the microstructural evolution of steel and alloys. Recognized for his outstanding contributions to advanced microscopy, he was awarded the prestigious Müller Award. His research primarily explores the development of novel applications for extreme and sustainable materials, significantly contributing to materials characterization with over 50 published works.

Email: sehonetkr@korea.ac.kr

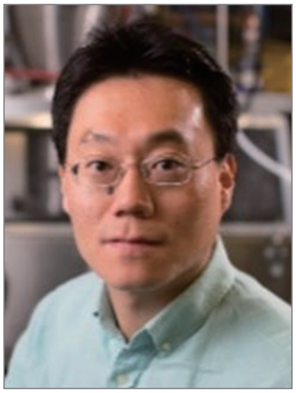
Green steel production using ammonia: the future of steel making

Se-Ho Kim[a], Yan Mab, Dierk Raabe[b]

[a]Korea University, Anam-ro 145 Seoul, Republic of Korea, [b]Max Planck Institute for Sustainable Materials GmbH, 40237 Düsseldorf, Germany

Iron making is the primary source of global carbon emissions, producing about 1.85 billion tons of steel and accounting for approximately 7% of annual global carbon emissions. While sustainability and green steel are often associated with hydrogen, the current methods of storing and transporting hydrogen require high pressures and low temperatures, which are both energetically and economically costly. In this talk, we will introduce a novel method for sustainable steel production using ammonia as a renewable and carbon-free reductant. We will compare ammonia-based direct reduction to hydrogen-based direct reduction, analyze the process characteristics and microstructural evolutions, and discuss the costs. Our findings indicate that green ammonia can effectively utilize intermittent renewable energy, facilitating a significant technological transition towards more sustainable iron and steel production.

KIER-KIMM-NRC Joint Session on Ammonia As Hydrogen Carrier



Speaker: Dr. Keun Su Kim

Senior Research Officer, Quantum and Nanotechnologies Research Centre, National Research Council of Canada

Dr. Kim is a Senior Research Officer at the National Research Council Canada and an Adjunct Professor at the Department of Mechanical Engineering, University of Toronto. He received his Ph.D. degree in Nuclear Engineering from Seoul National University in 2005. With growing interest in energy, materials, and the environment, his research interest has focused on the development of new plasma technologies for renewable energy production, advanced nanomaterial synthesis, and thermo-chemical conversion of low-valued materials into value-added materials. In 2009, he joined in NRC and has been working on the synthesis of low-dimensional nanomaterials including carbon and boron nitride nanotubes. Recently his research has been expanded to synthesis of multi-element nanoparticles (e.g., high-entropy alloy nanoparticles) as well as low-temperature plasma processing for surface treatment. Email: KeunSu.Kim@nrc-cnrc.gc.ca

Synthesis of high-entropy alloy nanoparticles

Keun Su Kim[a,b]

[a]Quantum and Nanotechnologies Research Centre, National Research Council Canada, Ottawa, Canada, [b]Department of Mechanical and Industrial Engineering, University of Toronto, Toronto, Canada

A high-entropy alloy nanoparticle (HEA NP) is a tiny melting pot of multiple metal elements – usually more than five – in roughly equal amounts. Whereas conventional alloys are made of less than three different elements, greatly limiting the alloy design opportunity. Homogenous blending of a large number of different elements in a small confined space also generates unusual functional properties. For example, the compositional diversity allows smart tuning of the catalytic performances (e.g., activity and selectivity) in clean energy applications, providing multielement adsorption sites. The overlap of d-bands of different transition metal elements can enhance the d-d interband transition, enabling the high light absorption in the entire solar spectrum. While HEA NPs became one of the most transformative concepts in current alloy design and significantly expanded the landscapes of alloy nanoparticles, controlled mixing of multiple immiscible elements in a tiny particle (< 100 nm) still remains a significant challenge. In this talk, I will introduce a recent breakthrough that reports an innovative way to continuously create HEA NPs from pure elemental metals. This achievement represents an important milestone towards the exploitation of HEA NPs in real-world applications, including structural alloys, catalysis, energy conversion/storage, EMI shielding and bio/plasmonic imaging.

KIER-KIMM-NRC Joint Session on Ammonia As Hydrogen Carrier

Speaker: Dr. Maurico Ponga

Associate Professor, University of British Columbia

Mauricio Ponga is an Associate Professor of Mechanical engineering at the University of British Columbia, Vancouver. His research is focused on modelling the mechanics of materials using atomistic-to-continuum models. Dr. Ponga develops and implements computational models using ab initio simulations and classical force fields that expand the realm of atomistic simulations and link information between smaller scales to build up a continuum understanding of materials at the macroscale.

E-mail mponga@mech.ubc.ca

Computational alchemical method for fast screening of catalytic high-entropy alloys

High-entropy alloys (HEAs) have shown a remarkable catalytic performance. One of the most challenging aspects of investigating HEA for catalytic applications stems from its inherent surface complexity, which significantly increases the number of active binding sites compared to conventional alloys. To tackle this issue, robust approaches must be developed to efficiently screen the configurational space of catalytic HEA materials. We investigated the navigation of the configuration space of HEA via the alchemical perturbation density functional theory (APDFT). One key advantage of APDFT is that a single-density functional theory (DFT) calculation of the adsorbate's binding energy (BE) can be used to predict many perturbed catalyst surface structures' BE at a negligible additional computational cost. This characteristic makes APDFT an appealing technique for exploring the configurational space of catalytic HEAs at significantly less computational cost than brute-force DFT calculations. Here, we assessed the accuracy of using APDFT to estimate the BE of the perturbed HEA surface and introduced a correction scheme for predicting APDFT errors based on the Gaussian process regression model.

KIER-KIMM-NRC Joint Session on Ammonia As Hydrogen Carrier

Speaker: Dr. Shin-Kun Ryi

Principle researcher, Korea Institute of Energy Research

Dr. Ryi received his Ph.D. from Korea University in 2008 and worked at University of British Columbia (UBC) in Canada as a post-doc. fellow. He is a principal researcher in the Hydrogen Convergence Materials Lab. at Korea Institute of Energy Research (KIER). His research interests are in the development of Pd-based hydrogen selective membrane and its application, such as membrane reactors. Recently, his research has been focused on the egg shell type catalysts for ammonia decomposition, natural gas steam reforming and abasement of Non-CO2 greenhouse gas such as N2O, HFCs, PFCs, NF3 and SF6. He published 75 international journals and ~120 patents. E-mail h2membrane@kier.re.kr

Eggshell-structured catalyst for ammonia decomposition

Eun-Han Lee[a,b], In-Heon Kwak[a,c], Segi Byun[a], Doo-Won Seo[a], Hyo-Jung Hwang[a], Hansung Kim[b], Shin-Kun Ryi[a]

[a]Korea Institute of Energy Research (KIER), 152 Gajeong-ro, Yuseong-gu, Daejeon 34129, Republic of Korea, [b]Department of Chemical and Biological Engineering, Yonsei University, 50 Yonsei-ro, Seodaemun-gu, Seoul 03722, Republic of Korea, [c]Department of Chemical and Biological Engineering, Korea University, 145 Anam-ro, Seongbuk-gu, Seoul, Republic of Korea

Catalysts can be classified as homogeneous, egg-white, egg-yolk, and egg-shell based on the location of the active metals. If the active metals were selectively located on the outer part of the support, the use of active metals could be reduced. From this perspective, egg-shell-type catalysts have been proposed for rapid reactions such as methane stream reforming, Fisher-Tropsch synthesis, purification of automobile exhaust gases, and selective hydrogenation of pyrolysis gasoline.
In this work, we focused on the effective manufacturing method of egg-shell-type catalysts. Before applying it to ammonia catalyst, which is structurally complicating, egg-shell-type Cu catalysts were prepared by three drying methods: oven drying (OD), vacuum oven drying (VOD), and rapid drying by heat gun (QD) after spray coating on the surface of γ-Al2O3 pellets, to apply to an N2O decomposition, which is similar catalysis mechanism with ammonia decomposition. From the EDS mapping analysis, although the same amount of 1% Cu was supported on the γ-Al2O3 support, the Cu content on the surface varied depending on the drying method and was in the highest order of QD- > VOD- > OD-catalyst because the quick drying by heat gun prevents the Cu solution from penetrating into the inner pores of the γ-Al2O3 support. From the direct N2O decomposition tests, we found that the QD-catalyst exhibited the highest deN2O activity because the Cu content on the surface of the γ-Al2O3 supports was the highest.
In the future, we plan to use these results to develop egg-shell structured catalysts for ammonia decomposition using Ru and non-precious metals.

YGF/YPF Alumni Workshop

Invitation Only

Time: 17:00 – 18:30, 16 June (Sunday) Canada, Mountain Daylight Time (MDT)

Place: KC 205

Sponsor: N/A

Organizer: Young Generation/Professional National (YGPN) and
The Association of Korean Canadian Scientists and Engineers (AKCSE)

Contact: Rose Oh (rose.oh@queensu.ca), YGPN (akcse.ygp@gmail.com)

Description: The YGF/YPF Alumni Workshop, taking place annually in different places across Canada, plays a critical role in reconnecting and establishing personal and professional relationships among alumni. The primary objectives of the workshop lie in strengthening the ties among alumni and providing a link to establish relationships between alumni and professionals. Through allowing the participation of YGP members who have not yet attended YGF/YPF the workshop also intends to share the valuable experiences gained by the alumni to encourage further participation within the YGP community in the future.

Program:

Time	Place	Topic	Facilitator	Affiliation
17:00–17:10	KC 205	Opening Remarks	Johnny Lee	University of Alberta
17:10–17:30		Icebreaker for Participants		
17:30–18:20		YGF/YPF Alumni Workshop: - Share YGF/YPF Experiences - Positives/Negatives of YGF/YPF - Recommendations for Program		
18:20–18:30		Closing Remarks		

YGP Project Showcase

Open Session

Time: 15:15–17:45, June 17 (Monday) Canada, Mountain Daylight Time (MDT)

Place: KC 205

Sponsor: N/A

Organizer: Young Generation/Professional National (YGPN) and
The Association of Korean Canadian Scientists and Engineers (AKCSE)

Contact: Rose Oh (rose.oh@queensu.ca), YGPN (akcse.ygp@gmail.com)

Description: The YGP Project Showcase is constructed with a binary goal. First, it aims to add in the career development of YGP members by research, thesis, or capstone presentations. Second, it encourages sharing career insights and expands interprofessional relationships, which are quintessential to YGP members' further growth and integration into academic and industrial fields. Researchers will present for 10 minutes followed by a 5 minute open-floor Q&A on the presented professional project or research. Each presentation will include a brief overview of the researchers' profession, their career development, a summary of the project, the magnitude of the project in the presenters' career, and future directions in the field. Attendees will assess and rank the presentations for awards.

Program:

Time	Place	Topic		Speaker	Affiliation
15:15–15:30		Opening & Introductions		Rose Oh	Queen's University, YGPN
15:30–15:45		Validity Assessment of a 3D Depth Sensor used in Movement Tracking Games for Children with Cerebral Palsy	Biomedical Engineering	Soowan Choi	University of Toronto
15:45–16:00		Understanding mental health factors to smoking cessation in the Republic of Korea: Cross-sectional findings from the 2023 ITC Korea Survey	Public Health	Yujin (Hanna) Kang	University of Waterloo
16:00–16:15		Visualizing RNA-Protein Relationships via Interaction Networks	Bioinformatics	Seungeun (Kristina) Song	Université de Sherbrooke
16:15–16:30	KC 205	Using a lattice structure coupon sample for build quality monitoring in metal additive manufacturing	Mechanical Engineering	Minsol Park	McGill University
16:30–16:45		Break			
16:45–17:00		Interpretable Artificial Intelligence in Crane Accident Cause Analysis using Shapely Additive Explanations: A Preliminary Study	Civil Engineering	Deokyeong Kim	Concordia University
17:00–17:15		Efficient Use of Molecular Functionality via Networking Strategy	Chemistry	Chang Wan Kang	McGill University
17:15–17:50		The Cardioprotective Effect of Caffeine: From bench to bedside	Medicine	Jae Hyun Byun	McGill University
17:30–17:45		Closing		Rose Oh	Queen's University, YGPN

YGP Project Showcase

Validity Assessment of a 3D Depth Sensor used in Movement Tracking Games for Children with Cerebral Palsy

Soowan Choi
PEARL, Bloorview Research Institute, Faculty of Biomedical Engineering, University of Toronto; Toronto ON, Canada

Background. This study evaluated the validity of a low-cost, three-dimensional camera (Persee+, Orbbec) for movement tracking, clinical assessment, and feedback in rehabilitation and exergaming applications relative to gold standard motion capture. Methodology. Twenty-eight participants (8 children, 20 adults) completed 14 exercises and 4 clinical assessments (i.e. 5 Time Sit-To Stand, 5TSST; Timed-Up-and-Go, TUG; One-legged Stance Test, Pediatric Reach Test) in the context of a novel exergame, Bootle Boot Camp, while their joint coordinate data were simultaneously collected by the Persee+ and a 12-camera, marker-based, infrared motion capture system (Motion Analysis Corp.). Metrics (e.g. trunk lateral lean <15 degrees) defining a quality repetition for each exercise were defined a priori through discussion and consensus by 7 experienced physiotherapists. The potential of the Persee+ to reliably count repetitions according to these quality metrics was described via precision, recall, and F1 scores, with ground truth established via the Motion Analysis system. For the clinical assessments, agreement between the Persee+ and the Motion Analysis system was determined via Pearson's correlation coefficient (r), root mean squared error (RMSE), Bland-Altman plots, and standard error of mean difference. Lastly, participants rated their perception of the exercise tracking on a 5 point smiley face rating scale. Results. Three of 14 exercises (seated knee extensions, seated star jumps and sit-to-stands) had F1 scores over 90% while 6 of 18 exercises (squat, VMO Dip, hip abduction, kicking, star jumps, seated hip flexion) had F1-scores between 80 and 90%. Five exercises (static lunge, hip flexion, hip extension, lateral step and backwards step) had F1-scores between 70 and 80%. Figure 1 presents the precision-recall for each exercise. Children agreed that the game accurately tracked their exercises with an average rating of 4 (SD 0.76) out of 5. Concurrent validity was excellent for the single leg stance ($r > 0.93$, RMSE = 0.57s for right leg grounded and 1.52s for left leg) when the leg was raised >15 cm from the ground. Concurrent validity was excellent for the TUG ($r = 0.95$, RMSE=1.91s), and the 5TSST ($r = 0.97$, RMSE=1.08s) and good for the Pediatric Reach Test ($r > 0.85$, MeanDiff: 0.002-0.03m) when participants reached laterally facing the sensor to avoid occlusion of the arm. Conclusion. Exercise counts were perceived to be reliable by participants and demonstrated good to excellent agreement with gold standard motion capture. Our results suggest that the TUG and the 5TSST can be reliably captured by the Persee+ as can the Pediatric Reach Test and the One-legged stance test with due consideration with respect to positioning of the body relative to the camera. The Persee+ sensor has high potential as a low-cost tool for monitoring exercise repetitions and for supporting clinical assessments in remote or tele-rehabilitation and exergaming applications. Integrated with gameplay, the sensor can potentially improve motor skills and overall quality of life through tailored and accessible therapies for children with cerebral palsy.

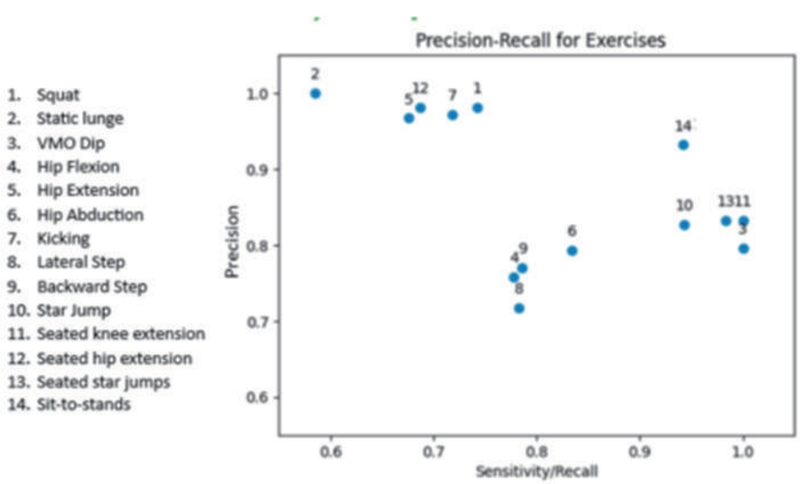


Figure 1: Precision-Recall for each clinical assessment and lower-body exercise movement.

YGP Project Showcase

Understanding mental health factors to smoking cessation in the Republic of Korea: Cross-sectional findings from the 2023 ITC Korea Survey

Hanna Kang
Faculty of Health, University of Waterloo; Waterloo ON, Canada

Smoking is the leading cause of preventable death in the world and in the Republic of Korea, with high daily smoking rates among men that account for a considerable portion of deaths and economic burdens. Recognizing this, the government has put considerable and sustained investments in smoking cessation. The International Tobacco Control Policy Evaluation Project (ITC Project) has partnered with the Korean Health Promotion Institute (KHEPI), Ministry of Health and Welfare, to conduct the current national cohort study in Korea. As a research assistant with the ITC Project for two years, I was given the opportunity to study the correlation between mental health and quitting cigarette smoking in Korea, under their supervision.

Studies have found that cigarette smokers who have depression are more motivated to quit smoking, and more likely to make a quit attempt, but are less successful staying quit than those without depression. The vast majority of these studies on depression and smoking have been conducted in Western Countries. Limited research exists in East Asian countries including Korea, where the conceptualization of depression is different and its social acceptability is considerably lower.

This project conducts analyses of the ITC Project's national cohort data from the most recently completed Wave 3 (KRA3) survey, which utilized web interviews (Computer-Assisted Web Interviews). The analyses measure and understand the relationship between depression and key variables associated with smoking cessation – not only quit attempts, but also the known precursors and correlates of cessation, which include nicotine dependence, interest in quitting, intentions to quit, and efficacy to quit. The survey also includes questions on beliefs about the harmfulness of smoking, social support for quitting, and key validated measures of depression (the CES-D). Regression models (multinomial or logistic regression, depending on the nature of the outcome variable) will be conducted on weighted data, controlling for key covariates including sex, education and income. This will also allow the examination of relationships between depression and cessation-relevant variables through equity analyses – whether the relationship differs among low-income/education individuals relative to high-income/education individuals. We also plan to examine the use of smoking cessation services because of the government's interest in collecting data on its vast smoking cessation program.

While the final results are pending; rigorous statistical analysis aims to uncover the association between mental health factors and smoking cessation outcomes, making us among the first to explore this complex interplay in Korea. In addition to leading this project, my contributions to the ITC Project over the two years involved researching smoking policies in Korea, checking the translation of surveys with cultural considerations, facilitating communication with the KHEPI on their visit, and drafting sections of the Korea National Report on tobacco landscape. Overall, my work will highlight the importance of understanding the role of mental health in smoking cessation efforts and will serve as an evidentiary foundation in informing future action and interventions in the area of smoking cessation. Ultimately, this will contribute to reducing smoking prevalence and improving public health outcomes in Korea.

YGP Project Showcase

Visualizing RNA-Protein Relationships via Interaction Networks

Sungeun (Kristina) Song
Faculty of Medicine and Health Sciences, Université de Sherbrooke; Sherbrooke QC, Canada

Cellular processes often depend on the intricate interplay between RNA and proteins, where each entity can mutually influence and regulate the other within a complex network of interactions. Box C/D small nucleolar RNAs (snoRNAs) constitute a class of small RNA molecules primarily guiding chemical modifications of other RNAs by forming functional complexes with specific core RNA-binding proteins (RBPs). While additional roles have been proposed for box C/D snoRNAs, few examples have been validated, and the underlying molecular mechanisms remain elusive. Some of these noncanonical functional roles are believed to be mediated by interactions with RBPs that were not previously characterized as core snoRNA binders. This suggests that snoRNAs can play a wide range of functional roles in gene regulation by interacting with various RBPs, thereby exerting a combined regulatory effect on their target molecules. To study the extent of these interactions and understand their functional consequences, I created the snoRNA-RBP interactome, an interaction network built through de novo analysis of high-throughput and computational RNA and protein interaction datasets. The interactome is currently visualized using Cytoscape, a software platform known for its capability to visualize and analyze complex networks, with future plans to develop it into a user-friendly web server. This extensive snoRNA-RBP interactome encompasses various modes of snoRNA and RBP interactions, including both direct binding and indirect interactions, reinforcing their concerted role in gene expression regulation. Notably, significant subnetwork analyses have unveiled potential regulatory complexes, promising a paradigm shift in our understanding of RNA biology and the collaborative orchestration of essential life processes by RNAs and proteins. Consequently, the snoRNA-RBP interactome will establish a fundamental framework for characterizing the snoRNA-RBP relationship and allow other RNA researchers to easily explore networks involving their snoRNAs and proteins of interest.

YGP Project Showcase

Using a Lattice Structure Coupon Sample for Build Quality Monitoring in Metal Additive Manufacturing

Minsol Park
Faculty of Engineering, McGill University; Montreal QC, Canada

Additive manufacturing (AM), particularly Laser Powder Bed Fusion (L-PBF), has revolutionised the manufacturing industry by offering enhanced geometrical design freedom, part integration, and reduced production lead time. However, the presence of manufacturing defects during the L-PBF process poses challenges to the mechanical properties and build quality of the manufactured parts. Traditional quality assessment methods involve costly and time-consuming manufacturing, destructive or non-destructive analysis and mechanical testing. To address these challenges, this research proposes a novel approach for quality control using lattice coupon samples instead of solid mechanical test specimens. Lattice structures, comprising repetitive unit cells with struts and nodes, serve as effective indicators of build quality. The smaller size and volume of the lattice coupon samples result in significant cost and time savings compared to traditional test samples. The high sensitivity of lattices to parameter deviations enables their use in assessing build quality within an L-PBF system. These coupon samples provide reliable indicators of structural integrity and long-term performance of AM parts, simplifying the quality control process and optimising L-PBF manufacturing. Additionally, this research develops a Finite Element (FE) model for AM lattice structures under quasi-static compression, offering a powerful tool for the virtual testing of components, enabling the study of their mechanical behaviour without the need for costly physical prototypes. The FE model incorporates defect states of the AM lattice structures observed from computed tomography (CT) scanning. By taking input from the CT scans, the prediction of mechanical properties of lattices with a high accuracy rate of 83 % was achievable. This model represents a promising tool for developing manufacturing defect-incorporated lattice representative volume elements (RVEs) for use in the design of AM parts incorporating lattice regions. By replacing complex lattice structures with solid-infilled features in the form of RVEs in simulations, the computational expense can be significantly reduced. This approach allows for efficient exploration of the mechanical behaviour of latticed AM components while accounting for manufacturing defects, offering insights for design optimisation and material selection. Furthermore, this research aims to leverage the developed FE model and interpolation methods to predict the mechanical properties of lattice structures, reducing the reliance on physical printing and CT scanning. By utilising these computational tools, accurate estimations of the mechanical properties can be achieved, minimising the need for extensive experimental testing and CT scan. Overall, this research contributes to the advancement of quality control in AM by introducing lattice coupon samples as indicators of build quality and developing computational models for predicting their mechanical properties. These innovations lead to improved efficiency and optimisation of L-PBF manufacturing processes, benefiting industries that rely on AM technology.

YGP Project Showcase

Interpretable Artificial Intelligence in Crane Accident Cause Analysis using Shapely Additive Explanations: A Preliminary

Deokyeong Kim
Department of Building, Civil, and Environmental Engineering, Concordia University; Montreal QC, Canada

Crane accidents present significant risks to both workers and property, necessitating thorough investigation and prevention measures. Despite advancements in safety protocols, identifying crucial risk factors remains challenging. This study addresses the need for comprehensive risk assessment in crane operations, aiming to enhance safety practices and minimize potential hazards. Our objective is to develop predictive models for estimating property and equipment damage resulting from crane accidents and investigate the causing factors using explainable Artificial Intelligence (AI).

Our research uses a dataset encompassing crane accidents that occurred from 1983 to 2017, comprising 701 crane accidents from the construction field. The dataset, stored in a Microsoft Access database, includes 108 features, including the accident type, capacity, operational factors, as well as contextual variables, such as site location and the number of injuries or deaths.

To analyze the dataset, we employed an explainable AI method, specifically SHAP (SHapley Additive exPlanations), to analyze the importance of features contributing to crane accidents. In order to augment the given raw dataset, historical weather data was additionally extracted through a publicly available API. We conducted exploratory efforts to adjust input parameters through feature engineering, aiming to evaluate the robustness of our findings. This involved the transformation of textual data into categorical, or ordinal formats, utilizing techniques such as one-hot encoding for categorical variables, to effectively represent them in the machine learning models. Subsequent experimentation involved various combinations of input parameters, including training models using solely numeric and ordinal data, as well as other configurations such as using only weather (numeric) data, combining ordinal and numeric data, or combining ordinal and categorical data. We encountered challenges due to the wide range of estimated property and equipment damage values. To address this issue, we preprocessed the dataset by categorizing property and equipment damage into specific ranges, such as (0 to 10,000) and (10,000 to 100,000). This preprocessing step aimed to better understand the relationships between predictors and outcomes. Our analysis revealed that weather data significantly influenced the predictions, resulting in improved R2 values. This finding underscores the importance of weather data in assessing the extent of property and equipment damage in crane accidents.

The implications of this research extend to both academic and industrial domains. Academically, our study contributes to the advancement of knowledge in crane safety and risk assessment methodologies, through the application of AI techniques for predictive analytics. Industrially, the insights gained from our research can inform the development of more effective safety protocols and training programs, reducing the incidence of crane accidents and their associated costs.

In conclusion, this study contributes to the ongoing efforts to improve safety in crane operations by providing a data-driven approach to risk assessment. By identifying key predictors of crane accidents, our research contributes to empower stakeholders with the knowledge and tools needed to prevent accidents and protect workers and property in industrial settings.

YGP Project Showcase

Efficient Use of Molecular Functionality via Networking Strategy

Chang Wan Kang
Department of Chemistry, McGill University; Montreal QC, Canada

Introduction: The majority of substances around us are composed of tiny building blocks, i.e. molecules, which are identifiable as the smallest units of chemical properties. Each molecule exhibits distinctive characteristics, yet they remain indistinguishable on a macroscopic scale, requiring exploration at the molecular level. In general, small molecules are chemically unstable, decomposed to lose their original properties by external stimuli, e.g. light/heat. Even if they are chemically stable, they are physically less stable, transformed to the other phase, e.g. liquid/gas, under those of stimuli. Given that instability of small molecules limits efficient use of their function, chemists have devised a new method, i.e. molecular networking, which links each molecule, enabling the enhancement of their chemical and physical stability. Notably, networking of molecules creates void spaces within materials, typically only a few nanometers in size, leading to high surface areas. This feature distinguishes it from conventional plastics, as the functional groups in the chemical structures are exposed to the void spaces, thereby facilitating the efficient utilization of molecular functions. However, molecular networking leads to (i)defect-rich materials and (ii)irregular shapes with broad size distributions, due to the initiation of linking at multiple location, i.e. simultaneous reactions. This project aims to address these limitations by exploring new synthetic methods for achieving defect-free materials or controlling their shapes. If realized, such molecular networks (MNs) could facilitate the utilization of their functional properties by tailoring the chemical structures to suit their potential applications.
Methods: There are two plausible solutions for the challenges: (i)defect-repair mechanism in wet chemical reaction, where the reversibility of chemical bonds allows to 'undo' formed defects, eventually leading to energetically favorable states. (ii)Surface-templated networking, which involves coating specific substrates to control their shape.
Results: I am currently leading the project for challenge(i) as a postdoctoral researcher at McGill University. To date, synthesis of defect-free MNs through reversible reactions has been successfully achieved immediately after synthesis. However, these MNs are prone to decomposition in humid environments due to their inherent 'reversibility'. Therefore, it is crucial to explore new methods to lock those of chemical structures to prevent reverse reaction. Prior to commencing postdoctoral research at McGill University, I developed new synthetic methods for shape-controlled MNs (SC-MNs) using various templates over PhD at Sungkyunkwan University. This project for challenge(ii) led to authorship of 16 papers as a (co)first author in the fields of energy and environmental technologies. Overall, SC-MNs offer several advantages over conventional plastics. Uniform particle sizes and atom-economical synthesis of SC-MNs enable not only production of more particles using the same amount of building blocks, but also enhancement of reaction rates through easy reagent transfer into MNs.
Conclusion: The projects show that molecular networking can enhance their chemical/physical stability and facilitate the utilization of functional sites in MNs. In the aspect of applications, the benefits of MNs can be applied as new class of materials for the enhancement of the functional performance. In this project showcase, I will cover details of results and the perspectives of networking strategies in chemistry.

YGP Project Showcase

The Cardioprotective Effect of Caffeine: From bench to bedside

Jae Hyun Byun
Faculty of Medicine and Health Sciences, McGill University; Montreal, QC, Canada

Cardiovascular disease (CVD) remains the leading cause of death worldwide, and has had catastrophic effects on human health, economics, and society. A major driver of CVD progression is increased circulating low-density lipoprotein (LDL) cholesterol levels, leading to countless CVD-related deaths from events consisting of heart attacks and strokes. Recent advancements in therapies available for the management of LDL cholesterol levels in the context of CVD have led to the characterization of the proprotein convertase subtilisin kexin type-9 (PCSK9). PCSK9 is a hepatocyte-secreted circulating factor capable of inducing the degradation of cell-surface LDL receptor (LDLR), a receptor well-known to enhance the uptake of LDL cholesterol from the circulation. Based on these seminal discoveries, the inhibition of PCSK9 became an attractive therapeutic target for patients at high risk of CVD, as it enhances the clearance of LDL cholesterol from the circulation by increasing the expression of the LDLR. In large, randomized controlled trials, administration of anti-PCSK9 antibodies yielded an unprecedented 60-70% reduction of LDL cholesterol levels, and has recently undergone FDA approval for its use in the clinical setting.

Caffeine or 1,3,7 trimethylxanthine, is best known as a stimulant alkaloid of the central nervous system commonly found in widely consumed beverages such as coffee and tea. Current evidence suggests that caffeine reduces CVD risk and progression, but its mechanism by which this occurs has not yet been uncovered. Herein, we sought to investigate whether caffeine can reduce circulating LDL cholesterol levels by inhibiting the expression of PCSK9.

I am an MD-PhD student at McGill University aspiring to become a clinician scientist by undergoing medical training while completing a PhD doctoral degree, striving to understand how bench-side, wet lab research contributes to the clinical bedside care that we provide for our patients. By understanding the mechanism in which caffeine can reduce CVD risk through bench-side research, we have since then, used structure/activity relationships (SAR) to generate more than 300 original, novel compounds which aim at significantly lowering circulating LDL cholesterol by reducing PCSK9 levels in our clinical patients.

YGP Skill Share Workshop

Open Session

Time: 13:00–15:00, June 18 (Tuesday) Canada, Mountain Daylight Time (MDT)

Place: KC 205

Sponsor: N/A

Organizer: Young Generation/Professional National (YGPN) and
The Association of Korean Canadian Scientists and Engineers (AKCSE)

Contact: SunMin Park (spark2@mta.ca), YGPN (akcse.ygp@gmail.com)

Description: This session serves as a workshop for YGP participants to share soft skills typically gained through first-hand exposure and personal experience in academia and/or industry. It will feature presentations covering different soft skills, followed by interactive workshop activities to engage the audience and promote reflection of the shared skills.

Program:

Time	Place	Topic	Speaker	Affiliation
13:00–13:05	KC 205	Opening & Introductions	SunMin Park	Health Canada, YGPN
13:05–13:30		Don't Lose Sight: How to Build a Personalized Guideline for Self-Motivation	Sienna Park	McMaster University
13:35–14:00		Communicate with Your Audience: Preparing Effective Presentations	Youhan Jung	University of Waterloo
14:05–14:30		Understanding the Implications of Diversity in Canada	Haewon Jung	McMaster University
14:30–15:00		Closing	SunMin Park	Health Canada, YGPN

YGP Skill Share Workshop

Don’t Lose Sight! How to Build a Personalized Guideline for Self-Motivation

Sienna Park
McMaster University; Hamilton, ON, Canada

Self-motivation is the fundamental skill for continuous progress and resilience while pursuing academic and career goals. When facing daunting tasks or overwhelming deadlines, the drive to move forward can be easily overshadowed by burnout. Therefore, maintaining motivation becomes easier once one understands their intrinsic motivators. Instead of overwhelming oneself until the goal is achieved, utilizing a self-motivation strategy can be a shortcut to completing the tasks.

My ongoing journey as a pre-dental student is constantly being challenged by balancing a high volume of academics and extracurricular. Knowing my strengths and setting my lifestyle following Maslow’s Hierarchy of Needs helped a lot to plan out my day-to-day life and keep my motivation high. I have realized that developing a personalized motivation tool can be a compass that can be used flexibly for both long-term and short-term goals.

The workshop will begin by providing insights on self-motivation through the lens of Maslow’s Hierarchy of needs, highlighting the journey towards self-actualization. The overview will enable attendees to connect each criterion to their personal experiences. The goal is to provide a deeper understanding of how fulfilling basic needs can significantly impact their motivational levels, especially in high-stress academic or career paths.

Example case studies will be presented during the activity. The fictional case studies consist of people aiming to reach the self-actualization stage. In groups of 4-5, the attendees will analyze the fictional character’s situation and identify their obstacles while reaching their full potential. Applying the principles from Maslow’s Hierarchy of Needs, attendees will identify multiple factors that the fictional character can modify to reach their maximum motivation. Subsequently, attendees will take turns proposing the steps to be taken by the fictional character.

By the end of the workshop, the attendees will be able to objectively analyze the contributing factors of self-motivation, and decide the steps to take to maximize their potential when working towards the goal. Attendees can apply the personalized guideline strategy to reflect on their intrinsic motivators at any point in their career. Ultimately, this workshop embodies a hope that the motivational strategy aids the progress of self-discovery and reaching one’s fullest potential.

YGP Skill Share Workshop

Communicate with Your Audience: Preparing Effective

Youhan Jung

University of Waterloo; Waterloo, ON, Canada

Challenging myself has always been a trait that I held subconsciously. Whether it is to learn the guitar or to create a wacky personal portfolio website, I was always up for trying new things regardless of whether I liked it or not because I understood that the experiences I gained would benefit myself in the future. Among these experiences, the skills obtained while preparing a presentation in front of a large audience has been one of my most treasured assets that I would incorporate in professional settings.

Though it may seem far-fetched, I noticed that preparing to present ideas for settings in group projects, grade representative speeches, and school TEDx talks requires a high involvement of critical thinking. Components such as the target audience, context of modern society, and other presentations before or after my own presentation are some of the factors that are considered when preparing a presentation to establish a stronger connection with the audience for effective communication. As such, my skill share workshop will focus on analyzing these components of effective communication in terms of a presentation in front of an audience regardless of size.

More specifically, the oral presentation will focus on the entire preparation process of an effective presentation and how it is prepared. The structure of the oral presentation will be divided into four main sections: the context of the presentation, brainstorming the idea, preparing the visual presentation, and further applications of the skills explained. Each section will include strategies and pointers that increase the effectiveness of communication for a presentation, supported by analyses based on my personal experience.

The workshop will focus on how to structure a presentation with effective communication in mind. Firstly, a sample context of the presentation and a sample script will be provided, giving attendees enough information to properly structure the presentation. Then, the attendees are prompted to select a section within the sample script to focus on structuring. Finally, everyone will discuss and apply the strategies from the oral presentation to structure the chosen portion of the sample script. By the end of this activity, attendees will be able to better absorb the strategies presented, and possibly incorporate their own personal strategies to improve it for their own use in the future.

The essential goal of this skill share workshop is to improve the quality of a presentation, but the extended goal is to give insight on how communication in other mediums can be prepared using the critical thinking involved in preparing a presentation. Writing a resume, conducting an interview, and even writing abstracts for a workshop require a full understanding of components such as the target audience and context of communication that should be considered for effective communication. Therefore, attendees will gain skills that can be applied in other professional areas and possibly gain the ability to develop different strategies for different mediums of communication.

YGP Skill Share Workshop

Understanding the implications of diversity in Canada

Haewon Jung
McMaster University; Hamilton, ON, Canada

Understanding the implications of diversity in Canada

The intended learning outcomes for the session are:

1. Reconstruct the current understanding of racial and ethnic diversity in Canada.
2. Critically evaluate the relationship between race and representation of racial groups.
3. Develop a connection between racial diversity and its influence on the STEM community.

As I am a first generation who moved from Korea, I found it difficult to grasp what it means to study STEM in a country with diverse racial groups. Until grade 5, I lived in Korea where the majority of the population is of the same race and same culture, which is vastly different from the melting pot that is Canada. From early post-secondary education, I was interested in exploring the racial diversity in Canada and pursued my education in public health and social determinants of health. Throughout my undergraduate at McMaster University, I studied extensively on subjects that explored the genetic implications of race in medicine, racial equities in science and research, and communicating science to audiences from various educational and cultural backgrounds. During the Winter semester of 2024, I hosted an hour-long seminar class in one of my courses to teach about the influence of government policy on racial disparity in health outcomes in North America. My academics equipped me with knowledge not only on the racial disparity in health outcomes but also on race as a whole and how it impacts STEM.

AKCSE YGP members have diverse backgrounds from Korean international students to second-generation Korean Canadians. Just as I struggled to transition from a monocultural to a multicultural country, I believe many AKCSE YGP are struggling to do so as well.

The skill-sharing activity will be hosted in a case study format. During the first 8 minutes, the participants are split into groups of 5-6 and provided with real-life scenarios that explore the implication of racial diversity in various contexts. The case studies can be categorized into three groups:

1. Diversity in STE
2. Research Equity
3. Racial representation in society

Case studies under Diversity in STEM will examine the contributions, challenges, and opportunities for individuals from diverse racial backgrounds in STEM academia and professional settings; Research Equity will explore racial diversity and ethical considerations that researchers should make throughout their research - from design to data interpretation; Racial representation in society will address broader societal issues related to systemic inequities and the importance of representation in shaping public discourse and policy decisions.

YGP Leadership Workshop for chapter representatives

Open to YGP chapter representatives

Time: 15:30–18:00, June 18 (Tuesday) Canada, Mountain Daylight Time (MDT)

Place: KC 205

Sponsor: N/A

Organizer: YGPN (Young Generation/Professional National)
and AKCSE (The Association of Korean Canadian Scientists and Engineers)

Contact: Yongjoo Han (yn585974@dal.ca), YGPN (akcse.ygp@gmail.com)

Description: The Leadership Workshop is a skill-building workshop for YGP Chapter Representatives. In this leadership workshop, chapter representatives will have the opportunity to communicate and ask questions to the HQ.
After the Q&A session, chapter representatives will be divided into small groups with a moderator (YGPN executive member) in groups. Chapter representatives will reflect on their chapter's overall performance during last year and share it with other chapter representatives. Chapter representatives will learn from each other by discussing challenges they faced during their leadership roles and share helpful tips for future chapter representatives during the discussion. This opportunity will encourage them to efficiently lead their chapter with a high level of confidence for the upcoming year. Also, chapter representatives will explore different traits to be a successful leader by participating in case study activities and leadership presentations prepared by the YGPN team.

Program:

Time	Place	Topic	Speaker	Affiliation
15:30–15:40	KC 205	Opening & Introductions	Yongjoo Han Hannah Cho	YP Atlantic Canada, YGPN YP Quebec, YGPN
15:40–16:10		Small group discussion with moderator	Chapter representatives from various chapters	AKCSE YGP
16:10–17:10		First step of successful leader (Interactive presentation)	Yongjoo Han	YP Atlantic Canada, YGPN
17:10–17:30		Case study activity within small groups	Chapter representatives from various chapters	YP Atlantic Canada, YGPN
17:30–17:55		Q&A session with Dr. Kim	Yongjoo Han Dr. Seonghwan Kim	YP Atlantic Canada, YGPN University of Calgary
17:55–18:00		Wrap up and Conclusion	Yongjoo Han	YP Atlantic Canada, YGPN

2024 AKCSE YGP Program

Chair: Johnny Lee

Undergraduate Student, Faculty of Engineering, University of Alberta

Johnny is currently an undergraduate student in his 4th year of Mechanical Engineering Co-op at the University of Alberta, scheduled to graduate in 2024. He has worked as a Co-op student at ATCO Gas under the Project Services group.

Since 2020, Johnny has contributed to the AKCSE Young Generation and Professional (YGP) group as President of the AKCSE Young Generation & Professional National (YGPN) group. E-mail: jslee@ualberta.ca

Vice-Chair: Mina Lee

Clinical Assistant, Waterfront Skin & Laser

Mina received her Bachelors of Science with a major in Biology and minor in Family Studies from University of British Columbia. She currently works as a Clinical Assistant at Waterfront Skin & Laser dermatology clinic.

Mina has contributed to the AKCSE Young Generation and Professional (YGP) group as President of the University of British Columbia YG Chapter in 2022, and is currently serving as an executive committee member of Mainland British Columbia YP Chapter and Vice President of the AKCSE Young Generation & Professional National (YGPN) group.
Email: dlalsk0324@gmail.com

2024 AKCSE YGP Program

Organizer: Jisoo Kang

Project Engineer, TC Energy

Jisoo received her Honours BSc. in Chemical Engineering from the University of Calgary. She currently works as a Project Engineer for Canada Gas projects at TC Energy. Prior to her current role, Jisoo worked at Schlumberger to develop solutions for oilfield production challenges and provided field technical support in the upstream energy industry.
Since 2014, Jisoo has contributed to the AKCSE Young Generation and Professional (YGP) community as President of the University of Calgary YG Chapter, President of the Southern Alberta YP Chapter, Vice President of YGP National, and is currently serving as a YGPN Executive. E-mail: jisookang95@gmail.com

Organizer: Hannah Cho

Master-PhD Student, Faculty of Dental Medicine and Oral Health Sciences, McGill University

Hannah is an MSc-PhD student at McGill University. She completed her Honours BSc.&Arts in Cognitive Science at McGill University. Her research interests include painful autoimmune diseases and the development of painful autoantibodies. Prior to pursuing her graduate degrees, she has been working on neuroimaging techniques on aggregations of alpha-synuclein, which is neuropathologically linked to Parkinson's disease.
Hannah has contributed to the AKCSE Young Generation and Professional (YGP) group as President of the McGill University YG Chapter from 2022 to 2023, and is currently serving as co-president of YP Quebec Chapter and an executive committee member of YGP National group. Email: hannah.cho2@mail.mcgill.ca

2024 AKCSE YGP Program

Organizer: Jonathan Kim

Undergraduate Student, Faculty of Medical Sciences, Western University

Jonathan is a fourth-year undergraduate student enrolled in the Honours Specialization of Interdisciplinary Medical Sciences with a Major in Physiology at Western University.

Jonathan has contributed to AKCSE as a co-founder and co-president of the 17th YG Chapter, Western University YG chapter since 2022. Now he is contributing as a Senior Advisor of the Western YG chapter and as an executive member of the YGP National group.
Email: bkim349@uwo.ca

Organizer: Rose Oh

Undergraduate Student, Faculty of Health Sciences, Queen's University

Rose is a third-year undergraduate student enrolled in the Health Sciences Honours program at Queen's University with the Global and Population Health learning track.

Rose has contributed to AKCSE since 2021 and served as the 2023-2024 co-president of the YG Queen's University chapter. During her journey, she has attended YGF, CKC as a chapter representative and a technical session speaker, and received the 2023 KCSSF scholarship. She is a current executive member of the Young Generation and Professional (YGP) group.
Email: rose.oh@queensu.ca

2024 AKCSE YGP Program

Organizer: Jane Lee

Undergraduate Student, Faculty of Engineering, University of Alberta

Jane is a 5th-year undergraduate student studying Civil Engineering at the University of Alberta, more specifically Structural Engineering and Construction Management. Outside of school, she has been involved in the University of Alberta YG chapter as an executive member, Vice President, and President. She is now a YGPN executive member, working behind the scenes of CKC 2024.

Email: jungha@ualberta.ca

Organizer: SunMin Park

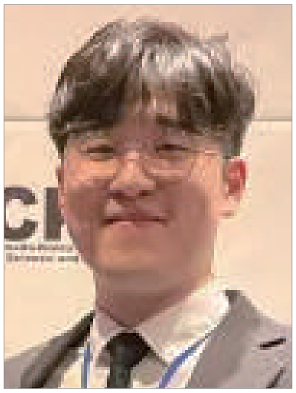
Policy & Operations Advisor, Health Canada
Incoming Master Student, Department of Chemistry and Biochemistry, Mount Allison University

After completing her B.Sc. in Honours Biology at Mount Allison University, SunMin now works on Parliament Hill advising Canada's Minister of Health in Cannabis and Controlled Drugs & Substances policy files as well as in strategic planning for regional operations. In the fall, she will also begin her M.Sc. studies where she will build upon her honours research to examine the role of orphan G protein-coupled receptors and their signaling in non nutritive sweetener-mediated metabolic disturbances in the GI tract.

SunMin is a member of YP Atlantic, a YGF alumni, and has been an executive member of YGP National since 2024.

Email: sunmin.park@hc-sc.gc.ca

2024 AKCSE YGP Program



Organizer: Yongjoo Han

CT, Interventional Radiology Technologist, IWK Health Centre

Yongjoo graduated from Dalhousie University with a Radiological Technology degree in 2023. He is currently working at the IWK Health Centre which is a pediatric healthcare environment. Yongjoo is passionate about providing high-quality care to pediatric patients with severe conditions, and always seeking opportunities to leave a positive impact on his patients.

Yongjoo joined AKCSE for the first time in 2019. After 4 years of contribution as an active member of AKCSE, Yongjoo served as a president of YP Atlantic during 2023-2024 and is currently dedicated to the YGPN event planning executive team.
E-mail: yn585974@dal.ca

Organizer: Seunghee Lee

Data Analyst, CIBC

Seunghee received her Bachelors of Science with a major in Computing Science from University of Alberta. She currently works as a Data Analyst at CIBC.

Seunghee had been involved in the University of Alberta YG chapter as an executive member for 3 years and she has been a Vice President of YP Edmonton and a YGPN executive member since 2024.
E-mail: shmg0204@gmail.com

CKC 2024 Award List

- Commendation from the Minister of Science and ICT (MSIT), Korea
- KOFST Scientist of the Year Award
- KOFST Engineer of the Year Award
- 2024 AKCSE Best Service Award
- 2024 AKCSE Early Achievement Award
- 2024 AKCSE WiSE Award
- 2024 AKCSE Best Young Professional Member Award
- 2024 AKCSE Best Student Member Award
- 2024 AKCSE Best Chapter Award
- 2024 AKCSE Best Young Professional Chapter Award
- 2024 AKCSE Best Young Generation Chapter Award
- 2024 AKCSE Best CKC Volunteer Award
- 2024 AKCSE Canada-Korea Collaboration Award

CKC 2024 Scholarship List

- SK Scholarship in Life Sciences
- Goryeo Medical Foundation Scholarship in Life Sciences
- Green Cross Scholarship
- CS WIND Scholarship
- KOGAS Canada Energy Ltd. Scholarship
- Hana Bank Canada Scholarship
- Lee Kyungsukun Scholarship
- KONA Scholarship
- KCSSF Scholarship

Organizing Committee

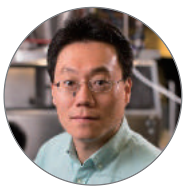
Conference Co-Chair: AKCSE President

Seonghwan Kim
University of Calgary
president@akcse.org

Conference Co-Chair: KOFST President

Tai Sik Lee
KOFST
taisik.lee@kofst.or.kr

AKCSE Vice President: Gov. Affairs & Public Relations



Keun Su Kim
National Research Council Canada
vice.president@akcse.org

AKCSE Vice President: Next Generation & E.D.I.

Regina Lee
York University
reginal@yorku.ca

AKCSE Vice President: Funding & Finance

Hyo-Jick Choi
University of Alberta
treasurer@akcse.org

AKCSE Vice President: Operations

Yong Hoon Kim
University of Windsor
kim523@uwindsor.ca

Technical Session Chair

Yong Hoon Kim
University of Windsor
kim523@uwindsor.ca

CKC Operations

Jeong-Ae An
AKCSE Administrative Manager
Info@akcse.org

CKC Operations

Aram Cho
AKCSE Executive Assistant
ckc@akcse.org

Organizing Committee

Local Committee

Chair

Keekyoung Kim
University of Calgary
keekyoung.kim@ucalgary.ca

Finance

Jongbok Lee
University of Calgary
jongbok.lee@ucalgary.ca

General Affairs

Jihyun Lee
University of Calgary
jihyun.lee@ucalgary.ca

General Affairs

Kangsoo Kim
University of Calgary
kangsoo.kim@ucalgary.ca

Registration

Jenny Shin
University of Calgary
jaemyung.shin@ucalgary.ca

Volunteer

Kinam Hyun
University of Calgary
kinam.hyun@ucalgary.ca

Volunteer

Youngbin Kim
University of Calgary
youngbin.kim1@ucalgary.ca

YGPN Program Organizing Team

Chair / YGPN President

Johnny Lee
University of Alberta
johnnylee180@gmail.com

Vice Chair / YGPN Vice President

Mina Lee
University of British Columbia
dlalsk0324@gmail.com

CKC YGP Program Lead

Hannah Cho
McGill University
hannah.cho2@mail.mcgill.ca

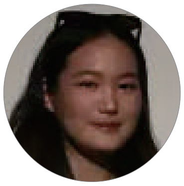
Jane Lee
University of Alberta
janeljh17@gmail.com

Yongjoo Han
IWK Health Centre
yn585974@dal.ca

YGP Events & Initiatives

Jisoo Kang
TC Energy
jisookang95@gmail.com

SunMin Park
Health Canada
spark2@mta.ca



Yeonjae Oh
Queen's University
rose.oh@queensu.ca

YGP Communications & Outreach

Jonathan Kim
Western university
jonathankim.work@gmail.com

Seunghee Lee
CIBC
shmg0204@gmail.com

Legend

keit
한국산업기술기획평가원
Korea Planning & Evaluation Institute of Industrial Technology

KERI 한국전기연구원
KOREA ELECTROTECHNOLOGY RESEARCH INSTITUTE

Lead

부산광역시
BUSAN METROPOLITAN CITY

부산정보산업진흥원
Busan IT Industry Promotion Agency

Presenting

ETRI 한국전자통신연구원
Electronics and Telecommunications Research Institute

IITP 정보통신기획평가원
Institute of Information & Communications Technology Planning & Evaluation

Presenting

KIER 한국에너지기술연구원
KOREA INSTITUTE OF ENERGY RESEARCH

KIMM 한국기계연구원
KOREA INSTITUTE OF MACHINERY & MATERIALS

KIMS 한국재료연구원
Korea Institute of Materials Science

KIMST
Korea Institute of Marine Science & Technology Promotion

KITECH
한국생산기술연구원

KRICT
Korea Research Institute of Chemical Technology

nst 국가과학기술연구회
National Research Council of Science & Technology

Registration Level

Event

KICT
한국건설기술연구원
KOREA INSTITUTE of CIVIL ENGINEERING and BUILDING TECHNOLOGY

KISTEP
한국과학기술기획평가원
Korea Institute of S&T Evaluation and Planning

국토지리정보원
National Geographic Information Institute

Venue

블루카본사업단
Blue Carbon Research Center

KIST
한국과학기술연구원
Korea Institute of Science and Technology

국가수리과학연구소
National Institute for Mathematical Sciences

Participation

KOFWST Since 2003
한국여성과학기술단체총연합회
Korea Federation of Women's Science & Technology Associations

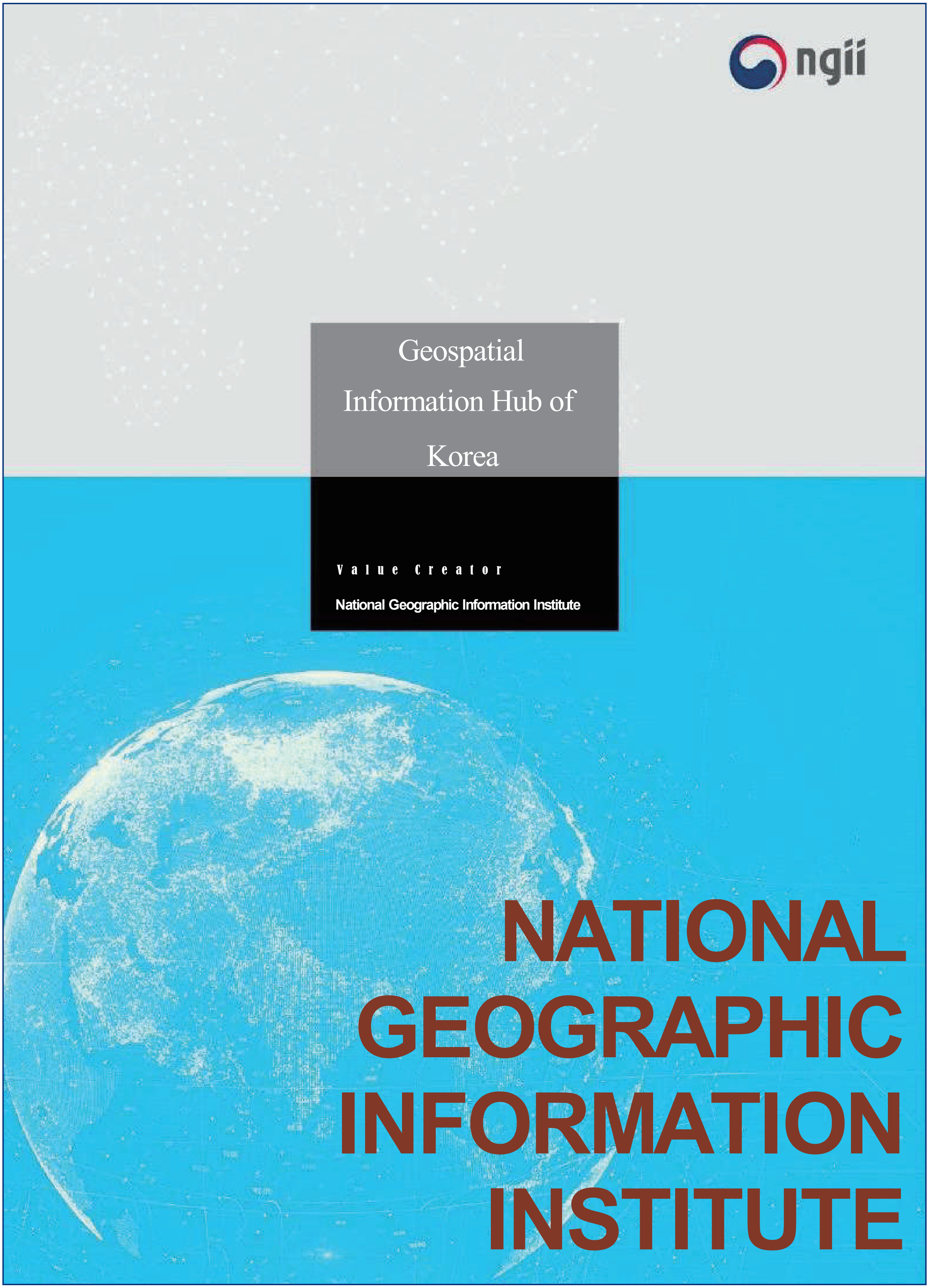
KWSE 대한여성과학기술인회
The Association of Korean Woman Scientists and Engineers

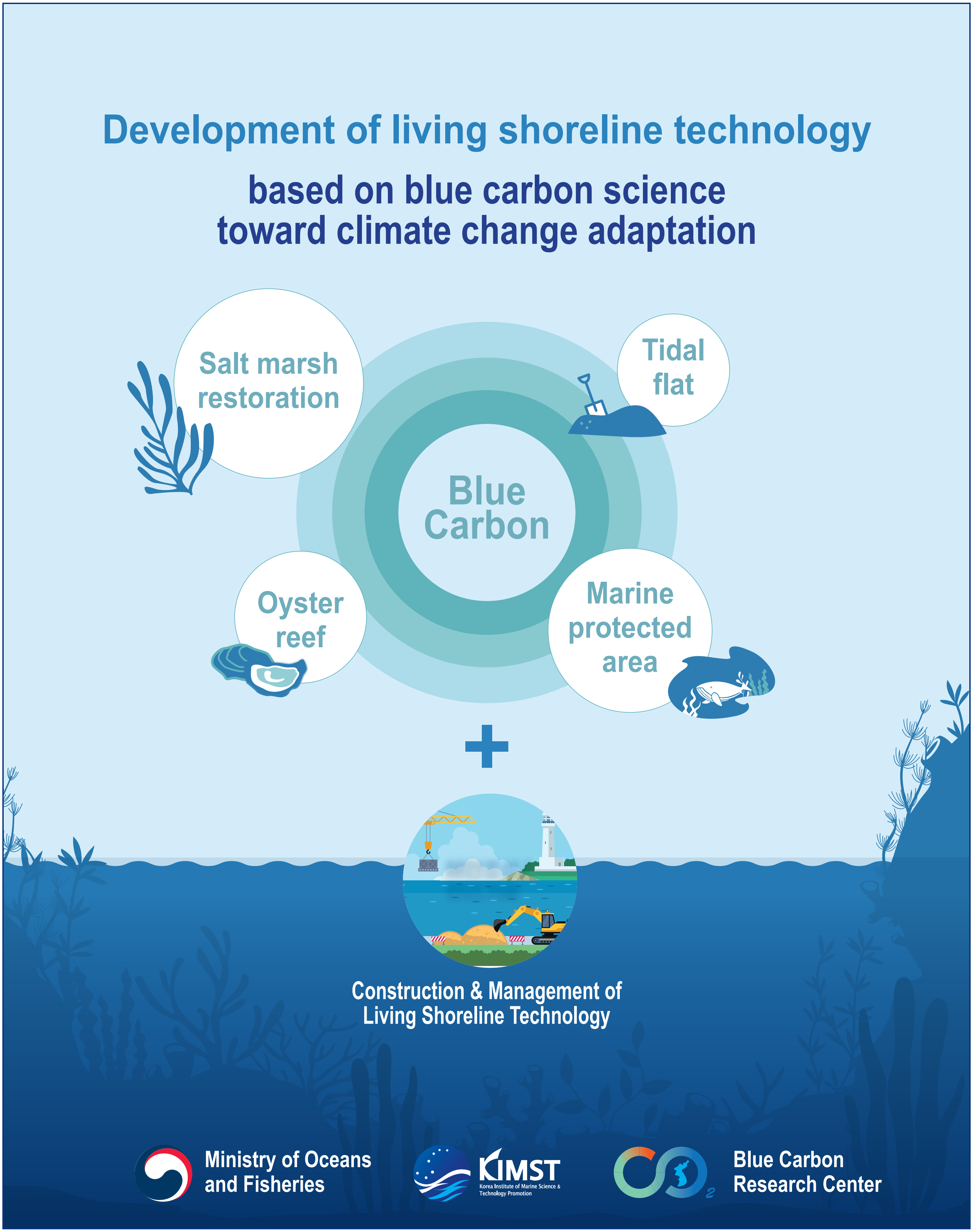
Embassy of the Republic of Korea

OVERSEAS KOREANS FOUNDATION
재외동포재단


"건설 한류의 꿈,
첨단 건설기술 개발로 이루어가겠습니다."
오늘날 K-팝, K-시네마가 전 세계의 주목을 받고 있습니다.
한국건설기술연구원은 도전적이고도 혁신적인 R&D, 과학기술뿐만 아니라 인간의 마음까지 아우르는 통섭형 R&D를 추구합니다.
산학연관이 함께 노력하여 세계최고의 기술을 개발한다면 국민의 행복을 증진하고,
대한민국 건설산업의 위상을 드높이는 K-construction 역시 실현할 수 있습니다.
KICT 화재안전연구소(화성)
KICT 하천실험센터(안동)
SOC 실증연구센터(연천))
한국건설기술연구원
KICT 한국건설기술연구원
http://www.kict.re.kr
주소 : 경기도 고양시 일산서구 고양대로 283 (대화동 2311) TEL : (031)9100-114
임 무
건설 및 국토관리 분야의 원천기술 개발과 성과 확산
비 전
국민의 안전과 행복을 건설하는 글로벌 연구기관
핵심가치
스스로
새롭게
뛰어나게
바르게
다함께
경영목표
01 뉴 노멀 시대 건설혁신 고부가가치 기술 개발 및 국민 안심 R&D 강화
02 세계 최고 연구 성과 도출을 통한 글로벌 경쟁력 강화
03 창의 연구 역량 강화와 공정한 보상을 위한 사람 중심의 연구환경 조성
04 중소기업 전주기 성장 지원 및 남북한 건설 협력 기반 구축


KISTEP 25Th
LEGACY MAKETH
INNOVATION
과학기술혁신의 기틀을 세워온 25년의 시간
지나온 성취를 넘어 지금, KISTEP은 더 큰 가능성을 꿈꿉니다
KISTEP 한국과학기술기획평가원


ngii
Geospatial
Information Hub of
Korea
Value Creator
National Geographic Information Institute
NATIONAL
GEOGRAPHIC
INFORMATION
INSTITUTE


Development of living shoreline technology
based on blue carbon science
toward climate change adaptation
Salt marsh restoration
Tidal flat
Blue Carbon
Oyster reef
Marine protected area
Construction & Management of Living Shoreline Technology
Ministry of Oceans and Fisheries
KIMST
Korea Institute of Marine Science & Technology Promotion
Blue Carbon Research Center

Korea Institute of Science and Technology

Korea Institute of Science and Technology (KIST)

- Korea's first government-funded research institute (established in 1966)
- Premier multi-disciplinary research institute pursuing world-class excellence
- Emphasizing convergence and open innovation across national R&D entities
- Solving national issues and providing future economic growth engines

R&D HISTORY

1966 ~	1980 ~	2000 ~	2020 ~
Building Foundation of National Backbone Industries	Rapidly Catching Up on Advanced Technology for National Major Industries	Leading R&D on Cutting-Edge Science & Technology	Challenging the S&T Conundrum to fulfill National and Global Agendas

MAIN RESEARCH FIELDS

RESEARCH INSTITUTES

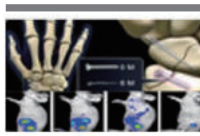
Brain Science
Brain mapping and brain disease diagnosis

Post-Silicon Semiconductors
Quantum computing, artificial neural chips

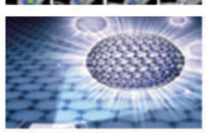
AI and Robotics
AR / VR, human-robot interaction

Climate & Environmental
Climate change and environmental issues

RESEARCH DIVISIONS



Biomedical
Customized treatments and rehabilitation



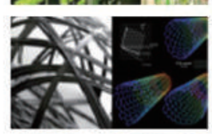
Advanced Materials
BT/ET/IT materials science and technologies

Clean Energy
Hydrogen and Carbon Neutrality

Research Resources
Advanced characterization and data support

BRANCH INSTITUTES

Gangneung
Natural products, future agriculture



Jeonbuk
Carbon composite materials

KIST Europe
Bio/environmental safety research

India-Korea S&T Center
Data science, machine learning


NATIONAL
INSTITUTE FOR
MATHEMATICAL
SCIENCES
산업에
數를 놓다
산업과 과학기술, 공공영역의
수학적 문제를 해결하는 산업수학의 중심!
국가수리과학연구소가
대한민국 수학의 국가경쟁력 강화를
이끌어 나가겠습니다
www.nims.re.kr
국가수리과학연구소
National Institute for Mathematical Sciences

KOFWST
Since 2003

한국여성과학기술단체총연합회는

기초과학, 공학, 생명과학, 환경, 에너지, 건설, 정보기술 등
학술단체뿐만 아니라 한국여자의사회, 대한약사회 여약사회 등
직능단체를 아우르는 80개 단체 8만여 명 회원의 연합회로
대한민국 최대의 여성과학기술단체입니다.

www.kofwst.org

CKC 2024

CANADA-KOREA CONFERENCE ON SCIENCE & TECHNOLOGY

CKC 2024 PROGRAM

JUNE 2024

PUBLISHED BY AKCSE

THE ASSOCIATION OF KOREAN-CANADIAN SCIENTISTS AND ENGINEERINGS

AKCSE 캐나다한인과학기술자협회
The Association of Korean-Canadian Scientists and Engineers

Address: 1133 Leslie Street, Suite #206, North York, ON M3C 2J6, Canada
Phone: +1(416) 449-5204, AKCSE email: info@akcse.org | CKC email: ckc@akcse.org
AKCSE website: akcse.ca | CKC 2024 website: akcse.ca/CKC2024