MOFs+ Advanced Nanoporous Materials for Environmental Sustainability

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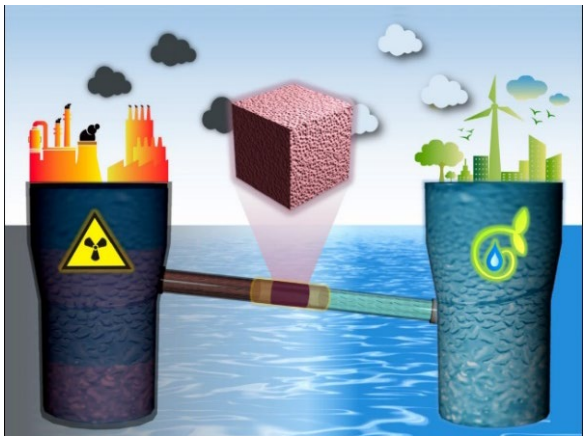
Abstract: Metal–organic frameworks (MOFs; the development of MOF materials was recognized with the 2025 Nobel Prize in Chemistry, and one of the laureates, Prof. Susumu Kitagawa of Japan, was the postdoctoral supervisor of Prof. Sujit K. Ghosh) and related nanoporous materials represent one of the most promising classes of advanced materials for tackling global sustainability challenges. Research in the laboratory of Prof. Ghosh at IISER Pune has pioneered the design and functionalization of MOFs to address critical issues in energy and environment. These efforts include selective capture of greenhouse gases, purification of water through removal of toxic metals and organic pollutants, and catalytic conversion of waste molecules into useful chemicals. By exploiting the structural tunability and high porosity of MOFs, the group has demonstrated frameworks that combine adsorption, separation, and catalytic functions in a single material platform. Emphasis is placed on scalable synthesis, stability under realistic conditions, and environmentally benign fabrication routes, ensuring that laboratory advances can translate into practical technologies. This lecture will highlight recent breakthroughs from IISER Pune, illustrating how molecularly engineered porous materials can evolve from fundamental science into transformative technologies for sustainable development.[1-5]



Scheme 1: Advanced nanoporous materials for environmental sustainability.

References and Notes:

(1) Book: Metal-Organic Frameworks (MOFs) for Environmental Applications 1st Ed. (Ed.: S K. Ghosh), Elsevier, 2019, https://doi.org/10.1016/C2017-0-01721-4 .

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(2) S. Mollick, S. Saurabh, Y. D. More, S. Fajal, M. Shirolkar, W. Mandal, S. K. Ghosh, ***Energy Environ. Sci.* 2022**,**15**, 3462.

(3) S. Fajal, W. Mandal, A. Torris, D. Majumder, S. Let, A. Sen, F. Kanheerampockil, M. M. Shirolkar and S. K. Ghosh ***Nature Commun.*, 2024**, **15**, 1278.

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Brief CV: Ph.D: IIT Kanpur (India) 2006; PDF: Kyoto University 2006-09; PI: IISER Pune, India 2009-. **Selected Honors/Recognitions:** 2026: Fellow of the Indian National Science Academy (FNA), New Delhi ; 2025- Friedrich Wilhelm Bessel Research Prize by the Humboldt Foundation, Germany; 2023- "The Distinguished Lectureship Award 2023" by the Chemical Society of Japan (CSJ); 2023- Editor: Chemical Engineering Journal; 2023-Fellow of the Royal Society of Chemistry (FRSC).

Research Focus: Metal-organic Frameworks (MOFs) and related advanced Functional Porous Materials for Safe Drinking Water, Clean Energy, Environmental Sustainability, and Industrially Relevant Chemicals Separations.