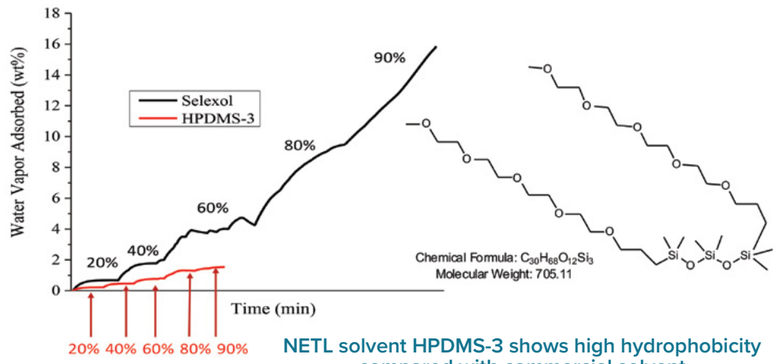
INNOVATIVE MATERIALS DEVELOPED TO IMPROVE CO_2 CAPTURE PERFORMANCE

Progress towards 2030 DOE program goal of demonstrating 95% CO_2 purity with a cost of capture less than $30/tonne

PATENT OBTAINED FOR NOVEL HYDROPHOBIC SOLVENT

NETL researchers obtained U.S. Patent #10,589,228 for a new solvent (HPDMS-3) for capturing CO_2 from fuel gas streams, such as downstream of coal gasifiers or at petroleum refineries. The solvent is hydrophobic, can operate at above room temperatures, and can be regenerated using waste heat, **significantly reducing the cost of CO_2 capture at IGCC powerplants and plants that generate hydrogen from fossil fuels**.

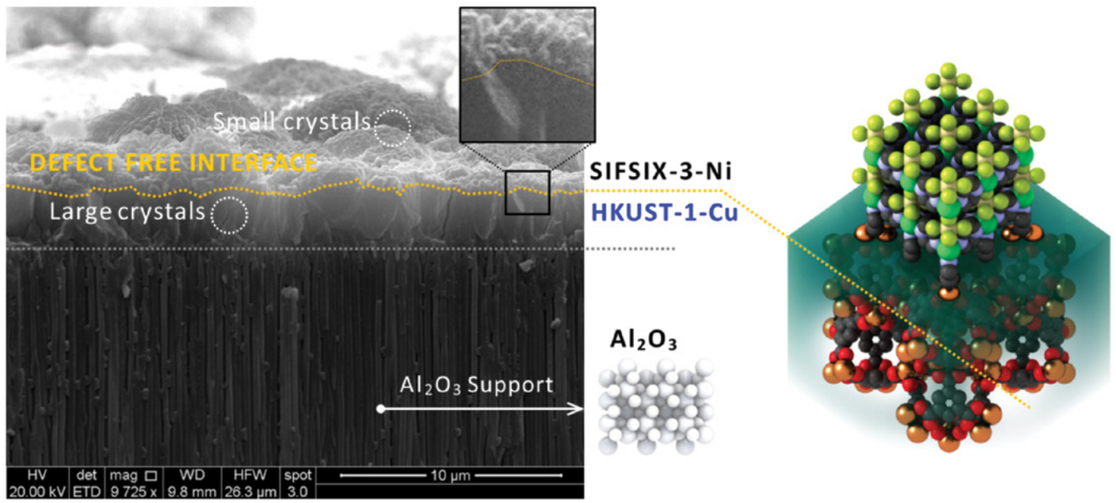


NETL solvent HPDMS-3 shows high hydrophobicity compared with commercial solvent

NEW TECHNIQUE FOR GROWING METAL-ORGANIC FRAMEWORK (MOF) THIN FILMS

Application to post-combustion CO_2 capture membranes

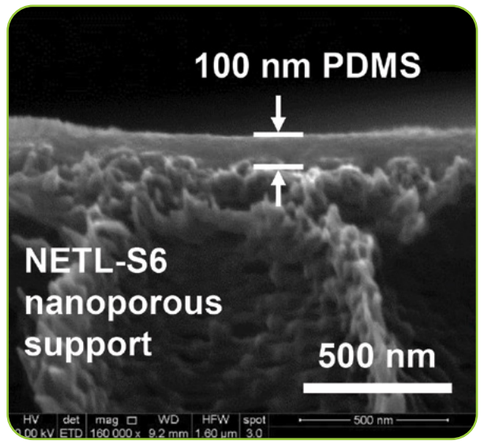
NETL developed a technique for growing a planar MOF thin film on the surface of a second type of MOF film, with chemical binding between them, to improve membrane permeance and selectivity performance for post-combustion CO_2 capture. **This novel technique was published in *Cell Reports Physical Science* and subsequently recognized as one of their "Best Papers of 2020."**



Dual layer MOF films form a layer of small crystal SIFSIX-3-Ni over HKUST-1-Cu

INVENTION OF NEW POLYMER SUBSTRATE FOR CO_2 SELECTIVE MEMBRANES

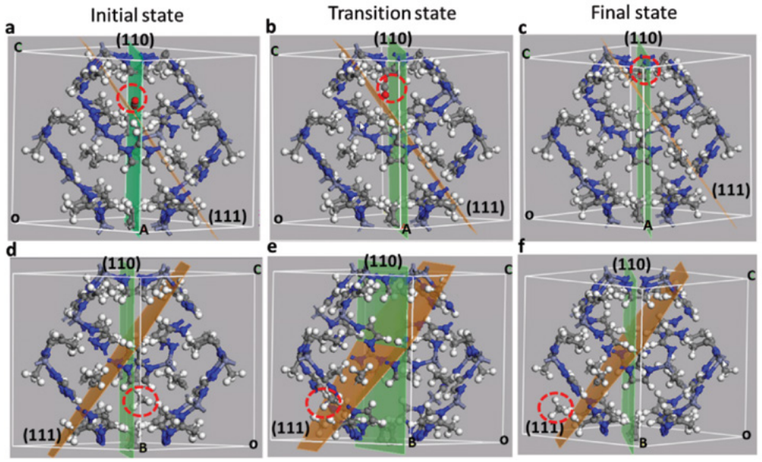
NETL researchers invented a new high permeance (260,000 GPU), chemically and thermally stable porous polymer support that is optimized to serve as the substrate for a CO_2 selective membrane. A composite membrane with a Polydimethylsiloxane (PDMS) selective layer **achieved the highest CO_2 permeance (12,600 GPU) of any known defect-free PDMS membrane**.



PDMS/NETL support thin film composite

STUDIES ILLUMINATE GAS SEPARATIONS BEHAVIOR IN KEY MATERIALS

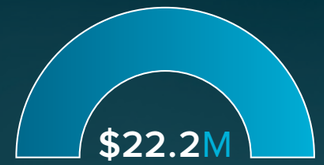
Research on CO_2 and methane (CH_4) gas adsorption and diffusion in bulk zeolitic imidazolate framework-8 (ZIF-8) materials using a density functional theory approach found that **CO_2 has higher adsorption energy and diffusion barriers than CH_4**.



Modeling of CO_2 (a, b, c) and CH_4 (d, e, f) molecules (indicated with red dotted circles) diffusing in ZIF-8, with reference to the miller planes (111) (orange) and (110) (green)

AWARD NUMBER
FWP-1022402

PROJECT BUDGET



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CORE COMPETENCIES

- COMPUTATIONAL SCIENCE and ENGINEERING
- MATERIALS ENGINEERING and MANUFACTURING
- SYSTEMS ENGINEERING and ANALYSIS

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