

HKIAS Distinguished Lecture Series

Toward a Circular Plastics Economy. Mechanism-Based Catalyst Design and Evolution for Waste Polymer Recycling



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Date: 13 January 2025 (Monday)

Time: 4:30pm-5:30pm (Light refreshment will be served from 4:00pm-4:30pm)

Venue: HKIAS Lecture Theatre, LG/F, Academic Exchange Building
City University of Hong Kong

Abstract The current increase in plastics production/consumption has generated vast quantities of waste with severe environmental consequences. In 2018, 395 million tons of plastics were produced annually, and this quantity will likely triple by 2050. Since >90% of these plastics derive from fossil feedstocks, the impact on finite natural resources is also a concern. In a classical linear economic model in which plastics are discarded after use, by 2050, the ocean will contain more plastics than fish, and plastics production will consume ~20% of global petroleum production. To counter such scenarios, a circular economy in which waste plastics are recycled and repurposed is urgently needed. Plastics such as polyethylene terephthalate (PET), Nylon, polyethylene, α -olefin-ethylene copolymers, and isotactic-polypropylene are among the most heavily used plastics worldwide, with multi-billion-dollar markets, hence in need of efficient, large-scale recycling. Yet, PET is currently the most recycled plastic, however only ~7% is currently bottle-to-bottle recycled.

This lecture focuses on mechanism and thermodynamics based strategies to deconstruct/recycle PET and other polyesters, nylons, and polyolefins, using structurally well-defined earth-abundant molecule-derived heterogeneous and homogeneous catalysts and complementary DFT analysis. These catalytic processes are solvent-free, proceed in high conversions and selectivities under relatively mild conditions, and the catalysts are multiply recyclable. Details of the reaction mechanisms and those factors governing catalytic selectivity are emphasized.

Biography Chemistry BS from University of Maryland, Inorganic Chemistry PhD from MIT. Recognitions: U.S. National Medal of Science, Spanish Asturias Prize, MRS Von Hippel Award, Dreyfus Chemical Sciences Prize, NAS Chemical Sciences Award, ACS Priestley Medal, Israel Harvey Prize, German Chemical Society Ziegler Prize. Fellow: U.S., German, Italian, European, and Indian Academies of Sciences, U.S. National Academy of Engineering, American Academy of Arts and Sciences, American Philosophical Society, and U.S. National Academy of Inventors. Fellow: U.K. ACS, Chinese, Israel Chemical Societies; MRS Fellow; ~250 other awards/recognitions; 1500 peer-reviewed publications; 210 U.S. patents. Honorary Doctorates: HKUST, University of South Carolina, Ohio State University, Nanjing Institute of Technology, Technical University Munich. Founded/co-founded 15 start-ups; his technologies generated ~\$100 billion in sales.

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