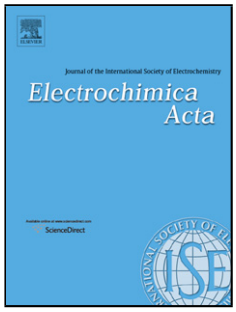

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Achieving High-Performance Silicon Anodes of Lithium-Ion Batteries via Atomic and Molecular Layer Deposited Surface Coatings: an Overview

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Abstract: Rechargeable secondary batteries (RSBs) have been practiced successfully for over one hundred years and now lithium-ion batteries (LIBs) represent the best-commercialized RSBs. However, the state-of-the-art LIBs are still not sufficient in many aspects to power electrical vehicles. In this context, research efforts are being intensively invested on developing next-generation LIBs. On the list of promising battery materials, silicon (Si) is particularly attractive as an anode material of LIBs, ascribed to its richness in the earth and extremely high capacity **(**~3500 mAh g^{-1} at room temperature). With the successful utilization of Si as anodes, LIBs would enable much higher energy density. However, Si anodes suffer from several issues technically, including huge volume changes, unstable interface between Si and electrolyte, and low conductivity. Aimed at addressing these challenges, various technical strategies have been investigated. Recently, atomic and molecular layer deposition (ALD & MLD) have emerged as two new research thrusts for LIBs and have demonstrated tremendous capabilities to resolve the issues of Si anodes. In this work, we for the first time made this comprehensive review on a variety of inorganic and organic coatings via ALD and MLD for achieving high-performance Si anodes in LIBs.

Keywords: Silicon anodes, Li-ion batteries, Atomic layer deposition, Molecular layer deposition, Surface coatings.