THE CHEMISTRY OF RETICULAR MATERIALS FOR CARBON DIOXIDE CAPTURE, REGENERATION, AND CONVERSION

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The carbon dioxide challenge is one of the most pressing problems facing our planet. Each stage in the carbon cycle — capture, regeneration, and conversion — has its own materials requirements. Recent work has demonstrated the potential of reticular chemistry and the effectiveness of reticular materials, such as metal-organic frameworks (MOFs) and zeolitic imidazolate frameworks (ZIFs), for addressing this challenge. In this presentation, I will demonstrate our success in rationally and systematically modulating the interplay between the structures of reticular materials and the desired output chemical properties in order to achieve exceptionally selective capture and effective catalytic conversion of carbon dioxide to value-added products. I will demonstrate how the interior of reticular materials can be designed with a level of precision that is crucial for the development of the next generation of carbon dioxide adsorbents as well as higher-performing catalysts for carbon dioxide conversion. To realize a total solution, I will argue the case that the precision of reticular chemistry is essential for building more complex materials to address selectivity, capacity, and conversion together in one material.