Enhancement of Electrochemical Properties of Si Alloy Anodes by ultrathin Al_2O_3 Atomic Layer Deposition for Li-ion Batteries

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We report ultrathin atomic layer deposition (ALD) enhanced the electrochemical performances of Si alloy anodes for Lithium ion batteries. Especially, the degradation of coulombic efficiency during cycling is suppressed remarkably by employing Al2O3 ALD-coated on Si alloy powder. The coated Si alloy anode powder with 8 ALD cycles and heat treatment deliver a coulombic efficiency of 99.5% in 1C rate after 52cycle, corresponding to a 0.5%point improvement, compared to bare Si alloy anode powder. These also exhibit a stable discharge capacity around 800mAh/g after 52 cycles. As a result, the simple ALD and heat treatment process is broadly applicable and provide new opportunities for the battery industry to design other novel nanostructured electrodes that are highly durable

Keywords : Atomic layer deposition, Lithium secondary battery, coulombic efficiency, Si alloy anode,

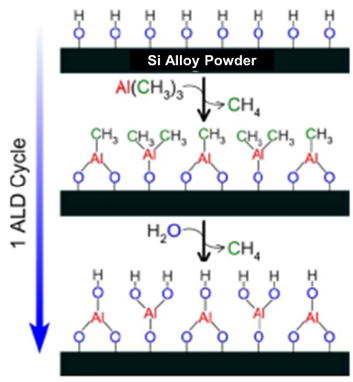

Figure 1. Schematic representation of Al_2O_3 ALD on Si alloy powder

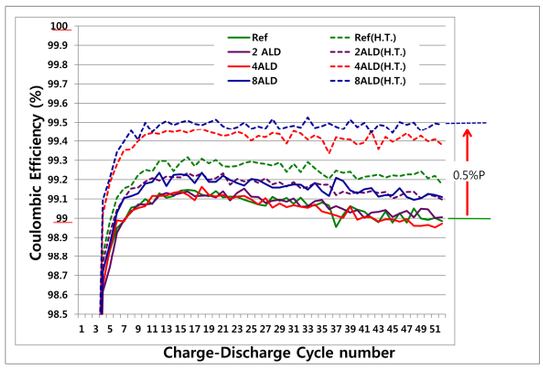

Fig. 2 Coulombic efficiency of Si alloy anode as a function of Al_2O_3 coating thickness and heat treatment

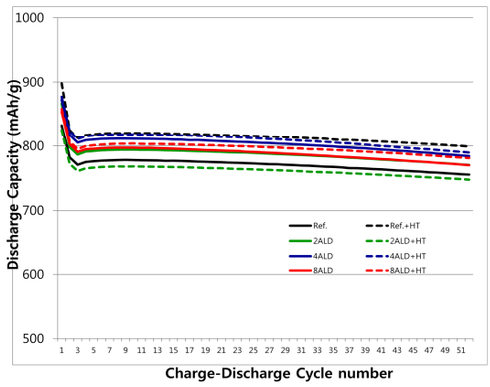

Figure 3. Specific capacity of a variety of ALD cycles versus charge-discharge cycle number

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