Studies of the Electrochemical Behavior of $LiNi_{0.80}Co_{0.15}Al_{0.05}O_2$ Electrodes Coated with $LiAlO_2$

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The goal of this work was to understand the influence of nano-sized $LiAlO_2$ coatings prepared by Atomic Layer Deposition (ALD) onto $LiNi_{0.8}Co_{0.15}Al_{0.05}O_2$ (NCA) electrodes on their electrochemical behavior at 30 and 60^0C in terms of the potential windows, capacity fade, impedance characteristics, and the self-discharge. $LiAlO_2$ coatings of 0.5, 1 and 2 nm thickness were effectively deposited directly onto $LiNi_{0.8}Co_{0.15}Al_{0.05}O_2$ *electrodes* using ALD technique. The novelty of the present study is that, for the first time, we obtained and analyzed significant results on the elevated temperature aging (the self-discharge) of bare and $LiAlO_2$ coated electrodes at 4.3 V. It was demonstrated that upon cycling, 2 nm $LiAlO_2$ coated electrodes displayed ~3 times lower capacity fading and lower voltage hysteresis comparing to bare electrodes [1]. We established a correlation among the thickness of the $LiAlO_2$ coating and parameters of the self-discharge processes at 30 and 60^0C. These results were obtained for the first time. By analyzing of X-ray diffraction patterns of bare and 2 nm coated $LiNi_{0.8}Co_{0.15}Al_{0.05}O_2$ electrodes after cycling, we concluded that cycled materials preserved their original structure described by *R-3m* space group and no additional phases were detected.

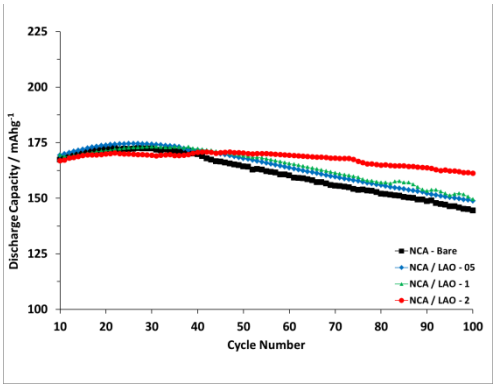

Figure 1. Cycling performance of NCA bare and NCA/$LiAlO_2$-05 nm, NCA/ $LiAlO_2$-1 nm and NCA/ $LiAlO_2$-2 nm coated electrodes at 30˚C, C/2.5 rate in the potential range of 2.7 – 4.3 V.

References:

[1] O. Srur-Lavi, V. Miikkulainen, B. Markovsky, J. Grinblat, M. Talianker, Y. Fleger, G. Cohen-Taguri, A. Mor, Y. Tal-Yosef, D. Aurbach, J. Electrochem. Soc. 164 (2017) A3266.