Metal Organic Framework Glass Composite Membranes for Gas Separation

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Abstract:

Metal organic frameworks (MOFs) are a group of versatile porous materials that can be tuned to show specific transport behaviours. MOFs have been demonstrated to exist not only in different crystalline phase, but also other structural phases such as amorphous, liquid, and glassy phase. These new phases, specifically the glassy phase, have been shown to have promising application in the field of molecular separation and transport. The glassy MOF phase have also been shown to be able to form functional composites with other functional materials such as other crystalline MOFs and perovskites, to improve this material's functionality. In this study, we demonstrate the effects of composites including silver ions/nanoparticles towards the thermal dynamics of MOF glass formation, and its incorporation into functional thin film for membrane-based gas separation for different gas pairs including light hydrocarbons. This study also demonstrates Ag nanoparticle composite's capability to increase the alkene permeation as its size increase (Permeability C_3H_6 > C_2H_4), which goes against the typical size-based separation usually observed in membrane separation processes. The understanding from this study could provide better insight towards the effect of composites towards the thermal dynamics and formation of MOF glass composites, as well as the transport dynamics improvements in a thin film setting, allowing for better MOF glass synthesis tailorability for future membrane-based separation processes.

Keywords: Metal Organic Frameworks Glass, MOF Composites, Gas Separation Membrane