הטכניון - מכון טכנולוגי לישראל

TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY

הפקולטה להנדסה כימית
ע״ש וולפסון
The Wolfson Department of Chemical Engineering

Wolfson Department of Chemical Engineering

Zoom Seminar
https://technion.zoom.us/j/96108259550
(Meeting ID: 96108259550)

December 10, 2026 at 09:00

"Assembly and interface engineering of low-dimensional materials for photo (electro) chemical systems"

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Abstract:

Converting solar energy into chemical energy through photo(electro)catalysis and photoelectrochemical (PEC) cathodic protection offers a sustainable route to green fuels, value-added chemicals, pollutant removal, and metal corrosion suppression. These systems rely on three sequential steps: photoexcitation, directional charge separation, and surface redox reactions. Because conventional material modifications typically address only one or two of these steps, overall efficiency remains bottlenecked. To systematically optimize the entire process, our group focuses on two synergistic strategies: functional materials assembly and interfacial engineering.
In functional materials assembly, we construct robust architectures from the molecular to the device scale. We developed universal supramolecular anchoring strategies to immobilize molecular chromophores onto magnetic scaffolds, overcoming aggregation and recyclability challenges in antibiotic degradation and fine chemical synthesis. At the device level, we pioneered a fully decoupled modular PEC architecture that integrates independent electron-transport, light-harvesting, and hole-consumption layers to achieve macroscopic charge transport for solar-driven cathodic protection.
In interfacial engineering, we regulate charge dynamics and surface kinetics at atomic and nanoscale boundaries. By constructing atomic coherent interfaces (e.g., CdS/CoS) and 2D–2D heterojunctions, we minimize charge-transfer barriers. We further designed spatially decoupled Janus and nano-dumbbell structures to isolate redox sites for synergistic H_2 evolution and organic transformations, and leveraged single-domain 2D ferroelectrics to generate macroscopic depolarization fields that direct charge flow for marine metal protection. This seminar will highlight our recent progress across these dual pathways and discuss future paradigms for solar-driven conversion systems.