Analysis of integrated electrode stacks for lithium ion batteries

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In an effort to reduce the cost of manufacturing lithium ion batteries, a novel layer by layer approach is being developed to prepare lithium ion batteries. The layer by layer approach offers a significant advantage over traditional rolling or stacking of multiple component cells by providing excellent contact and thinner separator layers. In addition, the method has the potential to conserve space and conserve energy density while lowering cost.

The initial stacks used with this method have been anode and cathode half stacks. Each half stack consists of a current collector, an electrode, and a 10 µm thick separator combined into a single component. The anode and cathode half stacks have been investigated in Li/anode and Li/cathode coin cells (half cells). The initial anode and cathode half cells were investigated at a low cycle rate (C/20) and provided excellent cycling performance. Variable rate performance was also utilized to investigate the rate capability of the cells. The anode and cathode half stacks were then used to construct full cells, where the separators of each stack stood face to face. The graphite/NMC cycled well possessing good performance both a low rates (C/20) and moderate rates (C/5), Figure 1. Cross sectional SEM images were acquired for fresh stacks and stacks cycled in full cells to investigate the mechanical stability of the novel electrodes. The SEM images reveal very little change in the anode and cathode materials upon cycling. Further optimization of the layer by layer deposited electrodes along with post-mortem analysis of the electrodes will be discussed.

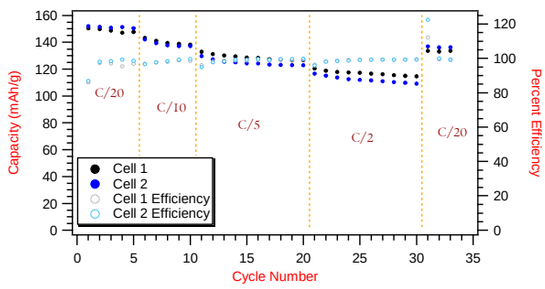

Figure 1: Efficiency plot and discharge plot of full cells cycled with anode and cathode half stacks.

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