# IMPROVED CATHODE MATERIALS FOR NEXT GENERATION LITHIUM-ION BATTERIES

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Due to their high energy and power density, excellent efficiencies and long life time lithium ion batteries have become the dominating energy storage technology for the new generation of Plug-in hybrid electric vehicles (PHEV) and full electric vehicles (EV). However, there is still considerable improvement needed to achieve extended driving range and to reduce significantly the cost of battery packs. For these reasons, the development of new high capacity, safe and lower cost cathode materials is necessary.

Among various cathode materials under development, high voltage $LiMn_{1.5}Ni_{0.5}O_4$ (LMNO) with spinel structure is one of the most promising candidates, because of the high operating voltage, high rate capability and good thermal stability. Moreover, it is easy to obtain via low cost synthesis methods from abundant raw materials.

However, the high voltage can also lead to side reactions with the electrolyte, which cause impedance increase and capacity fading during cycling or storage especially in full cells using graphite as anode. The long term stability can be significantly improved by adjusting the composition, the particle morphology and by surface coating. In this presentation, we discuss intensively the effect of composition, particle morphology and surface modification on the electrochemical performance, structural and thermal stability of LNMO.

Another approach towards high energy and lower cost is the development of $Li_{2-x}Mn_{1.5-y}M_yNi_{0.5}O_4$ ($0 \leq x \leq 0.5$) materials. These materials combine both the high voltage and the high specific capacity approach, reaching reversible capacities up to 280 $mAhg^{-1}$. Morphological features can be easily adjusted to meet industrial needs. These materials show high coulombic efficiency, high rate capability and excellent cycling stability. More than 150 cycles without any capacity loss could be demonstrated for complete cells consisting of graphite as anode material. We will report the influence of stoichiometry, structure and particle morphology on electrochemical performance, structural stability and ageing behavior.

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