

iCeMS Kitagawa Group Seminar



Assoc. Prof. Soumya Mukherjee

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“Clean Air and Water: Crafting Molecular Solutions through Crystal Engineering”

Date: October 7th , 2025

Time: 11:00-12:00

Place: 2F Seminar room, iCeMS main bldg.

Abstract: Crystal engineering focuses on designing, understanding, and applying crystals, while reticular chemistry links molecular building blocks through strong metal–organic or carbon–carbon bonds to form extended frameworks. Their intersection is exemplified by porous coordination networks (PCNs) and covalent organic frameworks (COFs), key reticular solids amenable to crystal engineering. Recent work, including ours, shows that tuning pore size and chemistry in PCNs and polymer–PCN hybrids yields efficient physisorbents for hydrocarbon (HC) separation and freshwater purification from persistent and mobile organic chemicals (PMOCs, including “forever chemicals”). The need for such sorbents arises from replacing energy-intensive HC separation with energy-efficient, recyclable alternatives. Physisorbents offer strong, selective HC binding with lower energy use and smaller plant size, but most current materials still suffer from weak binding and poor selectivity, especially at low concentrations. Our group explores how crystal engineering enables precise structural control for improved HC selectivity and water purification, though challenges remain for commercialization. This seminar will address these challenges and highlight how bottom-up nanomaterial design advances next-generation adsorbents. Key insights include new understanding of sorption performance for chemical separations and water purification, aiming to contribute to UN Sustainable Development Goals 3 (Health), 6 (Clean Water), 7 (Clean Energy), and 13 (Climate Action).

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