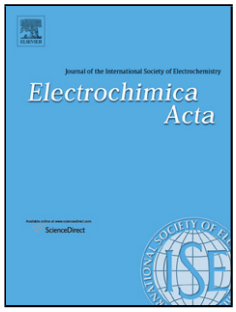

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Nano-particle size effect on the performance of $Li_4Ti_5O_{12}$ spinel

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Abstract

The effect of nano-scale particle size on the performance of $Li_4Ti_5O_{12}$ (LTO) electrode is investigated by computational simulation. Newman pseudo-2D (P2D) model is utilized to characterize the performance of LTO electrode. However, unlike previous P2D lithium ion battery (LIB) models, the model design adjustable parameters are set based on the experimental data obtained from monodispersed active electrode particles. This allows the model to accurately reflect real battery performance. The model provides the optimum nano-particle size for a specific application, which eliminates the performance loss due to the limited mass transportation. The model can be employed for a wide range of electrode materials to optimize the particle-size and reduce fabrication costs by avoiding unnecessary particle size reduction.

Keywords: Lithium titanate; Nano technology; Nano-particle; Experiment-based modeling

1. Introduction

Motivated by their high energy and power density, continued efforts have been devoted to improving and optimizing the performance of LIBs [1,2]. One practical approach is using nano-particle based electrodes to increase interfacial surface area while decreasing the lithium ion diffusion length within the particles to enhance active material utilization [3–6]. Computer models have been proved to be invaluable for investigating the effects of different materials design parameters, e.g. particle size, on the performance of electrochemical energy storage systems [7–10].