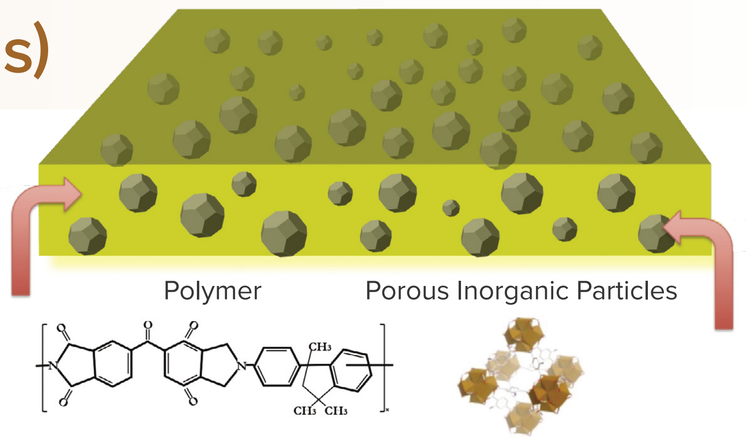
ADVANCED MEMBRANES LOWER THE COST OF CARBON CAPTURE

Highly permeable and selective membranes for post-combustion capture

HIGH-PERFORMING MIXED MATRIX MEMBRANES (MMMs)

Developing stable, transformational membranes with high CO_2 selectivity and permeability can **significantly reduce the cost for post-combustion capture.** Membranes with higher permeability lead to a **reduced area requirement, smaller capital cost, and a smaller equipment footprint.**



A mixed matrix membrane (MMM) consists of a polymer matrix with particles such as metal organic frameworks (MOFs) embedded in the matrix to enhance gas transport. The best MMMs for CO_2 capture need high performance polymers with mechanical toughness, nanosized MOFs with uniform dispersion, an optimized support layer, and a thin, defect-free selective layer.

PROMISING OPTION FOR LARGE-SCALE GAS SEPARATION

NETL's membrane flue gas test unit at the National Carbon Capture Center, where membranes are being tested for long-term stability under real conditions including moisture and contaminants

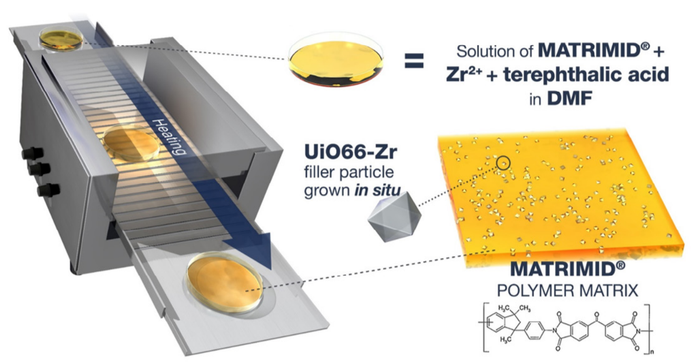
NETL analyses have shown that **materials with extremely high permeability are needed** to make membrane technology an economically viable option.

NETL is developing **innovative technologies and materials for bench-scale testing** in a slipstream of actual flue gas. NETL is currently working with a commercial membrane manufacturer to scale up this technology for demonstration in a small hollow fiber module.

ECONOMIC GROWTH AND LOW-COST ENERGY

Several mixed matrix membranes were developed that have CO_2 permeability >5000 Barrer and CO_2/N_2 selectivity of ~30, well above the Robeson Upper Bound. This membrane is now one of the **highest performance membrane materials reported for CO_2 capture from post-combustion flue gas.**

Preliminary results suggest that the performance is stable when exposed to humidified gas.



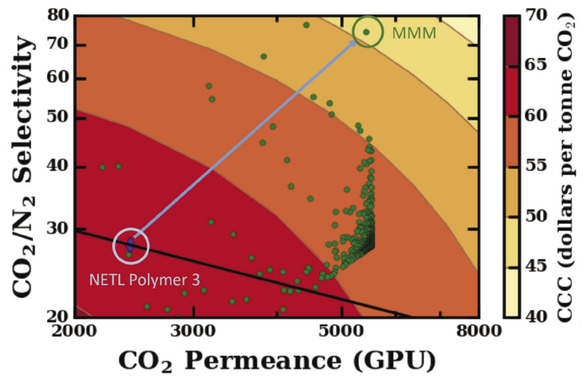
In-situ MOF growth is a possible scheme for **reducing steps for membrane scale-up.** NETL is now partnered with a commercial membrane manufacturer to **prove the scalability** of NETL's MMMs.

QUICK FACTS

AWARD NUMBER
FWP-1022402

PROJECT BUDGET

FY18 VALUE
$326,000



The chart shows the total cost of carbon capture for different hypothetical MOFs paired with one particular polymer as a function of the properties of the MOFs. Compared to a pure polymer, MMMs can dramatically reduce the cost of carbon capture (CCC).

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CCSI² Carbon Capture Simulation for Industry Impact

NETL - Penn State

University Coalition for Fossil Energy Research

2018 Science & Technology ACCOMPLISHMENTS SESSION

Reducing the cost of captured carbon and putting it to work for America

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