Structure-Function Relations of N-Rich Physisorbents: Material Property Engineering for Efficient CO_2 Capture by Swing Adsorption

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Despite significant recent advances in generation and storage of renewable energy, carbon capture and storage from fossil fuel combustion processes will likely play an essential role in transitioning toward worldwide societal decarbonization. Swing adsorption, one of the most promising methods for widespread carbon capture and removal, requires optimization of CO_2 adsorption thermodynamics – adsorption potential must be strong enough for selective adsorption of CO_2 from dilute streams, but weak enough to allow facile regeneration and cyclability. Nitrogen-rich porous carbons could enable efficient carbon capture via temperature swing adsorption, but a widespread tradeoff of surface chemistry with textural properties has resulted in a lack of detailed understanding in the relationships between a carbon adsorbent's material properties and its propensity for selective CO_2 adsorption. In this talk, I'll present some of my work on 1) revealing these structure-function relationships and 2) designing improved adsorbent materials.