

Li/Ag₂VO₂PO₄ batteries: the roles of composite electrode constituents on electrochemistry.

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The primary battery cathode material silver vanadium phosphorous oxide, Ag₂VO₂PO₄, was utilized as a model system to systematically study the impact of the constituents of a composite electrode, including polymeric and conductive additives, on electrochem. Notably, although highly resistive, this bimetallic cathode can be discharged as a pure electroactive material in the absence of a conductive additive as it generates an in situ conductive matrix via a reduction displacement reaction resulting in the formation of silver metal nanoparticles. Three different electrode compositions were investigated: Ag₂VO₂PO₄ only, Ag₂VO₂PO₄ with binder, and Ag₂VO₂PO₄ with binder and carbon. Constant current discharge, pulse testing and impedance spectroscopy measurements were used to characterize the electrochemical properties of the electrodes as a function of depth of discharge. In situ EDXRD was used to spatially resolve the discharge progression within the cathode by following the formation of Ag⁰. Ex situ XRD and EXAFS modeling were used to quantify the amount of Ag⁰ formed. Results indicate that the metal center reduced (V⁵⁺ or Ag⁺) was highly dependent on composite composition (presence of PTFE, carbon), depth of discharge (Ag⁰ nanoparticle formation), and spatial location within the cathode. The addition of a binder was found to increase cell polarization, and the percolation network provided by the carbon in the presence of PTFE was further increased with reduction and formation of Ag⁰. This study provides insight into the factors controlling the electrochemistry of resistive active materials in composite electrodes.