A NanoBioLab Symposium 2021 Webinar

Prof. Jeffrey Long, University of California, Berkeley

COOPERATIVE ADSORPTION AND GAS SEPARATIONS IN METAL-ORGANIC FRAMEWORKS

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ABSTRACT

The tunability of metal-organic frameworks offers the possibility of designing powerful new adsorbents that selectively adsorb and release gas molecules in a cooperative manner. An initial example of such a material was realized in mmen-Mg_2(dobpdc), which exhibits step-shaped CO_2 adsorption isotherms arising from a cooperative insertion mechanism that leads to ammonium carbamate chains running along the pore surface. This mechanism has now been widely elaborated, leading to adsorbents that cycle at high capacity in the presence of water, and are capable of efficiently separating CO_2 from flue gas emissions, air, natural gas, and biogas. Recently, this cooperative mechanism has been extended to the selective adsorption of CS_2, and a related mechanism has been shown to be operational in alcoholamine-appended frameworks. In addition, efforts to expand the scope of cooperative adsorption have led to new metal-organic frameworks containing chains of high-spin iron(II) sites that can cooperatively adsorb CO via a spin transition mechanism.

ABOUT THE SPEAKER

Jeffrey R. Long is a Professor of Chemistry and Chemical & Biomolecular Engineering at the University of California, Berkeley and a Faculty Senior Scientist in the Materials Sciences Division at Lawrence Berkeley National Laboratory. He served as Chair of the Division of Inorganic Chemistry of the American Chemical Society in 2012 and as a founding Associate Editor of the journal Chemical Science. He co-founded and directs two companies: Mosaic Materials, which is developing metal-organic frameworks for low-energy gas separations, and Flux Technology, which is producing high-performance polymer membranes for gas purification. His 350 publications have received more than 72,000 citations, and his recent awards include election to the American Academy of Arts and Sciences, the 2019 American Chemical Society F. Albert Cotton Award in Synthetic Inorganic Chemistry, and the 2020 Royal Society of Chemistry Ludwig Mond Award.

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