Canadian Association of Physicists

Association canadienne des physiciens et physiciennes

Contribution ID: **2045** Type: **Poster Competition (Graduate Student) / Compétition affiche (Étudiant(e) 2e ou 3e cycle)**

# POS-21 Revealing the unwanted reactions in lithium-ion cells with isothermal microcalorimetry

*Tuesday, 12 June 2018 18:29 (2 minutes)*

Improving the cost, lifetime, and energy density of lithium-ion cells is critical in the transition away from fossil fuels for energy production and transportation. Increasing the operational voltage of a lithium ion cell is one way to increase energy density and decrease cost. However, traditional solvents used in lithium-ion electrolytes are not stable at these potentials, causing what are termed 'parasitic reactions'–or the decomposition of electrolyte species into unwanted products. These reactions consume lithium content and electrolyte species, decreasing the available capacity of the cell, and can create films of reaction products on the electrodes which mitigate ion transfer, ultimately leading to cell death [1]. Due to the complexity of the electrochemical system, the exact mechanisms of parasitic reactions are often unknown and vary depending on electrode materials and coatings, electrolyte solvents, lithium salts, electrolyte additives, etc.

Isothermal microcalorimetry offers a unique way to probe parasitic reactions *in-situ* and non-destructively. The heat flow of a lithium-ion cell during operation has contributions from entropy changes in the electrode materials, the internal resistances in the cell (joule heating), and parasitic reactions. The heat flow from parasitic reactions can be found using a careful analysis during charge and discharge cycling of a cell. Using this analysis method, the parasitic heat flow has been found to directly correlate to cell lifetime [2, 3]. This presentation will highlight the advantages of this technique and how isothermal microcalorimetry has be used to aid in the design and understanding of electrolyte systems for high energy density, long lifetime lithium-ion cells.

[1] Xu, K. *Chem. Rev.* **2014**, 114, 11503–11618.
[2] Glazier, S.L. et al. *J. Electrochem. Soc.* **2017**, 164, A567–A573
[3] Glazier, S.L. et al. *J. Electrochem. Soc.* **2017**, 164, A3545-A3555

**Primary authors:** Mr GLAZIER, Stephen L. (Dalhousie University); Dr DAHN, J.R. (Dalhousie University)

**Presenter:** Mr GLAZIER, Stephen L. (Dalhousie University)

**Session Classification:** DCMMP Poster Session & Finals: Poster Competition and Mingle Session with Industry Partners (28) / Employers | Session d'affiches DPMCM et finales: Concours d'affiches et rencontres avec partenaires industriels et employeurs (28)

**Track Classification:** Condensed Matter and Materials Physics / Physique de la matière condensée et matériaux (DCMMP-DPMCM)