

Reduction-induced alkali ion capture with polyoxometalate encapsulated metal–organic frameworks

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POM@MOFs offer synergistic properties that combine the advantages of both polyoxometalates (POMs) and metal–organic frameworks (MOFs). When combined, POMs are introduced to provide strong acidity, oxygen-rich sites, and redox activity, while MOFs contribute their high surface area, porous cavities, and tunable rigid structure to counteract the high solubility of POMs. This combination provides a heterogenous material that can be used in applications such as, gas storage, catalysts, and proton conductivity.¹

In this work, various POM@ZIF-8 composites were synthesized for reduction-induced alkali ion capture. ZIF-8 ($\text{Zn}[\text{C}_4\text{H}_5\text{N}_2]_2$) was chosen for this study for its crystallinity, porosity, chemical, thermal stability, and simple synthesis.² As for the POMs, various Keggin-types, including $[\alpha\text{-PMo}_{12}\text{O}_{40}]^{3-}$, $[\alpha\text{-PW}_{12}\text{O}_{40}]^{3-}$, and $[\alpha\text{-SiMo}_{12}\text{O}_{40}]^{4-}$, were introduced into the ZIF-8 framework to compare the effects of differing reducibility on ion capture properties. The ion capturing potential of the synthesized POM@ZIF-8s were initially evaluated in a CsCl methanol solution. With the addition of ascorbic acid as a reducing agent, the metal building blocks of the POMs are reduced. Subsequently, to compensate for the increase in electrons, alkali ions can be captured into the framework of the POM@ZIF-8. Preliminary results suggest that the innate reducibility of the incorporated POMs have a direct impact on the maximum adsorption capacity of certain alkali ions.

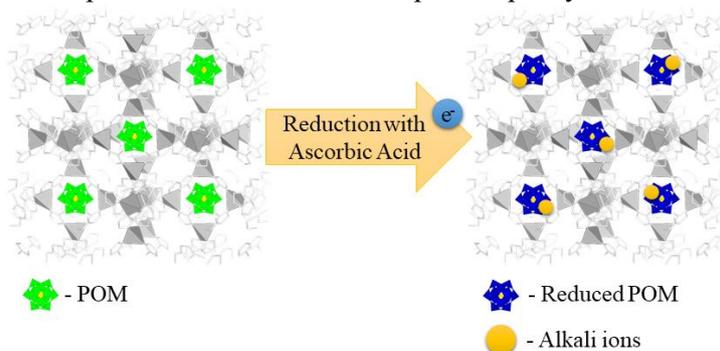


Figure 1. Scheme of reduction-induced alkali ion capture in POM@ZIF-8

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