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:

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