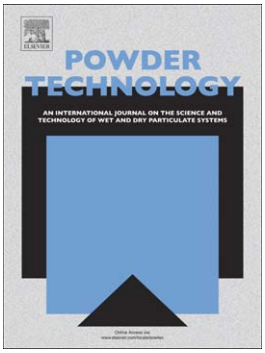

Preparation of a high-purity ultrafine α-Al_2O_3 powder and characterization of an Al_2O_3-coated PE separator for lithium-ion batteries

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Preparation of a high-purity ultrafine α-Al_2O_3 powder and characterization of an Al_2O_3-coated PE separator for lithium-ion batteries

Abstract

Ultrafine α-Al_2O_3 particles with a high purity of 99.997% and an average size of 300–400 nm were successfully prepared via hydrothermal and jet-milling processes. The jet-milled Al_2O_3 powders were coated on a conventional polyethylene (PE) separator, and the effects of the Al_2O_3 particle size on the coating properties of the Al_2O_3-coated PE separator were investigated. When compared with both the Al_2O_3-coated PE separator containing unmilled particles (D_{50} = 3.75 μm) and the PE separator, the Al_2O_3-coated PE separator incorporating the jet-milled particles (D_{50} = 0.37 μm) exhibited a high porosity (60–63%) and a high electrolyte uptake (243–245%). The cell with the Al_2O_3-coated PE separator showed a similar rate capability and cycling performance at room temperature compared with the PE separator. Regarding the thermal behavior, the Al_2O_3-coated PE separator has a lower enthalpy, lower thermal shrinkage, and improved melt integrity compared with the pristine PE separator.

Keywords: Lithium-ion batteries, α-Al_2O_3; Jet-milling; PE separator; Dip coating; Thermal stability