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Influence of Ionic Liquid Cations on IL-POM Salt Properties

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ABSTRACT

Ionic liquid (IL) cations play a significant role in determining the physicochemical and structural properties of ionic liquid–polyoxometalate (IL–POM) salts. The nature, size, charge distribution, and functional groups of the cation can strongly influence the interaction between the organic cation and the polyoxometalate anion. Changes in the cation structure can affect important properties such as thermal stability, melting behavior, viscosity, solubility, ionic conductivity, and electrochemical performance. Larger and more asymmetric cations generally reduce efficient crystal packing, which can lower melting points and promote ionic-liquid-like behavior. The strength of cation–POM interactions also influences the stability and organization of the resulting salt. Functionalized cations containing groups capable of hydrogen bonding or other specific interactions may establish stronger associations with POM clusters, thereby modifying their structural arrangement and stability. The hydrophobic or hydrophilic character of the cation can additionally affect solubility and compatibility with different solvents or reaction environments. Cation selection is therefore an important strategy for tuning the properties of IL–POM materials for specific applications. By systematically varying cation structure while maintaining the same POM anion, researchers can establish structure–property relationships and design materials with desirable thermal, electrical, catalytic, and electrochemical characteristics.