NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE | School of Materials Science and Engineering, College of Engineering

MSE-Colloquium @ NTU

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Metal-Organic Frameworks (MOFs) as Prospect Adsorbents and Membranes for Energy-intensive Separations and Carbon Capture

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Abstract

Demand for functional materials targeted for specific applications is ever increasing as societal needs and demands mount with advancing technology. Evidently, improvement of existing materials and quest for new approaches to the design of novel materials are both valuable paths worth pursuing in order to address the myriad technological challenges that face us, pertaining to energy an environmental sustainability.

Metal-organic frameworks (MOFs) are a unique class of solid-state materials amenable to design and manipulation for desired function and application, thanks to advancement in reticular chemistry and the various design strategies developed for its effective practice. Several design strategies have been utilized and developed to target viable MOF platforms, from the single-metal-ion molecular building block (MBB) approach to the hierarchical supermolecular building block and supermolecular building layer approaches (SBB and SBL, respectively) to the merged nets approach, and centring structure-directing agents (c-SDA) strategy. This inherent built-in information allows access to highly stabile and made-to-order porous materials, with controlled pore-aperture size and/or inner pore system functionality, toward applications pertaining to energy and environmental sustainability. Specifically, MOF materials addressing the energy-intensive separations and carbon capture will be highlighted, as well as insights into MOF based membranes, namely pure MOF membranes and mixed matrix membranes (MMMs), construction and respective gas separation properties.

Biography

Prof Mohamed Eddaoudi is the Ibn Alhaytham Distinguished Professor of Chemical Science and Director of the Advanced Membranes and Porous Materials Center at King Abdullah University of Science and Technology (KAUST), Saudi Arabia. He holds a master's and doctorate in Chemistry from Denis Diderot University (Paris VII), France. Prof Eddaoudi is a member of several prestigious societies, including the ACS, MRS, FRSC and SASTA. He has received numerous awards, such as the Outstanding Faculty Research Achievement Award and the Chemistry Outstanding Teaching Award from the University of South Florida, as well as the Kuwait Prize for Chemistry (2024), the Almarai Prize for Distinguished Scientist (2020), and the Abdul Hameed Shoman Prize for Arab Researchers (2019).He is a Thomson Reuters Highly Cited Researcher from 2014 to 2023, with over 300 publications, 93,000 citations, an h-index of 118, and over 50 granted patents. His research focuses on Reticular Chemistry and the design and synthesis of functional porous solids for energy and environmental sustainability, including hydrogen and methane storage, CO_2 capture, Direct Air Capture (DAC), and energy-efficient gas separation. For more information, please refer to Prof Eddaoudi's research group page.