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POS-25 Impedance Growth in Lithium-Ion Pouch Cells

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The widespread adoption of electric vehicles over gas-powered transport is essential to our sustainable future. Consequently, the lithium-ion batteries used for electric cars are receiving more and more attention. Lithium-ion cells with LiNi0.8Co0.15Al0.05O2 (NCA) positive electrodes have been observed to lose capacity during their lifetime as a result of impedance growth.1,2 Understanding the origin of the impedance growth is important to improving the lifetime of these cells, which in turn can help make electric vehicles more desirable to consumers and speed the adoption of sustainable transport.

In this study impedance growth was observed to contribute to capacity loss in pouch cells with NCA positive electrodes and graphite, graphite-SiO, or graphite-SiC negative electrodes. The positive electrode was observed to have drastic impedance growth during cycling while the negative electrode impedance was small in comparison. The impedance growth for NCA pouch cells was controlled by cycling in the limited voltage range of 3.0 V –3.8 V, while impedance growth was still observed for cells cycled only at high voltage (3.8 V –4.2 V). Additionally, the magnitude of impedance was highest near 4.2 V. The cathode material undergoes irreversible impedance growth in the high voltage region. Differential capacity vs. voltage (dQ/dV) for the NCA material shows a peak at 4.2 V vs Li/Li+, which may correspond to the impedance growth at high voltage. Similar experiments are also presented for pouch cells with LiNi0.8Mn0.1Co0.1O2 (NMC811) or LiNi0.5Mn0.3Co0.2O2 (NMC532) positive electrodes. Understanding the dQ/dV peak at 4.2 V vs Li/Li+ for these positive electrode materials may be important for preventing capacity loss from impedance growth during long term cycling.

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