

# Development of Novel Process for Large-Scale Fabrication of High Surface Area MOF (Metal Organic Framework) Membranes for CO<sub>2</sub> and H<sub>2</sub> Capture

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Energy, transportation, and chemical sectors are major contributors to the increase in the greenhouse gas CO<sub>2</sub> concentration in our atmosphere. Increasing greenhouse gases causes global warming. The growing concern about global warming is placing greater demands on improving energy efficiency of processes and on reducing CO<sub>2</sub> emissions. The latter requires the separation of CO<sub>2</sub> at the source before it is dispersed into the atmosphere. The U. S. Department of Energy has shown that separation of CO<sub>2</sub> represents 75% of the overall cost associated with separation, storage, transport, and sequestration. Therefore, to make CO<sub>2</sub> separation economically feasible, highly efficient materials and processes for CO<sub>2</sub> capture are needed. Metal Organic Frameworks (MOFs) are a group of materials that shows tremendous promise for CO<sub>2</sub> removal. However, MOFs are generally synthesized as powders, which can greatly limit the use of these materials for large-scale applications as those needed for CO<sub>2</sub> capture during energy generation using post- and pre-combustion of fossil fuels. Membranes represent a simple way to expand the use of MOF materials to large-scale applications. However, technologies to make MOF membranes are still at infancy. In this project, a novel process called the SEAS Process, for making defect free MOF membranes was developed. Using the SEAS technique, MOF membranes were successfully made using CO<sub>2</sub> selective MOF materials. The quality of the membranes prepared was evaluated using SEM, SEM-EDS, and XRD techniques. Although the project focused on MOF membranes for CO<sub>2</sub> capture, the SEAS process is general enough that it can be applied to a broad variety of MOF and inorganic membranes for H<sub>2</sub>, O<sub>2</sub>/N<sub>2</sub>, and other gas separations. A provisional patent application has been filed.

## Awards Won:

Serving Society Through Science: First Award of \$500

Second Award of \$2,000