

Control of Breathing Behavior in Flexible Metal–Organic Frameworks for Efficient Proton Conduction

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Metal–organic frameworks (MOFs), which possess high surface area and porosity, and structural tunability, have received much attention as a solid–state proton conductor in proton exchange membrane fuel cells. The inclusion of guest molecules as proton carriers into the pore spaces of MOFs can improve the proton conductivity attributed to the formation of hydrogen–bonding networks while the relevant mechanism is still unclear. Here, we prepared imidazole molecule–loaded flexible MOFs (IM@MIL–88B) and investigated its effect on proton conductivity by controlling the breathing effect, which is possibly related to the formation of proton–hopping pathway. The breathing behaviors of flexible MIL–88B are tuned by varying the loading amount of guest molecule and introducing functional groups onto MOF ligands. The elaborately designed strong host–guest interaction can selectively lead to a full breathing effect on the framework, contributing to an enhanced proton conductivity due to the formation of successive proton conduction pathway. Our investigation provides the promise about the design of hydrogen–bonding networks for the exploration of facile proton conduction.