72nd Annual Meeting

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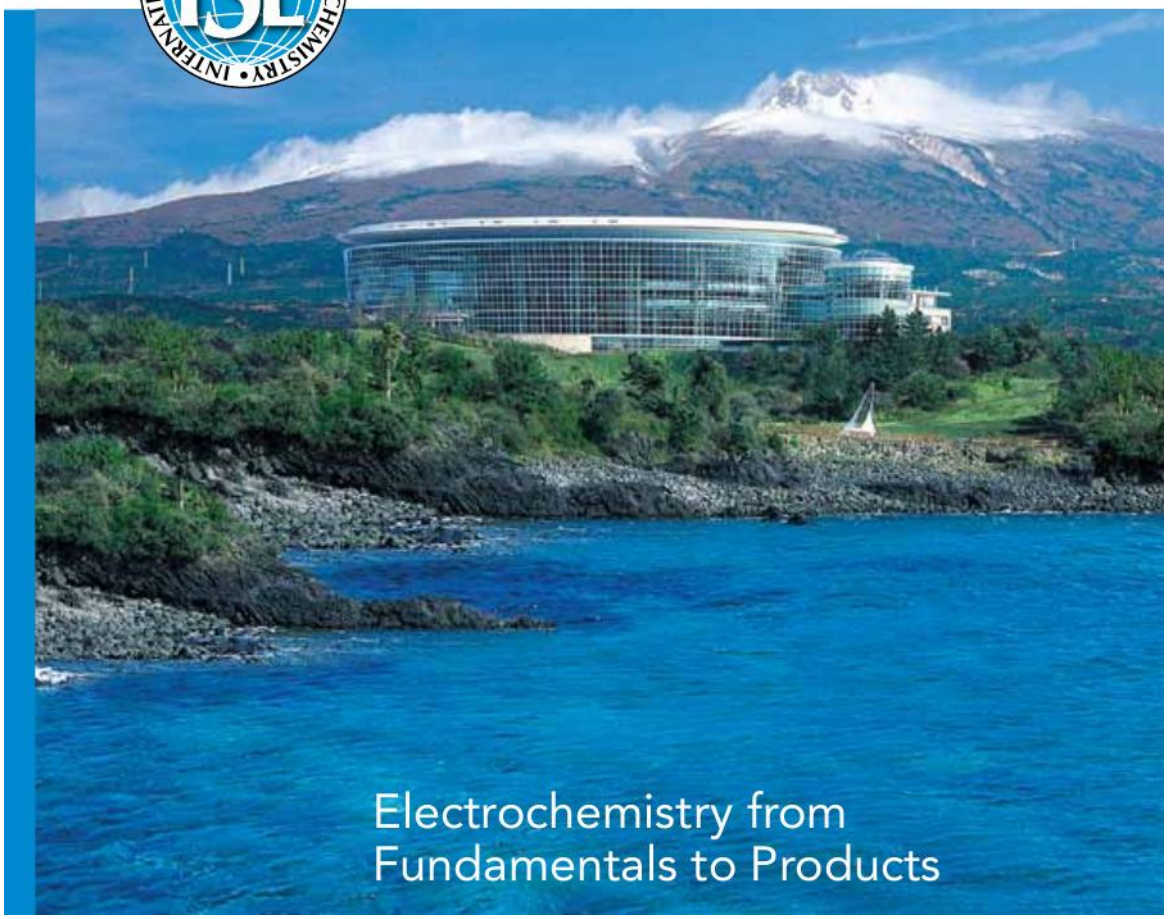
29 August - 03 September 2021
Jeju Island, Korea



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Influence of the mixing and synthesis conditions of the precursors of the NMC811 cathodes on their electrochemical performance

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Influence of the Mixing and Synthesis Conditions of the Precursors of the NMC811 cathodes on their Electrochemical Performance

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Electrochemical energy storage technologies are key for the complete energy transition and the successful use of renewable energy sources, especially for mobile devices, transport sector, and stationary storage.
Since the traditional cathode of $LiCoO_2$ release up to today, lithium ion batteries, dominate the market and are widely spread in a great variety of devices.
An alternative material that reduce the Co content and decrease the high costs and toxicity associated with it, are the Ni-rich layered transition metal oxides cathodes ($LiNi_{1-x-y}Mn_xCo_yO_2$), as NMC532, NMC622, NMC811. The use of these materials is expected to increase in the next years, hence more information is needed regarding their production [1].
These cathodes can be obtained by calcining the precursor $Ni_{1-x-y}Mn_xCo_y(OH)_2$ (NMC hydroxide) with LiOH. The synthesis of the transition metals hydroxide through coprecipitation, commonly with the help of a complexing agent, is an economical and scalable method. Although, more information regarding the influences of synthesis conditions is needed to improve the manufacturing.
In this work, we focus on the influence of synthesis conditions in the production of NMC hydroxides via coprecipitation, carrying out a systematic study of the effect of mixing on particle size distribution (PSD), morphology and crystallinity. In addition, different calcination protocols were studied to obtain the NMC oxide. Finally, the relationship between the NMC hydroxide characteristics and the corresponding oxide electrochemical performance was also investigated.
To ensure a precise control in the coprecipitation process, with reproducible mixing conditions, a multi-inlet vortex mixer (Figure 1) was used [2]. All experiments were performed at a fixed metal proportion (80 % of Ni, 10 % of Mn and 10 % of Co), but different flow rates, total metal concentrations and different ratios between the total metal concentration and complexing agent (NH_4OH). The resulting particles (NMC hydroxides, Figure 2) were characterized by measuring the tap density, PSD (by DLS) and morphology (by SEM). Finally, the calcination protocol, under air flow, to obtain $LiNi_{0.8}Mn_{0.1}Co_{0.1}O_2$ (Figure 3) from the precursors was optimized. The active materials were electro-chemically characterized by charge-discharge galvano-static cycling, CV, ESI in coin cells.

Figure 1. Multi-inet vortex mixer.

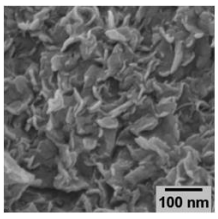

Figure 2. SEM image of $Ni_{0.8}Mn_{0.1}Co_{0.1}(OH)_2$

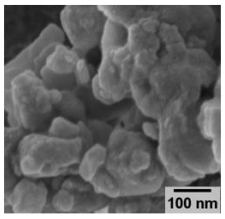

Figure 3. SEM image of $LiNi_{0.8}Mn_{0.1}Co_{0.1}O_2$

Acknowledgements
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