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IAPME Seminar

Metal Halide Perovskite for Photonics and Electronics

28 July 2025

Prof. Tae-Woo LEE
Seoul National University
Venue: N23-1004b
Time: 10:30 - 11:30
Hosted by: Prof. Guichuan XING

Abstract

Metal halide perovskites (MHPs) are emerging as leading materials for next-generation display and optoelectronic technologies due to their excellent color purity, tunable bandgaps, and high photoluminescence quantum yield. With growing demands in AR/VR devices and the need to meet Rec. 2100 color standards, this presentation introduces advanced strategies to enhance the performance of perovskite light-emitting diodes (PeLEDs), known for their narrow FWHM and precise wavelength control. Key approaches include guanidinium doping, bromide-based surface passivation, and core/shell PNC structures to improve efficiency and stability. Hybrid tandem PeLEDs and surface-binding molecular multipods further boost device performance. Neuromorphic display systems, in which organic synaptic transistors are integrated with PeLEDs to mimic biological signal processing, are also highlighted. In addition, ultra-stable perovskite nanocrystals for color-conversion displays are explored, with over 95% of the Rec. 2020 color gamut successfully achieved. Finally, the potential of MHPs in quantum technologies—such as room-temperature single-photon sources and low-threshold lasers—is discussed, emphasizing their versatility for future photonic and quantum systems.

Biography

Prof. Tae-Woo LEE is a Professor in the Department of Materials Science and Engineering at Seoul National University. He earned his Ph.D. in Chemical Engineering from KAIST in 2002, followed by postdoctoral research at Bell Laboratories (USA) and research staff work at Samsung Advanced Institute of Technology (2003–2008). Prior to joining SNU in 2016, he served as faculty at POSTECH. He has received numerous honors, including the Merck Award (2006), Korea Young Scientist Award from the President (2008), Scientist of the Month (2013), Research Innovation Award (2018), Korean Engineering Award (2021), Minister's Commendation (2021), and Kyung-Ahm Prize (2023). He was named a Fellow of the Korea Academy of Science and Technology (2021), MRS (2020), and SPIE (2024). Prof. Lee has published over 300 high-impact journal papers, including in Science, Nature, Nature Photonics, and Advanced Materials, and holds 445 patents. He serves on editorial boards including Advanced Materials, EcoMat, and Nano Convergence, and is Associate Editor of Organic Electronics. His research focuses on organic, perovskite, and carbon-based materials for applications in flexible and printed electronics, displays, solid-state lighting, photovoltaics, and neuromorphic devices.

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