Electrochemical storage: new materials for the batteries of the future

Investigation of the effect of Li- and Al- co-doping on electrochemical properties of Li-rich transition metal oxides

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Lithium-rich transition metal oxides are considered a promising cathodic solutions in Li-ion batteries to meet the growing energetic demand, thanks to their high specific capacity and operational voltage[1,2]. Li-rich layered materials have a general stoichiometry $Li_{1+x}M_{1-x}O_2$, in which M is a blend of transition metals, as Ni, Mn, Co. The presence of extra lithium ions within the transition metals layers allows to achieve a specific capacity between 200 and 250 mAh/g[3]. However, they suffer from voltage decay and they also possess a moderate cobalt content which raises ethical and environmental issues[4]. In this communication, we present that the simultaneous replacement of cobalt in the layered structure with balanced amounts of aluminum and lithium, the latter exceeding the common 1.2 stoichiometry coefficient, leads to new stoichiometries with improved electrochemical stability. We report the characterization of these novel layered materials in terms of composition, structure, morphology and electrochemical performances in close comparison to the parent $Li_{1.2}Mn_{0.54}Ni_{0.13}Co_{0.13}O_2$. This approach can be applied to various Li-Rich materials as a strategy to mitigate the voltage decay and reduce the Cobalt content.

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