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POS-23 Li-ion Differential Thermal Analysis; an in-situ method for studying changes to electrolyte

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Li-ion cells contain liquid electrolyte that degrades over the course of their lifetime. High temperatures, high charging currents, and high voltage exposure can all accelerate electrolyte degradation. This degradation will eventually contribute to the death of the cell. As the electrolyte degradation pathways are not currently well understood, tools for careful probing of the electrolyte are required to further develop cell chemistries for longer lasting cells, which is especially important for long term grid level storage.

Li-ion differential thermal analysis (Li-ion DTA) is a non-destructive in-situ method for probing the state of an electrolyte in a liquid electrolyte cell. Various methods of studying electrolyte ex-situ, by opening a Li-ion cell, have been developed, but these destroy the cell of interest. Using Li-ion DTA methods, which do not damage the cell, the degradation to the electrolyte of a single cell can be tracked throughout its lifetime. The DTA method functions by cooling a sample cell to below the electrolyte freezing point using a temperature controlled cryostat, and heating the cell linearly in time back to room temperature where the electrolyte is liquid again. By comparing the resultant temperature-time signal of the sample cell to that of a reference cell that did not undergo a phase change in the same temperature range, the phase changes of the electrolyte in the sample cell can be determined. By comparing these phase change temperatures to known electrolyte compositional phase diagrams, the state of the electrolyte can be determined qualitatively, and, in future, quantitatively. The method will be explained and results from several long term experiments on aged Li-ion cells will be described.

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