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Effects of Ag-Embedment on electronic and ionic conductivities of LiMnPO_4 and performances as a cathode for lithium-ion batteries

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Ag-embedded LiMnPO_4 (LMP) cathode was synthesized by solid-state reaction using 1 wt% Ag precursor. Structure, morphology, and electrical conductivity studies of Ag-embedded LMP were performed by high resolution synchrotron powder X-ray diffraction, high resolution transmission electron microscopy, energy dispersive X-ray spectroscopy, and four probe measurements. An Ag nanoparticle (~ 26 nm) surrounded by several olivine crystallites within a single particle dramatically improved overall electrical conductivity of LMP by four orders of magnitude relative to that of pristine LMP, playing roles as conducting bridges among LMP crystallites as well as particles. Rietveld analysis confirmed structural variations related to modification of atomic bond lengths of Mn-O, P-O, and Li-O coordination due to Ag-embedment and thereby leads to facile Li ion diffusion in LMP. Consequently, although small amount of Ag was included, Ag-embedded LMP cathode exhibited outstanding electrochemical performances (92 mAhg⁻¹ at 10 C) versus lithium.

Keywords

synchrotron powder X-ray diffraction; Rietveld analysis; cathode materials

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