

Direct Determination of Transport Rates in Li-Ion Battery Electrodes

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Electrolyte transport rates in Li-ion battery electrodes are often calculated using 1-dimensional models fitted to macroscopic data such as capacity vs voltage. Although the electrodes have a complex 3-dimensional microstructure, it is common for them to be treated as though they were composed of a homogeneous material characterized by a single measurable parameter, porosity, together with an associated adjustable parameter, tortuosity. Unfortunately, it is often the case that an adequate fit to the data can be obtained with multiple parameter sets because the transport equations contain more parameters (35 in Dees' model) than can be unambiguously determined. In this work we describe a new technique which allows for a more direct measurement of transport rates in battery electrodes and gives an unambiguous separation of transport by diffusion and by migration. The experiment is analyzed with a 1D model. Measurements of electrolyte transport rates in a graphite electrode are presented and compared with values that have been obtained using other methods.