Marrying Organic-Inorganic Hybrid Materials with Polymeric Hollow Fibers for Applications in Catalysis and Adsorptive Separations

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Organic-inorganic hybrid materials based on porous oxide particles functionalized with organic or organometallic moieties enables the tailoring of functional composites for a variety of applications. My group develops such materials for applications in catalysis and adsorptive separations. However, for both commodity and specialty applications, these materials have to be married with suitable gas-solid or liquid-solid contactors to develop truly scalable processes.

In this regard, for the past five years, in collaboration with Koros and Lively at Georgia Tech, we have exploited polymeric hollow fibers as contactors. In this presentation, I will describe the marriage between functional organic-inorganic composite materials[1-5] with polymeric hollow fibers for large scale CO_2 capture,[6-9] enabling CO_2 capture, utilization and storage (CCUS), as well as the first use of composite fibers in low temperature, liquid phase enantioselective catalysis. In particular, this latter part of the talk will describe work done in the NSF Center for Selective C-H Functionalization (CCHF) in collaboration with Davies at Emory University, employing dirhodium carbene catalysts for C-H functionalization and cyclopropanation.[10-11]

Overall, this work combines sophisticated materials chemistry as well as process know-how to enable new approaches to catalysis and separations.

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