Stability of $LiNi_{0.5}Mn_{1.5}O_4$ in 1.2M 3:7 EC/EMC Electrolyte Solution

Brandon Knight[1], Hugues Duncan[2], Guoying Chen[2], and Brett L. Lucht[1]

[1]University of Rhode Island, Kingston, RI 02881
[2]Lawrence Berkeley National Laboratory, Berkeley, CA 94720

The degradation of lithium manganese spinel electrodes, including $LiNi_{0.5}Mn_{1.5}O_4$, is an area of great concern within the field of lithium ion batteries (LIBs). Manganese containing cathode materials frequently have problems associated with Mn dissolution which significantly reduces the cycle life of LIB. Thus the stability of the cathode material is paramount to the performance of Mn spinel cathode materials in LIBs. In an effort to gain a better understanding of the stability of $LiNi_{0.5}Mn_{1.5}O_4$ in common $LiPF_6$/carbonate electrolytes, samples were stored at elevated temperature in the presence of electrolyte. Then after storage both the electrolyte solution and uncharged cathode particles were analyzed. The solid cathode particles were analyzed via scanning electron microscopy (SEM) whereas the electrolyte solution was analyzed using inductively coupled plasma mass spectroscopy (ICP-MS). The SEM analysis assists with elucidation of changes to the surface sof the cathode particles. The ICP-MS of the electrolyte allows the determination of the extent of Mn and Ni dissolution. Samples of $LiNi_{0.5}Mn_{1.5}O_4$ with different crystal surface facets were prepared to investigate the role of particle morphology in Mn and Ni dissolution. The factors affecting Mn and Ni dissolution and methods to inhibit dissolution will be discussed.

Acknowledgement

This work was supported by the Assistant Secretary for Energy Efficiency and Renewable Energy, Office of Vehicle Technologies of the U.S. Department of Energy under Contract No. DE-AC02-05CH11231, Subcontract No 6879235 under the Batteries for Advanced Transportation Technologies (BATT) Program.