53nd GREEN Open Seminar

2016/ 12/2(Fri) 14:00～15:30

Venue : Auditorium, 1F, WPI-MANA Bldg., Namiki Site

~Development of Characterization Technique for Batteries Materials~

Perspectives on the Analysis and Improvement of Lithium-Ion Batteries

Dr. Frank McLarnon
Lawrence Berkeley National Laboratory, ECS Fellow

Abstract

High-capacity manganese-rich (HCMR™) materials are promising candidates for commercial Li-ion battery positive electrodes for applications in electric and plug-in hybrid electric vehicles. However, these materials have significant limitations and suffer from high first-cycle irreversible capacity loss, impedance rise, and voltage fade during cycling.
Extensive studies of HCMR™ electrodes indicated structural modification/rearrangement as one of the major reasons for the electrode/material degradation. This work describes three possible scenarios for the origin of the DC-R rise.

Challenges and Opportunities in Battery Characterization

Dr. Robert Kostecki
Lawrence Berkeley National Laboratory, ECS Fellow

Abstract

NMC-type cathodes surface reactivity toward the electrolyte strongly depends on the surface crystalline orientation, local defects, and surface reconstruction processes. Surface oxygen vacancies, which are preferentially located in Mn-depleted regions, affect the local surface charge density distribution. Thus, the activation energy of lithium deinteracalation and the strength of Mn-O, Co-O and Ni-O bonds are significantly lower adjacent to those oxygen vacancies, which are flanked by MnIII coordinately unsaturated sites. Post mortem diagnostic evaluations of aged commercial and model Li-ion cells reveal strong and omnipresent fluorescence from electrodes and passive cell components. Interestingly, these processes also overlap with metal dissolution, which suggests that the fluorescent compounds could be metal ion based. The postulated heterogeneous catalysis mechanism accurately describes interfacial processes on NMC positive electrodes in organic carbonate electrolytes and relates to the observed failure modes in Li-ion batteries.

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