Electrochemical-Thermal Modeling of Large-Format Prismatic Li-ion Cells

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Thermal management of large Large-format prismatic Li-ion cells is crucial due to their small surface-to-volume ratios, which can lead to local degradation of active materials within the battery, or catastrophic thermal runaway of the battery [1]. In order to predict the transient electrochemical-thermal response of a 15-Ah A123 prismatic pouch cell, a simple physics-based model has been developed. The 3D model is based on the Newman-Tobias porous-electrode theory [2] and coupling the charge and energy balances. Li ion transport inside the particles as well as liquid phase are not considered. A data-fitting approach based on dimensionless parameters predicts surface-average temperature, maximum and minimum temperature, as well as cell voltage. In spite of its simplicity with respect to the standard Dualfoil model [3], the proposed model prediction is within the experimental error as shown in Figure 1.

[1] T. M. Bandhauer, S. Garimella, and T. F. Fuller, *J.Electrochem. Soc.* 158, R1 (2011).

[2] J. S. Newman and C. W. Tobias, *J. Electrochem. Soc.* 109, 1183 (1962).

[3] M. Doyle, T. Fuller, and J. Newman, *J. Electrochem. Soc.*, 140, 1526 (1993).

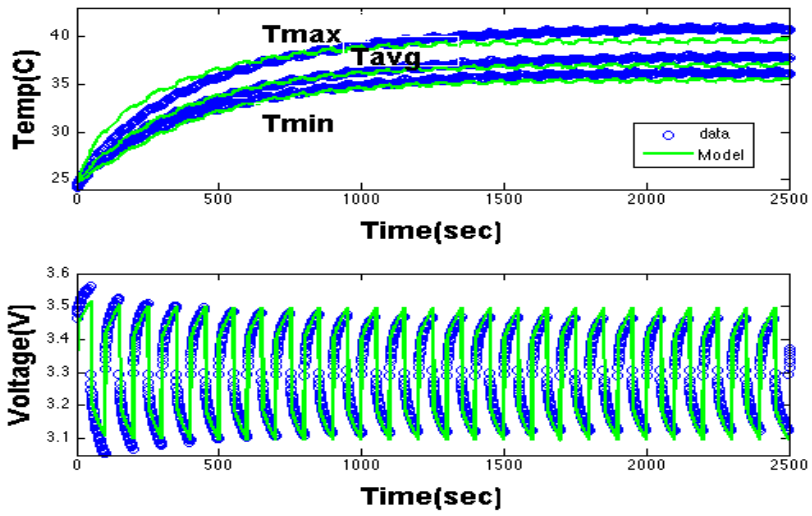


Figure 1, Prediction of Electrochemical-Thermal response at 5C and 100 sec period time