# Interfacial Engineering of Metal-Organic Framework Glass Composites

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**Abstract:**

Typically, metal-organic frameworks (MOFs) are hybrid crystalline materials with metal nodes connected by organic ligands. Recently, the melting behaviour of MOFs has attracted increasing research interest. Glassy MOFs are an emerging family of MOFs with the crystal-liquid-glass transformation capability upon heating and the subsequent vitrification during cooling. Glassy MOFs possess attractive features, including high processability due to the formation of the liquid state, and unique separation properties due to the well-maintained porosity after vitrification. Our group recently identified the reactivity of MOF liquids which contain dynamically under-coordinated metal nodes. The dynamically under-coordinated metal nodes can promote the bond formation between MOF liquid and its neighbouring functional groups. Together with the flowing nature of MOF liquids, this drives us to use the liquid MOF to regulate the interface properties of MOF composites.

This presentation will introduce our studies in glassy MOF composite materials for membrane separation and electrochemical applications, focusing on optimizing the composite interface. We developed a MOF glass mixed matrix membrane by in situ melting of ZIF-62(Zn) within the polyimide matrix. The in situ melting of glassy MOF effectively healed the defects at the MOF-polymer interface, which led to a 57% increase in $CO_2/N_2$ selectivity for the composite membrane compared to the pure polymeric counterpart. Utilising the reactivity of MOF liquids, a bimetallic MOF glass hybrid was prepared by melting the ZIF-62(Co) together with an adsorbed ferric coordination complex. The reactive ZIF-62(Co) liquid facilitates the formation of coordinative bonds between Fe and imidazolate ligands. The presence of bi-metal ions within the framework significantly improved the catalytic oxygen evolution reaction (OER) performance of the MOF glass. Moreover, we introduced a rapid mechanochemical technique to produce MOF glass coatings on carbon cloth for fabricating larger area electrodes. More results about MOF glass composite fabrication, structure and performance evaluation will be presented.

**Keywords**: metal-organic framework, glass, interfacial engineering, composite