# High Performance Computing Strategy for Coupled Multi-Physics Li-Ion Battery Pack Simulations

**Srikanth Allu, Bruno R. Trucksin, Damien T. Lebrun-Grandie, Mark A. Berrill, Stuart R. Slattery and John A. Turner**

Computer Science and Mathematics Division
Oak Ridge National Laboratory
Oak Ridge, Tennessee
e-mail: allus@ornl.gov

## ABSTRACT

Simulations at the scale of battery packs are conducted for design and analysis of temperature distribution that lead to nonuniform aging of the cells and eventually loss of performance and life. Incorporating degradation and aging mechanisms into these electro-chemistry models is necessary to understand balancing and packing efficiency of cells in a Li-Ion battery pack and is computationally expensive. In this paper, we will present an efficient way to simulate battery packs that utilizes infrastructure of high performance computing to demonstrate the importance of coupled electro-chemical model on temperature and potential gradients in a battery pack that lead to cell imbalance. The 3D multi-physics model for the individual Li-Ion pouch cell used to construct the battery pack has been validated earlier with the experimental data at various discharge rates [1]. We will discuss the recent results that explain complex behavior of lithium ion battery packs under various aggressive drive cycle loading conditions that show interaction of the multi-physics across various length scales

## REFERENCES

[1] Allu, S., Kalnaus, S., Simunovic, S., Nanda, J., Turner, J.A. and Pannala, S. A three-dimensional meso-macroscopic model for Li-Ion intercalation batteries. *Journal of Power Sources*(2016) *325*:42–50.