Harnessing Solar and Thermal Energy for Carbon-Neutral Power and Fuels

- Time: 2026.05.19. (Tue) 16:00-17:15
- Place: 104-E206 Classroom

Speaker

Prof. Sung-Yeon Jang

School of Energy and Chemical Engineering, UNIST

Abstract

The transition toward a carbon-neutral society requires the development of diverse energy conversion technologies capable of efficiently harvesting and utilizing renewable energy sources. In addition to mitigating climate change, the adoption of renewable energy technologies is becoming increasingly important for energy security, particularly in countries with limited domestic energy resources. In this seminar, I will discuss our recent efforts to harness solar and thermal energy for sustainable power generation and fuel production through advanced materials and interface engineering. First, I will present our work on high-efficiency solution-processed photovoltaics, including perovskite and perovskite quantum dot solar cells, with a focus on ligand engineering, defect passivation, and charge transport optimization for achieving high performance and operational stability. I will also introduce our recent strategies for overcoming voltage losses and interfacial limitations in next-generation perovskite systems. Next, I will discuss photoelectrochemical approaches for solar-to-fuel conversion, particularly the systems for hydrogen and ammonia production. Emphasis will be placed on the design of photoelectrodes, catalyst integration, and system-level engineering toward practical solar fuel production. Finally, I will introduce our recent work on ionic thermoelectric and thermogalvanic systems capable of converting low-grade heat into electrical power. In particular, I will discuss new materials and device concepts that simultaneously enhance thermodiffusion and thermogalvanic effects, enabling high-power wearable and self-powered energy systems. Through these studies, we aim to establish fundamental design principles for next-generation energy conversion platforms that bridge solar energy harvesting, thermal energy utilization, and carbon-neutral fuel production.

UNIST | SCHOOL OF ENERGY AND CHEMICAL ENGINEERING