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Research Keywords: Ionic Crystals, Porous Materials, Redox Chemistry, Cation-Exchange and Uptake, Proton Conduction, Heterogeneous Catalysis.

Abstract: We are interested in synthesizing functional porous ionic crystals based on POMs, which are different from conventional porous crystalline materials such as zeolites and MOFs. Some of our recent works are summarized as follows: **I.** Redox-active ionic crystals containing redox-active POMs as constituents show cooperative migration of electrons with metal ions in the porous structure (so called cation-coupled electron-transfer (CCET) in relation to proton-coupled electron-transfer (PCET)). We have recently reported selective adsorption of Cs⁺ from aqueous solutions^{1,2} and formation of small mixed-valence luminescent silver clusters³. **II.** POMs can efficiently transport protons because of the relatively low surface charge density, while application has been limited by the low structural stability. In order to solve this problem, POMs are hybridized with polymers especially with those containing amine group, which serves as protonation sites. The crystalline hybrids show high proton conductivity due to the extended hydrogen-bonding network and segmental motion of the polymers.^{4,5} **III.** Ionic components create strong electrostatic fields at internal surfaces of the pores, which are suitable for accommodation and stabilization of polar guests and cationic intermediates. We have reported structure-function relationships in conventional acid-type reactions such as pinacol rearrangement⁶ and biomass-related⁷ reactions.

Possible Collaborations: Please provide us with POMs and counter cations, which may show interesting properties as components of ionic crystals!! We have experience in characterization of solids (elemental analysis, solid state NMR, *in situ* powder XRD, gas and vapor adsorption studies, impedance measurements, catalytic reactions, etc).

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