Development of high voltage $Li_{1.0}Ni_{0.5}Mn_{1.5}O_4$

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$Li_{1.0}Ni_{0.5}Mn_{1.5}O_4$ (LNMO) high voltage spinel is a very promising next generation battery cathode material. Among the most interesting features are the high operating voltage and the absence of cobalt, which enable an energy dense and cheap battery. The challenges are mainly related to the surface reactions involving electrolyte degradation and dissolution of nickel and manganese. Strategies to limit these unwanted degradation reactions often involve surface treatments and doping.

The LNMO precursor is made by co-precipitation to obtain spherical particles with a controllable particle size distribution. The precursor is calcined with our proprietary calcination program that increases the density of the spherical particles and reduces the surface area to below 0.2 m^2/g. The material has a high phase purity, high power capability, low degradation and low dissolution rate of manganese and nickel. The electrochemical properties of our untreated LNMO is shown in Figure 1.

This poster will present our LNMO material with superior electrochemical properties and give insides from key methods that has been used in the development. Materials are screened physically by XRD and SEM and electrochemically in half cell coin cells at 55 °C. The performance is later confirmed in full cells at 25 °C.

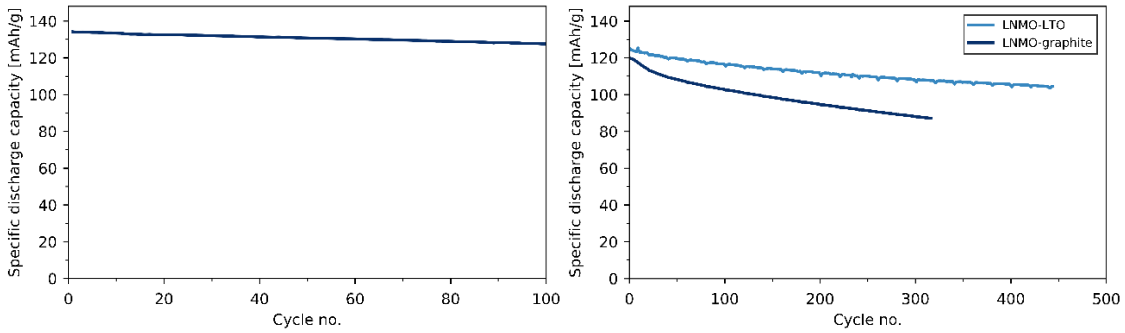

Figure 1. **Left**: Discharge capacity of the untreated LNMO in half cell screening test at 55 °C and a 0.5C/1C charge/discharge rate. **Right**: Full cell data of untreated LNMO with graphite (blue) and LTO (black) anodes tested at 25 °C. Half cell: Coin cell (Hohsen), lithium disc anode (EQ-Lib-LiC25, MTI), 1 M $LiPF_6$ in EC:DMC electrolyte (E001, Solvionic) and cathode electrodes with 84 wt% active material, 35% porosity and a loading of 0.7 mAh/cm^2. Full cell: Coin cell (Hohsen), graphite and LTO electrodes (1.0 mAh/cm^2, Custom cells), 1 M $LiPF_6$ in EC:DMC electrolyte (E001, Solvionic) and cathode electrodes with 84 wt% active material, 35% porosity and a loading of 1.0 mAh/cm^2.