“Reticular chemistry: The design journey from highly-connected building blocks to merged nets”

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Abstract

We will present our recently developed and introduced approaches for the design of intricate multicomponent reticular structures, namely the centring structure-directing agents (c-SDA) strategy and the “merged-net” approach for the design of intricate multicomponent reticular structures. The “merged-net” methodology simplifies the design of complex reticular structures, marking a significant leap in materials science. A systematic process of merging blueprint nets and fundamental structural frameworks in chemical design will be presented. By analyzing 53 edge-transitive nets, we identified unique “signature nets” that facilitate merging distinct frameworks, producing a catalog of 353 new merged-net structures. This expanded catalog offers researchers a more versatile toolkit for constructing complex, multicomponent materials, addressing limitations in traditional materials design.

In addition, progress in MOF Chemistry with built-in information allowing 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 will be presented. 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 Ibn Alhaytham Distinguished Professor of Chemical Science, and the Chair of the Advanced Membranes and Porous Materials (AMPM) Platform, King Abdullah University of Science and Technology (KAUST), Kingdom of Saudi Arabia.
He received his master's and doctorate in Chemistry from Denis Diderot University (Paris VII) in Paris, France.
He is as Associate Editor at Chemical Science, and Associate Editor at IUCrJ, Board member of JACS and JMCA.
He is a member of the American Chemical Society (ACS), Materials research Society (MRS), and a Fellow of the Royal Chemical Society (FRSC), the Society for the Advancement of Science and Technology in the Arab World (SASTA). He received the Outstanding Faculty Research Achievement Award (2004 and 2007) and the Chemistry Outstanding Teaching Award (2005 and 2008) from the University of South Florida.
He was selected in 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024 and 2025 as Thomson Reuters Highly Cited Researchers and world’s most influenced scientific minds (2014). Dr. Eddaoudi published over 350 publications with over 108000 citations and an h-index=130 (google Scholar). Dr. Eddaoudi has over 50 granted patents and presented over 150 invited talks.
He is elected as a lifetime Fellow of The World Academy of Science (TWAS), Starting January 2026.
He was awarded the Kuwait Prize for the field of Chemistry (April 2024)
He was awarded Almaraii Prize for Distinguished Scientist (November 2020)
He was awarded the Abdul Hameed Shoman Prize for Arab Researchers, topic 'Renewable Energy'. (September 2019).
Prof Mohamed Eddaoudi is a pioneer in Metal-Organic Framework (MOF) Chemistry, conceiving and introducing new strategies for Reticular Chemistry, the rational design and construction of functional solid-state materials. Design and synthesis of functional porous solids for Energy and Environmental Sustainability: Hydrogen storage, Methane storage, CO_2 capture and Direct Air Capture (DAC). Design and synthesis of functional Adsorbents and Membranes, proffering energy-efficient and cost-effective Gas Separations.