

Development of Novel Process for Large-Scale Fabrication of High Surface Area MOF (Metal Organic Framework) Membranes for CO₂ and H₂ Capture

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Energy, transportation, and chemical sectors are major contributors to the increase in the greenhouse gas CO₂ 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 CO₂ emissions. The latter requires the separation of CO₂ at the source before it is dispersed into the atmosphere. The U. S. Department of Energy has shown that separation of CO₂ represents 75% of the overall cost associated with separation, storage, transport, and sequestration. Therefore, to make CO₂ separation economically feasible, highly efficient materials and processes for CO₂ capture are needed. Metal Organic Frameworks (MOFs) are a group of materials that shows tremendous promise for CO₂ 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 CO₂ 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 CO₂ 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 CO₂ capture, the SEAS process is general enough that it can be applied to a broad variety of MOF and inorganic membranes for H₂, O₂/N₂, and other gas separations. A provisional patent application has been filed.

Awards Won:

Second Award of \$2,000

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