Atomic Layer Deposition of ZrO_2 coating on $LiNi_{0.5}Mn_{0.3}Co_{0.2}O_2$ for High-Voltage Operation in Lithium ion batteries

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In order to employ lithium ion batteries (LIBs) in large-sized energy storage system such as electric vehicles and energy storage systems, electrodes with long life span, high energy density, and improved safety are required. Three-component layered $LiNi_xMn_yCo_{1-x-y}O_2$ (NMC) has the advantages of high capacity, high rate capability, stable cyclability, and reliable safety. Especially, $LiNi_{0.5}Mn_{0.3}Co_{0.2}O_2$ (NMC532) has been successfully applied to Li-ion batteries, and regarded as one of the promising cathode materials in industrial application. However, the capacity fading of the bare material during cycling at a high cut-off voltage (4.4V) is problematic. To overcome this obstacle, some efforts, including surface modification and introduction of additives, have been effectively applied. Due to the complex structure of prepared electrode, surface coating on prepared electrode via traditional wet chemical methods usually led to poor conformality and uniformity. ALD is an advanced thin film deposition technique and has drawn considerable attention recently.

In this work, we successfully fabricated surface coating of nano-sized ZrO_2 on the prepared NMC532 via atomic layer deposition (ALD). The ZrO_2 coated NMC532 electrode shows improved cycle stability at high-voltage (4.6V) operation.

References:

[1] S.H. Lee, S. Yoon, E.H. Hwang, K.Y. Cho, J. Power Sources 378 (2018) 112–118.