

Dimensionality Control of Li Transport by MOFs Based Quasi-Solid to Solid Electrolyte

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Abstract : Lithium-ion batteries (LIBs) are a promising technology for energy storage, but they suffer from safety concerns due to the use of flammable organic solvents in their liquid electrolytes. Solid-state electrolytes (SSEs) offer a potential solution to this problem, but they have their own limitations, such as poor ionic conductivity and high interfacial resistance. The aim of this research was to develop a new type of SSE based on metal-organic frameworks (MOFs) and ionic liquids (ILs). MOFs are porous materials with high surface area and tunable electronic properties, making them ideal for use in SSEs. ILs are liquid electrolytes that are non-flammable and have high ionic conductivity. A series of MOFs were synthesized, and their electrochemical properties were evaluated. The MOFs were then infiltrated with ILs to form a quasi-solid gel and solid xerogel SSEs. The ionic conductivity, interfacial resistance, and electrochemical performance of the SSEs were characterized. The results showed that the MOF-IL SSEs had significantly higher ionic conductivity and lower interfacial resistance than conventional SSEs. The SSEs also exhibited excellent electrochemical performance, with high discharge capacity and long cycle life. The development of MOF-IL SSEs represents a significant advance in the field of solid-state electrolytes. The high ionic conductivity and low interfacial resistance of the SSEs make them promising candidates for use in next-generation LIBs. The data for this research was collected using a variety of methods, including X-ray diffraction, scanning electron microscopy, and electrochemical impedance spectroscopy. The data was analyzed using a variety of statistical and computational methods, including principal component analysis, density functional theory, and molecular dynamics simulations. The main question addressed by this research was whether MOF-IL SSEs could be developed that have high ionic conductivity, low interfacial resistance, and excellent electrochemical performance. The results of this research demonstrate that MOF-IL SSEs are a promising new type of solid-state electrolyte for use in LIBs. The SSEs have high ionic conductivity, low interfacial resistance, and excellent electrochemical performance. These properties make them promising candidates for use in next-generation LIBs that are safer and have higher energy densities.

Keywords : energy storage, solid-electrolyte, ionic liquid, metal-organic-framework, electrochemistry, organic inorganic plastic crystal

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