A Mo-based Polyoxometalate as Anode Materials for Lithium–Ion Batteries

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Abstract

Low-cost, high-energy, and high-safety electrode materials for LIBs have been studied intensively. Graphite is the most widely used commercial anode material, but its low theoretical capacity (372 mA h g^{-1}) results in low energy density. Lithium-titanium–based insertion materials possess excellent cycle life, but it suffers from low capacity (< 200 mA h g^{-1}) and high electrical resistivity. Silicon-based materials and conversion oxide materials have high capacity more than 1000 mA h g^{-1}, but large volume change during charging/discharging processes lead to severely capacity fading.

Polyoxometalates (POMs) are transition metal oxide clusters. They possess well-defined structures, and have multiple redox reactions as a molecular cluster, like an electron/ion sponge. Several POM electrodes have been used in energy storage devices, such as LIBs, sodium-ion batteries, and supercapacitors. Most of them possess well electrochemical properties such as high capacity and excellent cycling stability.

In this work, we utilized a Mo-based POM as anode material for LIBs. This Mo-based POM was synthesized through a simple solution process, and it exhibited a high specific capacity more than 1250 mA h g^{-1} as well as a good cycling stability of 92% after 100 cycles, demonstrating this LIB anode material is suitable for energy storage applications. We also conducted in operando measurements such as X-ray Absorption Spectroscopy and X-ray diffraction to study the charge storage mechanisms of this Mo-based POM.

Keywords - Li-ion batteries, Polyoxometalates, In operando measurements.