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✧ Content

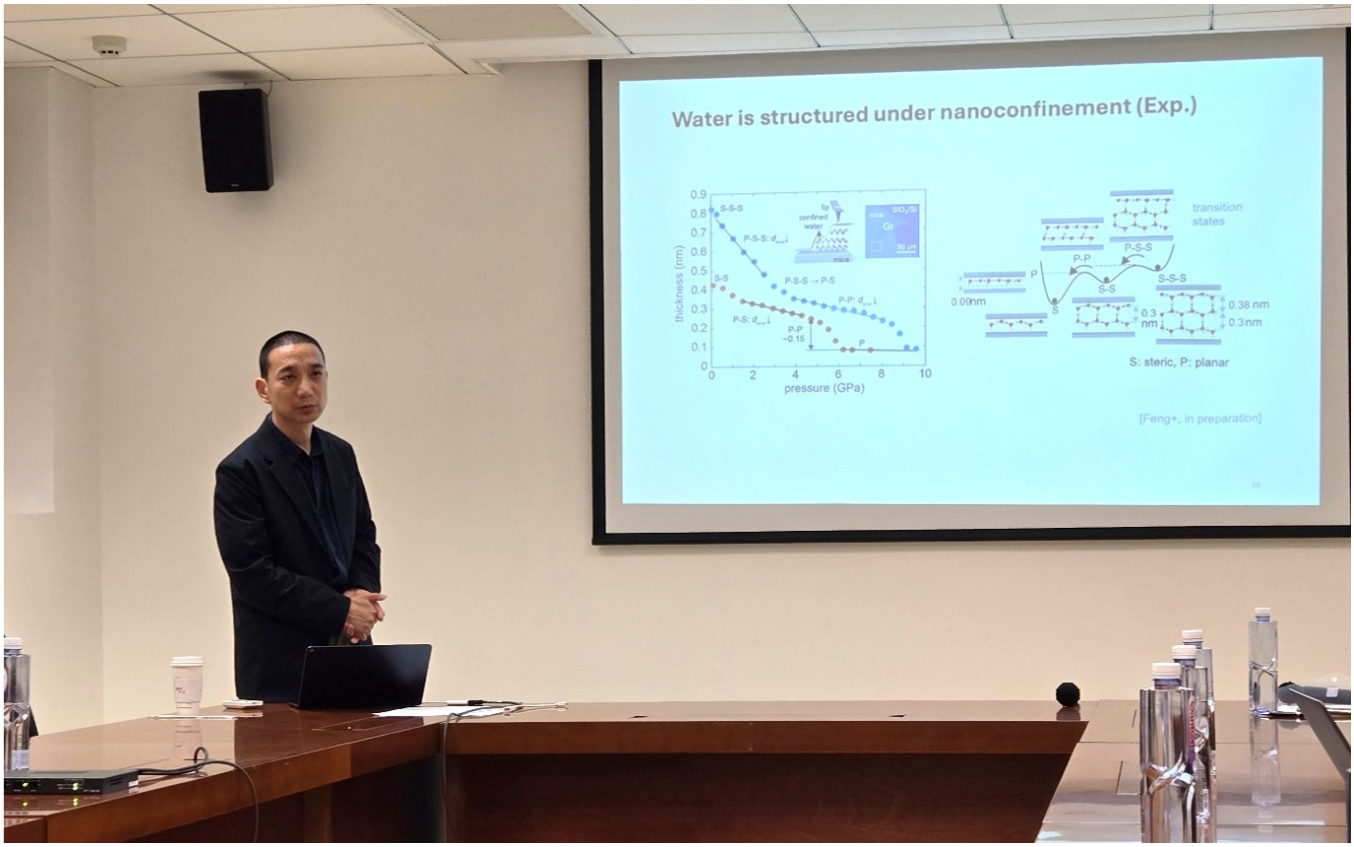
❖ IAPME Mini-Symposium Showcased Breakthroughs in Nanofluidics

On December 4, 2025, our Institute hosted a high-level mini-symposium on nanofluidics, organized by Prof. Pengzhan Sun, featuring five leading experts who presented cutting-edge research at the intersection of nanoscience, fluid dynamics, and advanced materials. The event attracted a packed audience of faculty, researchers, and students, fostering vibrant discussions on emerging technologies and theoretical challenges.

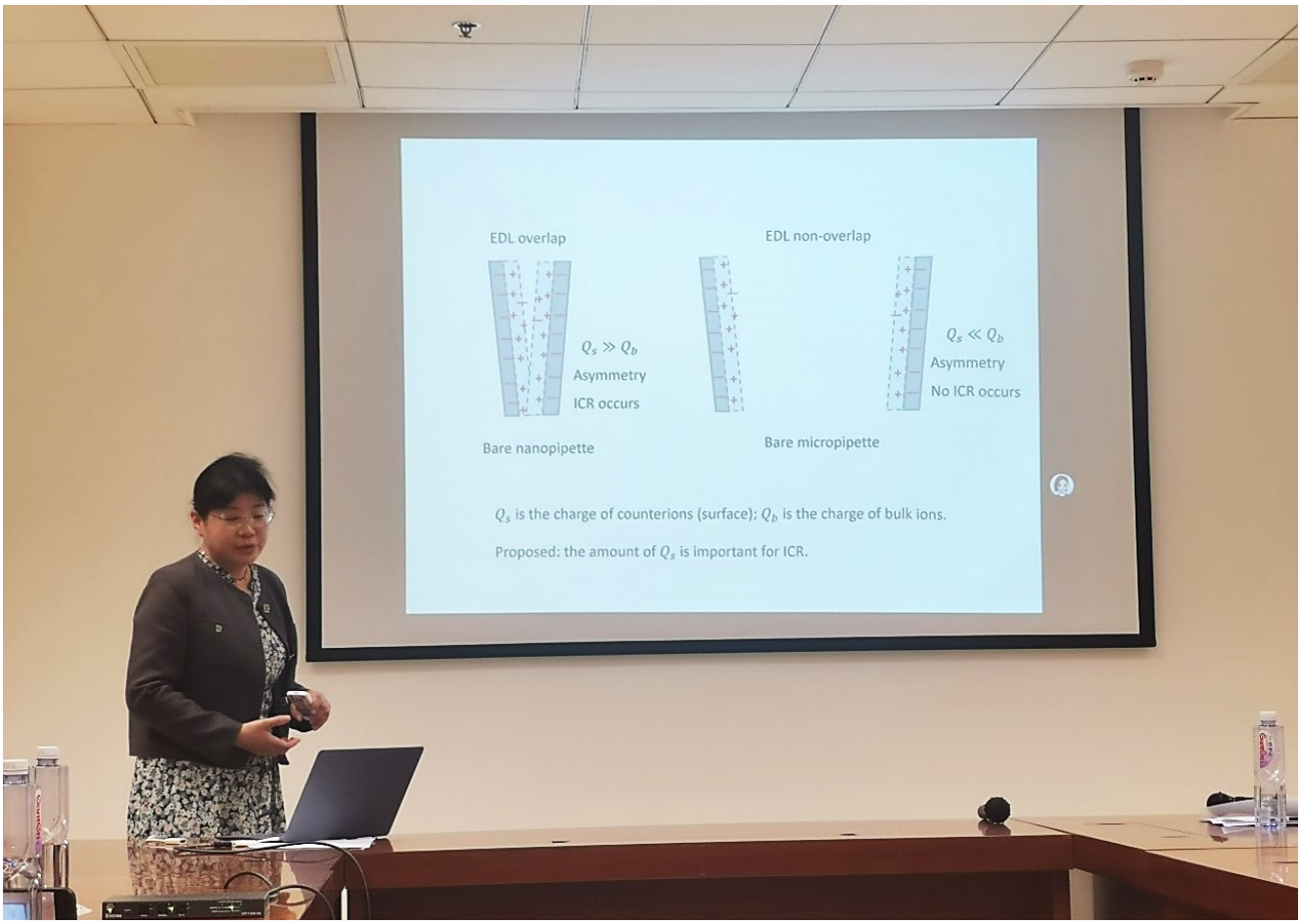
The symposium opened with Prof. Yahui Xue (薛亞輝), from Southern University of Science and Technology, delivered a talk titled "*Mimicking the Multifunctionality of Ion Channels by Electrostatically Gated Graphene Nanofluidics*". Prof. Xue introduced graphene-based atomic-scale ion transistors and nanopores capable of ultrafast, highly selective ion transport with precise electrical gating. Highlights included 3-Å channels enabling concerted ion movement, switchable tri-layer graphene nanopores with ionic current rectification, enhanced thermoelectric response inspired by thermoTRP channels, and nanofluidic synapses exhibiting short- and long-term plasticity via cation-π interactions.

Next, Prof. Alessandro Siria, from Shenzhen University, presented "*Synergistic Nanofluidics between Soft and Hard Condensed Matter*". His talk explored anomalous water permeation and ultra-low friction phenomena at carbon interfaces, challenging classical continuum models. Prof. Siria introduced a new theoretical framework based on electron–phonon coupling and shared experimental evidence of quantum friction effects at liquid–solid interfaces, concluding with perspectives on leveraging these phenomena for energy conversion and ultra-efficient membranes.

The third talk, "*Can We Emulate Brain Functions via Nanofluidic Iontronics?*" was delivered by Prof. Zhiping Xu (徐志平) from Tsinghua University. Prof. Xu discussed how brain-like information processing emerges from coupled ion transport, chemical modulation, and electrochemical signaling, presenting a multiscale theoretical framework for iontronic systems. He demonstrated how physical parameters—such as ion mobility and interfacial barriers—map onto cognitive functions like learning, memory, and decision-making, positioning iontronics as a promising platform for neuromorphic computing.



In the fourth talk, Prof. Ping Yu (於萍) from the Institute of Chemistry, Chinese Academy of Sciences (ICCAS), spoke on "*Polyelectrolyte-Confined Nanofluidics*". Prof. Yu showcased a tunable nanofluidic platform using ATRP-grown polyelectrolyte brushes in nanopipettes, revealing phenomena such as ion current rectification and inversion, oscillations, and strong hysteresis. The system exhibited memristor-like behavior and demonstrated neuromorphic functions including paired-pulse facilitation (PPF), paired-pulse depression (PPD), dynamic filtering, and chemically gated signal transduction, paving the way for chemically tunable nanofluidic neurons.



The symposium concluded with Prof. Mingzhan Wang (王銘展), from the City University of Hong Kong, presenting "*Anomalous Ion Transport in Angstrom-Scale Two-Dimensional Channels*". Prof. Wang revealed how subtle confinement chemistry changes dramatically enhance ion transport speed and selectivity, producing asymmetric and cooperative ion interactions that defy classical theory. He demonstrated practical applications in rare-earth element separation with unprecedented resolution, underscoring the industrial potential of angstrom-scale channels.

The symposium drew the attention of institute members, researchers, and students, with each lecture sparking animated and in-depth discussions during Q&A sessions. This gathering highlighted the growing importance of nanofluidics in advancing energy systems, neuromorphic technologies, and molecular-scale transport, reinforcing our Institute's role as a hub for interdisciplinary research and innovation.