

Greenhouse Gas Capture in Porous Molecular Crystals

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The ongoing climate changes are caused by the changes in the composition of our atmosphere. Better methods for the sequestration and management of greenhouse gases--carbon dioxide, methane, nitrous oxide, and fluorinated hydrocarbons--are needed to avoid the most catastrophic scenarios. Our group has been developing small organic molecules which assemble into porous crystal structures capable of capturing various greenhouse gases based on the chemical functionalities present in their pore surfaces. These porous molecular crystals (PMCs) are lightweight, solution-processable, and easily synthesized. In this seminar, I will discuss two classes of such materials. The first is based on fluorinated aromatic pyrazoles and capable of capturing Freons and fluorinated hydrocarbons. The second is derived from the readily prepared cyclobenzoin macrocycles which can include a carbon dioxide molecule in their internal square-shaped pores. This selectivity for carbon dioxide has been used to separate it from methane and nitrogen, which often accompany it in natural gas deposits and flue gases. Strategies for the stabilization of methane hydrates will also be discussed.