Facile synthesis of Layered Metal Organophosphate Open Frameworks (MOPOFs) for high voltage electrode material in K-Ion Batteries

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Lithium-ion batteries (LIBs) have revolutionized the energy storage industry due to its various advantages including high energy density. However, the advancement in renewable energy production demands the need for large-scale energy storage as the renewable energy is intermittent. Due to the low-abundance of Li in the earth crust and its high extraction cost, alternate energy storage technologies created immense interest. Potassium-ion batteries (KIBs) are relatively a new kind of rechargeable batteries with technology similar to that of LIBs. Higher abundance of potassium and the possibility of higher voltage than sodium ion batteries (SIBs) make them interesting for future needs. Development of low-cost and advanced electrode/electrolyte materials are crucial for commercial realization.[1]

In this work, vanadium based inorganic-organic hybrid materials termed as MOPOFs[2, 3] have been investigated as potassium intercalation positive electrode for KIBs. These frameworks are layered materials with K^+ ions in the interlayer space and hence they can be reversibly intercalated accompanied by a $V^{4+/5+}$ redox couple. The material could be prepared by an environmentally friendly route at room temperature in aqueous solution, thus reducing the synthesis cost. Different electrolyte solutions were tested to realize higher energy density and rate capability of the material. The K^+ ions can be reversibly intercalated in the framework at ~4.2 and 3.4 V. Two dimensional K^+ ion migration ensures high rate capability of the material.

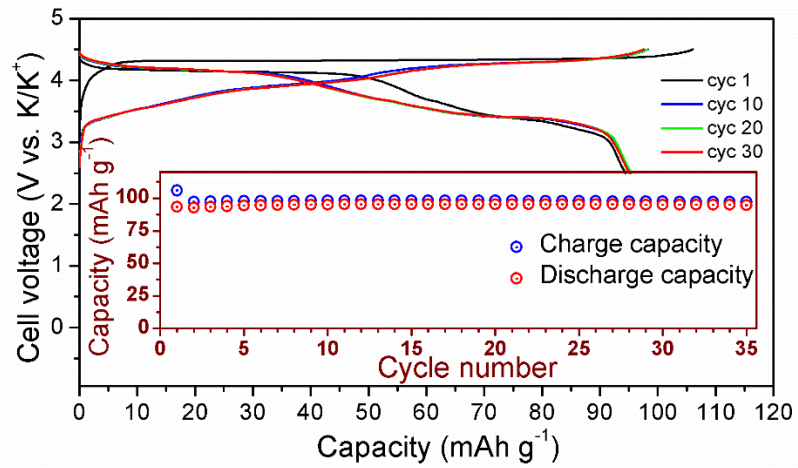

Fig.1: Reversible potassium intercalation in a MOPOF material

References:

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