

Energy, Materials & Resources

This cluster explores next-generation energy systems, advanced materials, and sustainable resource technologies that support global energy transition and industrial innovation.

The Energy, Materials & Resources Technical Symposium will feature three podium sessions and one poster session. We invite researchers and professionals conducting experimental, computational, and integrated work in chemical engineering, materials science, nanotechnology, advanced manufacturing, energy systems, and related fields to present innovations that address emerging challenges in energy, materials, and resource-related engineering, while engaging in discussions that foster interdisciplinary collaboration and new research connections.

This symposium is jointly organized by two Technical Groups (TGs) of KSEA and their affiliated professional societies (APS): Chemical, Textile, Energy, and Nuclear Engineering; and Materials Science and Engineering, Nanotechnology.

The Chemical, Textile, Energy, and Nuclear Engineering TG (C-2 CHE) is a community of researchers and professionals advancing chemical engineering across fundamental and applied domains. The group encompasses areas including advanced nanomaterials and biomaterials, nanoscience and nanotechnology, and complex processes addressing challenges in energy, health, and environmental systems.

The Materials Science and Engineering TG (C-4 MSE) includes members working across materials innovation and advanced manufacturing, with shared interests in electronic materials, functional materials, nanomaterials, and related emerging areas that support advances in micro/nanoelectronics, energy conversion and storage, additive manufacturing, and other technologies critical to sustainable innovation.

Supporting contributions are provided by the Mechanical, Aerospace, and Naval Engineering (C-3 MAN) TG in mechanics, thermal systems, and precision manufacturing; the Civil and Environmental Engineering and Architecture (C-5 CEA) TG in sustainable infrastructure and environmental quality; and the Computer and Information Sciences (C-7 CIT) and Industrial, Manufacturing, and Systems Engineering (C-8 IMD) TGs in data-driven methods, optimization, and circular resource management.

Chair



Jaewon Lee (C2)

University of
Missouri - Columbia

Co-chairs



Inseok Chae (C2)

Texas Tech University



Sungwoo Nam (C4)

University of
California, Irvine



Hyun-Tae Hwang (C2)

University of Kentucky

Thursday, Aug 6 5:00 – 6:45pm

CHE Session: Hydrogen, Catalysis, and Sustainable Energy

Chair: Jaewon Lee (University of Missouri-Columbia), Inseok Chae (Texas Tech University), Sungwoo Nam (University of California, Irvine), Hyun-Tae Hwang (University of Kentucky)

Time	Title and Speaker
5:00	Vapor Pressure Suppression of Hydrocarbons under Nanoconfinement Revealed by Differential Scanning Calorimetry Hyeyoung Cho (Florida Polytechnic University)
5:12	Korea's Path to Fusion Energy: Progress and Strategic Vision Yeongkook Oh (Korea Institute of Fusion Energy)
5:24	Optimization of Surfactant-Imbibition In-situ DNAPL Remediation with Horizontal Wells Seung Ihl Kam (Louisiana State University)
5:36	Sorp-Vection: A Non-Equilibrium Transport Platform for Complex Fluid Separations Jinyoung Kim (Georgia Institute of Technology)
5:48	Two-dimensional gas chromatography (GC×GC) Applications in Plastic Pyrolysis Research Do Hyun Lee (Penn State University)
6:00	A Semi-Markov Process Approach to Quantify Material Content Over Multiple Product Lifecycles with Application to a Hard Disk Drive Yong Han Kim (Purdue University)
6:12	Controlling Surface Cation Configurations in Ir_xRu_{1-x}O₂(110) and Their Effects on Adsorption Jisu Shin (Purdue University)
6:24	Balancing Dark Current and Photoresponse in Organic Photodetectors via Cleavable Side Chain Engineering Seung Hyun Kim (University of North Carolina at Chapel Hill)
6:36	Innovative Process Development for Natural Hydrogen as a primary energy source Jihyun Hwang (Korea Institute of Energy Technology)
6:48	Improved Hydrogen Yield and Safety in Solid-State Hydrolysis of Sodium Borohydride Using Water Adsorbents Hyun-Tae Hwang (University of Kentucky)

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@Congressional B

Friday, Aug 7 3:15 – 5:00pm

MSE Session: Advanced Manufacturing, Functional Materials, Nanomaterials

Chair: Jaewon Lee (University of Missouri-Columbia), Inseok Chae (Texas Tech University), Sungwoo Nam (University of California, Irvine), Hyun-Tae Hwang (University of Kentucky)

Time	Title and Speaker
3:15	Novel Nanophotonic Devices based on Strong Light-Matter Interaction Hong Gyu Park (Seoul National University)
3:27	Fabrication of Textured pHEMA Hydrogels: The Impact of Micro/Nano Textures on Optical Property Chang-Hwan Choi (Stevens Institute of Technology)
3:39	Simulation Study of Mechanically Tunable Phononic Crystals: Effects of Scatterer Geometry and Material on Acoustic Band Gap Properties Taeyul Choi (University of North Texas)
3:51	Orientation-Dependent Residual Lattice Strain in Single-crystal Sapphire Cutting with Hard X-ray Nanoprobe Sangkee Min (University of Wisconsin-Madison)
4:03	Thermal Management Technologies for High-Thermal-Load Systems: Applications in Data Centers and Re-Entry Spacecraft Tae Young Kim (Seoul National University of Science and Technology)
4:15	Low-Cost Titanium Powder Design and in-situ Alloying Approach for Laser Powder Bed Fusion Bin Lee (Kyung Hee University)
4:27	Entanglements in Polymer Networks: A New Pathway for Soft Material Design Junsoo Kim (Northwestern University)
4:39	Purpose-Engineered Alloys for LPBF Additive Manufacturing: From Computational Alloy Design to Functional Component Demonstration Yongho Sohn (University of Central Florida)

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Saturday, Aug 8 8:00 – 10:00am

CHE, MSE & CEA Session : Advanced Materials, Resources, Separations

Chair: Jaewon Lee (University of Missouri-Columbia), Inseok Chae (Texas Tech University), Sungwoo Nam (University of California, Irvine), Hyun-Tae Hwang (University of Kentucky)

Time	Title and Speaker
8:00	Soft Piezoelectric-Powered Capacitive Sensor for High-Fidelity Vibration Detection Jeng-Hun Lee (Georgia Institute of Technology)
8:12	Plasticization-Driven Ionic Transport in AlBr₃-Based Solid Electrolytes Kyunghyun Kim (Hongik University)
8:24	Materials and Devices for Event-Memory Bifurcation in Dynamic Vision Won Il Park (Hanyang University)

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Time	Title and Speaker
8:36	Highly Efficient Triboelectric Nanogenerator Based on Low Impedance and High Charge Density through Multi-Layer Design JinKyeom Kim (University of Wisconsin-Madison)
8:48	Effect of Hexagonal Boron Nitride Fillers on Ion Transport and Viscoelasticity of Vitrimer Electrolytes Seongon Jang (University of Pennsylvania)
9:00	Analysis of Cutting Force Characteristics in Ultra-Precision Milling of Single Crystal Sapphire Jinho Park, (Korea Aerospace University)
9:12	Effectiveness of Low-Cost Window Fans for reducing Indoor Cooking Emissions Compared with Kitchen Hoods Semi Park (University of Texas at Arlington)
9:24	From Classroom to Community: Preparing Next-Generation Engineering Through Municipal Water Quality Projects Jun Kim (Florida Polytechnic University)
9:36	Virus-Based Sustainable Recovery of Critical Minerals Inseok Chae (Texas Tech University)
9:48	Machine Learning Enhanced Modeling of Orientation-Dependent van der Waals Interactions in Nanostructured Cuboids with Surface Roughness Effects Jaewon Lee (University of Missouri)

Poster Session

@ International
Ballroom II

Friday, Aug 7 5:00 – 6:45pm

Energy, Materials & Resources Poster Session

Chair: Jaewon Lee (University of Missouri-Columbia), Inseok Chae (Texas Tech University), Sungwoo Nam (University of California, Irvine), Hyun-Tae Hwang (University of Kentucky)

P1	Direction-Independent Stretchable Liquid-Metal Heater Enabled by a Space-Filling Printed Layout Hongchan Kim (Seoul National University)
P2	Spatial Visualization and Analysis of Architectural Heritages Classification and Sustainable Typology Jae Yoon Byun (North Carolina State University)
P3	Regulating Sulfur Redox Microenvironments through Phase Separation for High-Energy-Density Lithium-Sulfur Batteries Dong-Yeob Han (The University of Texas at Austin)
P4	Sustainable AI: Routing Queries to Small Language Models Yun Kim (University of Minnesota)

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P5	Quantifying the Ultimate Potential of Nucleate Pool Boiling Under Idealized Bubble Dynamics Junseo Gu (Gyeongsang National University)
P6	Development and Evaluation of an Alkaline Water Electrolysis Hybrid System for Resource Recovery Sang Yong Nam (University of Florida)
P7	Evaluation of Do-It-Yourself (DIY) Air Cleaner Performance: A State-of-the-Art Review Semi Park (University of Texas at Arlington)
P8	Self-crosslinking of PDMS on metal substrates for self-healing coatings Kyujin Ko (University of Cincinnati)
P9	Toward Automated Physics-Grounded Interpretation of HVAC Operational Data Using Large Language Models Yujin Kim (North Carolina State University)
P10	Opto-charge Microscopy (OCM) for Resolving Particle Dynamics in Electrochemical Network Materials Jeongok Choe (Purdue University)
P11	Electrification of Conventional Sustainable Aviation Fuel Production: Greenhouse Gas Emissions Benefits and Costs TJ Park, (MIT)
P12	Porosity Dependence of Furnace Thermal Cycling Lifetime and Failure Characteristics of Multi-layer Thermal Barrier Coatings Hye-Yeong Park (University of Central Florida)
P13	Development of a Thermal Energy Storage Combined with Water-side Economizer System Kwanghee Kim, (Gyeongsang National University)
P14	Plasmon Resonance Color Shifts in Nanogaps for Rapid Thickness Mapping in Two-Dimensional Materials Lauren Park (Korean Minjok Leadership Academy)
P15	Implementation of Radially Graded TPMS Lattice Structures for Stress Shielding Reduction and Optimized Material Utilization in Dental Implants Abdus-Samad Shaik (University of Central Florida)
P16	ZIF-8 as a Porous Additive for Phosphogypsum-Based Materials Hyeyoung Cho (Florida Polytechnic University)
P17	Resilient and Low-Cost Passive Thermosyphon Cooling for Climate-Vulnerable and Low-Income Households Hyun Jin Kim (California Polytechnic State University)