Benchmarking Material's Safety in the Li-ion Battery Industry - Cathodes

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Recent recalls, due to safety concerns, of laptop computer batteries that use Li-ion technology, stress the importance original equipment manufacturers place on the safety performance of their components. As research into new Li-ion battery materials pushes forward to meet the power-performance requirements of new technology, focus on safety testing remains at the top of the list of concerns. The key to understanding the safety of any new material rests on combining understanding of the fundamental nature of the material along with an understanding of that material's reactivity with other system components.

In this study, we examined the safety performance of different metal oxide cathode materials from different suppliers. These active cathode materials include $LiCoO_2$ and $LiNiCoO_2$ materials. We combined physical and structural characterization, calorimetric safety testing and extensive electrochemical testing in order to compare, evaluate and understand the safety features of these different materials in the context of their use in a Li-ion battery.

Scanning electron microscopy and X-ray diffraction measurements show these similarly structured materials to possess varying physical characteristics. Electrochemical results show the expected differences of higher specific capacity and lower cyclability for Ni containing lithium metal oxides.

Safety was assessed with a combination of differential scanning calorimetry (DSC) and accelerating rate calorimetry (ARC) tests. Using the same cell assembly protocol as with electrochemical testing, additional cells were prepared in order to examine different cathode materials with varying extents of lithiation. Thus, both raw materials and charged/discharged electrodes could be tested for safety in the common electrolyte system EC/DMC (1:1), 1 M $LiPF_6$. Results of safety features will be presented and discussed with comparison to each material's electrochemical performance.