

**CYCLING BEHAVIOR OF
NANOSIZE COMPOSITE TIN-
ALLOY ANODE IN Li-IMIDE
EC:DEC ELECTROLYTE**

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Safety considerations have led to the replacement of pure lithium anodes in lithium batteries, by anodes made of disordered carbon or graphite. In order to increase anode capacity, an effort has been made to replace these materials by metals or alloys that are capable of alloying lithium and have a higher charge capacity. However, the most prominent disadvantage of the metal alloys is the large changes in volume that occur during cycling. This result in large mechanical stresses, that causes the host matrix to crack and eventually disintegrate. Furthermore, the use of LiPF_6 electrolytes enhances the formation of LiF-rich SEI. We believe that large quantities of this compound in the SEI, decrease its elasticity and, thus, contribute to the degradation of the anode.

The goal of this work is to study the effect of Li-imide electrolyte on the cycle life, and the variation of SEI composition and electrode kinetics during cycling.

A composite anode material that contains nano-size ($<100\text{nm}$) particles of tin alloy $\text{Sn}_{58}\text{Sb}_{25}\text{Cu}_{17}$ was prepared. The alloy was electroplated at high current densities (above i_L), from aqueous solutions, directly on the copper current collector and was coated with a PVDF - graphite matrix at a ratio of alloy: graphite matrix 88:12 w/w.

Characterization of the tin-based anode was performed with the use of two sets of 2032 coin cells. The first set was used for the electrochemical characterization, and the second, was dismantled after 5, 15, and 40 cycles for XPS analyses of the SEI. Over 30 (100% D.O.D) cycles were demonstrated in half-cells, and over 40 in a LiCoO_2 battery containing Li-imide EC-DEC electrolyte. The faradaic efficiency ($Q_{\text{De-ins}}/Q_{\text{Ins}}$) is less than 100%.

The results of AC-impedance measurements, and XPS analyses of the SEI will be discussed.