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New Sorbent Types for Moisture Swing Technology

Capturing carbon dioxide from open air to minimize harmful emissions becomes less effective with lower carbon dioxide concentration. To address this, scientists use moisture swing sorbents which are chemicals that bind to carbon dioxide in dry environments and release it when exposed to moisture. Metal-organic frameworks (MOFs) contain a metal and a ligand (organic component) bonded in a sponge-like crystal structure. The MOF properties are governed by the type of metal and ligand, where users can tune the properties by choosing specific metal and ligand compounds. MOFs are typically used in gas adsorption but their moisture swing behavior remains unexplored. Therefore, scientists are now looking to synthesize MOFs with moisture swing behavior for carbon dioxide sequestration.

Researchers at ASU have developed a new class of sorbent materials called metal-organic frameworks (MOFs) that can bind to and release carbon dioxide in a moisture swing sorption cycle. The MOFs show moisture swing property by capturing carbon dioxide in dry conditions and, with increased levels of moisture, can release it. After the sorption cycle, the MOFs do not have components that are not part of the original MOF structure, demonstrating its resilience. In summary, the strong moisture swing behavior of the MOFs enable tuning of its properties to offer flexibility of design that ultimately simplifies carbon sequestration for a variety of applications.

Potential Applications

- Carbon Sequestration
- Commercial and Industrial Carbon Dioxide Processes
- Gas Purification, Separation, and/or Storage
- Heterogeneous Catalysis

Benefits and Advantages

- Effective – The MOFs show strong moisture swing behavior and do not chemically change after a moisture swing sorption cycle
- Tunable – The metal and ligand can be selected to give an MOF with desired initial properties thereby allowing sequestration under various conditions
- Innovative – MOFs, as a new class of moisture swing sorbents, support further understanding in materials selection and exploration of environmentally-friendly and economically-effective materials for carbon dioxide sequestration

For more information about the inventor(s) and their research, please see:

Dr. Bin Mu's directory webpage

Dr. Klaus Lackner's directory webpage

For more information about related technologies, please see:

M15-211P: Carbon Dioxide Sorbents and Structures