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POS-17 Analysis of "Rollover Failure" of Lithium-ion Cells

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Sometimes lithium-ion cells show a very insidious type of failure where they display close to 100% of their capacity for about 1000 charge-discharge cycles and then lose most of their capacity in only 100 cycles or so with very little warning to the user. This is called "rollover failure". Experimental observations show that the likelihood of rollover failure increases with upper cutoff potential of lithium-ion cells. Since increasing the upper cutoff potential is essential to increase the energy density of lithium-ion cells, a full understanding of the causes of rollover failure is essential, but this is proving very difficult to attain.

In this presentation, the phenomenon of rollover failure during long-term cycling will be discussed based on a comparison among Li(Ni0.5Mn0.3Co0.2)O2/graphite pouch cells with different electrolyte and electrode designs undergoing different testing protocols. A few facts can be gleaned from the data:
1. For cells charged to the same upper cutoff potential, those showing the highest rates of electrolyte oxidation at the positive electrode (due to electrolyte or cell chemistry changes) are most prone to rollover failure.
2. Any cell is more prone to rollover failure if charged to higher potential. This increases the rate of electrolyte oxidation at the positive electrode.
3. When cells are disassembled after rollover failure, they invariably show unexpected and unwanted lithium metal plating on the surface of the graphite negative electrode.
Based on these and other observations some simple handwaving models of rollover failure can be postulated but serious experimental studies using a variety of methods are required for full understanding. It is hoped that this lecture can spur other researchers to help tackle this critical problem!

Primary author: Dr MA, Xiaowei (Dalhousie University)

Co-authors: Ms HALLOW, Jessie (Dalhousie University); Ms THOMPSON, Lauren (Dalhousie University); BAUER, Michael (Dalhousie University); KEEFE, Alison; Dr LI, Jing (Dept. of Physics and Atmosphere Science, Dalhousie University, Halifax, NS, Canada, B3H 3J5); GLAZIER, Stephen (Dalhousie University); Mr MA, Lin (2. Dept. of Chemistry, Dalhousie University, Halifax, NS. B3H 4R2, Canada); HALL, David (Dalhousie University); AIKEN, Connor; GENOVESE, Matthew (Dalhousie University); CORMIER, Marc (Dalhousie University); Prof. DAHN, Jeff (Dalhousie University)

Presenters: Dr MA, Xiaowei (Dalhousie University); Prof. DAHN, Jeff (Dalhousie University)

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