

Metal Organic Framework Glass Composites

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Metal–organic frameworks (MOFs) are a versatile class of porous materials with tunable structures and transport behaviours. While MOFs have traditionally been studied in their crystalline forms, our recent work has focused on exploring their alternative structural phases — particularly the glassy phase — which offers a unique combination of isotropy, stability, and processability. This unconventional phase has shown significant promise for applications in molecular separation, transport, and beyond.

We have investigated the thermal dynamics of MOF glass formation, specifically the role of incorporating silver ions and nanoparticles as composite-forming agents. These additives modulate the vitrification process and enable the development of functional thin films for membrane-based gas separation. We demonstrate that these MOF glass composites enhance gas transport properties for demanding separations, such as light hydrocarbon mixtures, while also improving the thermal and mechanical stability of the membranes.

Beyond separation applications, we have recently extended our exploration of MOF glasses into the field of photocatalysis. By embedding photoactive species — including metal oxides and quantum dots — within the glassy MOF matrix, we have created multifunctional composites capable of efficient light-driven reactions. These materials show strong potential in solar fuel generation and environmental remediation, benefiting from the robust and tunable characteristics of the MOF glass network and synergistic interfacial interactions within the composites.

Through these work, we aim to establish MOF glasses as a versatile platform for advanced membrane technologies that integrate separation, durability, and photocatalytic functionality. Our findings contribute to the rational design of next-generation materials with broad potential in energy, environmental, and chemical processing applications.

Reference:

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