Modeling for Low Temperature Performance of Lithium-ion Battery

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Lithium-ion batteries (LiB) are used in plug-in hybrid electric vehicle (PHEV) and consumer portable electronics. In order to operate these batteries more efficiently, accurate estimation of battery states is necessary. Modeling of the battery is important for accurate estimation of these battery's states. Especially, estimation of the low temperature performance of the LiB is very important for PHEV for usage in the winter. However, characteristics of the electrochemical property of the battery at low temperature are very different with standard temperature properties. Therefore, the low temperature model of the Lib is suggested in this paper. The dynamic equivalent circuit battery model with modified discrete time concept is suggested. This model is based on first order RC circuit model which represents the polarization phenomenon in battery. The model parameters are estimated with adaptive parameter estimation algorithm using least square estimators based on experimental cell data with pulse patterns. The electrochemical model and the parameter estimation algorithm are validated with urban driving pattern data for PHEV. The result is that suggested model is accurate at low temperature condition.