The ORNL Carbon Fiber Adsorbent

Removal of CO_2 from gases can be accomplished with a novel carbon fiber composite molecular sieve (CFCMS) developed at the Oak Ridge National Laboratory

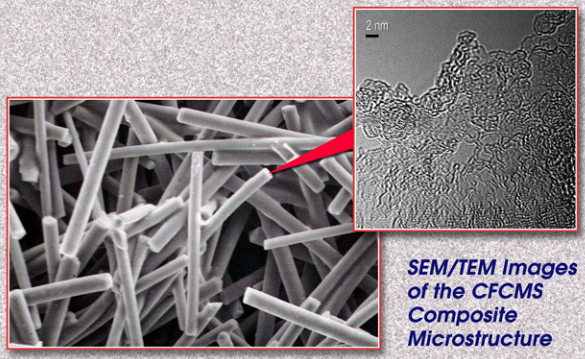
The Activated Carbon Composite

Microstructure

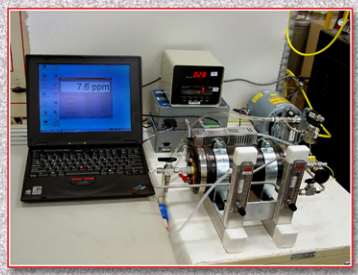
- Graphene Layers Distinguishable
- Amorphous Structure
- Micropores Visible (<2.0 nm)

Properties

- High Adsorption/Desorption Rates
- High Active Surface Area
- Electrically Conductive



SEM/TEM Images of the CFCMS Composite Microstructure



Single-Cell CFCMS/ESA Demonstration System

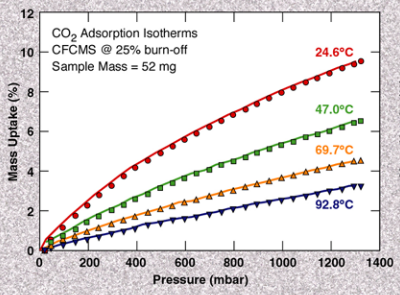
CFCMS for CO_2 Removal

CFCMS adsorbs CO_2 by selective accumulation of the gas onto the surface of a microporous solid. Adsorption occurs about 5 times faster in the CFCMS than in granulated carbon. Because CFCMS is electrically conductive, the adsorbed contaminants can be desorbed simply by passing an electrical current through the filter while maintaining a flow of a low-pressure purge gas. This provides the basis for incorporating the CFCMS material into an electrical-swing adsorption (ESA) regenerative filtration system

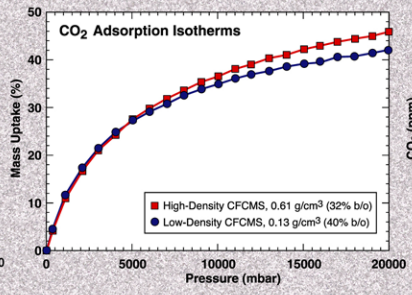
CFCMS/ESA Cell

CO_2 Capacity Determination

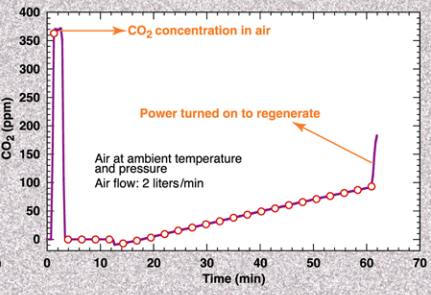
CO_2 Adsorption Isotherms (0–1300 mb) Sample of CFCMS @ 25% Burn-Off



High-Pressure CO_2 Isotherms



CO_2 Can Be Separated from Air



- CFCMS has a high CO_2 storage capacity
- CFCMS has demonstrated CO_2 removal from low- to high concentration gas streams
- CFCMS is electrically conductive, and desorption can be effected rapidly by passage of an electric current
- CFCMS is a low-cost carbon-fiber-based technology

ORNL 2003-05149/dlg

Funded by the U.S. Department of Energy, Fossil Energy Advanced Research Materials Program

OAK RIDGE NATIONAL LABORATORY