Protective Coating Strategies for Enhanced Stability of NMC532 in Humid Environments

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High-energy cathode materials in Li-ion batteries such as NMCs ($Li_xNi_yMn_zCo_{1-y-z}O_2$) are susceptible to surface degradation upon exposure to water, including ambient atmospheric humidity [1]. In humid conditions, NMC materials are prone to lithium loss from their surface structure, which leads to the formation of salts such as Li_2CO_3 and LiOH [2]. These salts do not contribute to the energy conversion mechanism and instead increase internal resistance and promote side reactions within the cell [3]. To address this issue, a promising solution is to apply a protective coating on the NMC's surface, aiming to maintain structural integrity and mitigate performance decline.

Plasma coating processes such as Plasma Enhanced Chemical Vapor Deposition (PECVD) and Physical Vapor Deposition (PVD) are advantageous for their minimal waste production, high deposition rate and industrial scalability. This study aims to investigate the effects of copper-doped carbon coatings on NMC532 in relation to their protective properties against moisture-induced degradation after humid air storage conditions, as well as their compatibility with a clean and eco-friendly water-based electrode formulation.

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