

Direct air capture: A challenge of unprecedented scale

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The technological removal of CO₂ from atmospheric air is gaining increased attention as one of the most scalable “negative emission technologies” available to tackle climate change. This seminar aims to provide an overview of the key challenges and drivers involved in scaling up direct air capture (DAC) technologies. Specifically, the focus will be on addressing a crucial challenge: the development of robust adsorption materials and their cost-effective manufacturing into energy-efficient devices. Engineering novel materials—such as solid-supported amines—into fiber-based adsorption devices shows promise for direct air capture, where scalability is key. Fiber sorbent materials can help manage kinetic and engineering factors associated with the separation, including pressure drop, sorbent stability, and heating/cooling rates. The presentation will touch upon recent developments in fiber sorbent manufacturing and their application in DAC systems, while also discussing the critical research needs in the field of direct air capture.

Biography

Ryan Lively is the Thomas C. DeLoach Professor in the School of Chemical & Biomolecular Engineering at the Georgia Institute of Technology. His current research seeks to revolutionize fluid separation processes critical to the global energy and carbon infrastructure. He has a specific focus on membrane- and adsorbent-based science and technology aimed at addressing some of the world’s most difficult chemical separations. His group’s research activities range from fundamental material science and discovery to translational engineering applications focusing on making and testing separation devices. He has received a variety of awards for his research efforts including the 2020 Allan P. Colburn Award from AIChE, and the 2022 Curtis W. McGraw Award from ASEE. He is currently an Editor for the Journal of Membrane Science, the Secretary of the North American Membrane Society, and an ACS Industrial & Engineering Chemistry Division Fellow. He is the Director of the Center for Understanding & Controlling Accelerated and Gradual Evolution of Materials for Energy (UNCAGE-ME), an Energy Frontier Research Center of the US Department of Energy. He has over 160 publications in the field of separations including articles in *Science*, *Nature*, and other impactful venues.