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Carbonate-Infused Activated Carbon for Direct Air Capture Sorbents

-Background Removal of carbon dioxide (CO2) from the atmosphere by direct air capture (DAC) can be accomplished using two chief approaches, liquid and solid. Liquid systems pass air through chemical solutions containing basic ions (e.g., hydroxide ions or bicarbonate ions), heat the resulting mixture to release the captured CO2, and then reuse the solution. Solid DAC systems on the other hand, employ solid sorbent filters that chemically bind to CO2, which is followed by a heating process that releases the CO2 for storage or use. Invention Description Researchers at Arizona State University have developed epoxy composites with a foam-like morphology loaded with K2CO3-infused activated carbon (AC) that are applicable for the sorption of CO2 gas directly from air. The epoxy resin can be used with various molecular weights that allow for tuning of the resin's elastomeric properties, and the AC can be in either powder or particle form. Thickness of this foam structure can be changed by altering the ratio of epoxy resin, AC, and foaming agent; or by changing the volume of the mixture. A variety of shapes or sizes can be achieved simply by changing types of molds. The composites have a high degree of porosity and fast rate constants for CO2 uptake (on the order of 0.03 L/s assuming a first-order sorption process), and capacity is tunable with AC loading. Potential Applications • Carbon dioxide sequestration • Direct air capture systems Benefits and Advantages • Cost-effective and simple to fabricate • Composite preparation can be achieved in ~20 minutes • Non-brittle and non-fragile • Maintains performance and can be regenerated even after treatment of hot steam • Can be fabricated in different sizes and shapes

Research Homepage of Professor Matthew Green

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