View Abstract

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CURRENT SYMPOSIUM: PacRim S33: Ceramics for Electrochemical Energy Storage

CURRENT SESSION: Electrodes for batteries (e.g., Li-ion and Na-ion) and supercapacitors.

PRESENTATION TYPE: Contributed (Oral)

TITLE: Tailored NMC core/shell cathode powder for long cycle life LIB batteries

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ABSTRACT BODY:

Abstract Body: NMC ($LiNi_xMn_yCo_zO_2$) cathode materials with high Ni content remain the most successful formulas, delivering strong overall performance and excellent specific energy. However, the increased reactivity of Ni with surface oxygen during charge-discharge cycles and larger Li/Ni cationic mixing can lead to chemical and structural degradation, resulting in poor cycling performance, rapid capacity fading and short cycle life. The present work deals in the frame of EU-funded PHOENIX project with the development of core/shell structured NMC-particles. This morphology provides surface stabilization of NMC90 core via Mn-rich (NMC 622) shell by keeping the energy storage capabilities at higher level and prevents cathode degradation. For its synthesis, an oxalate-assisted, two staged coprecipitation route and advanced in-situ Li-infiltration approach has been developed. Moreover, prior to application of Mn-rich shell, a thin WO_3 layer has been brought onto the surface of the Ni-rich core particles to prevent interdiffusion between the core and shell. Relying on a relatively high I(003)/I(104) ratio (1.59 at NMC90 and 2.18 at NMC622), it is shown that the formation of R3m structure via in-situ Li-infiltration can be achieved for both compositions already at 850 °C. Further electrochemical studies and long cycling tests have been carried with half-cell LiBs using core/shell NMC cathodes with and without WO_3 interlayer.

KEYWORDS: Li-ion batteries, NMC core/shell cathode powder, WO3 interlayer, cycling stability, R3m phase, coprecipitation route.

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