Call for Papers

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Short title: Influence of impurities on the recycling process of NCM active materials

Authors: Vladislaw Gorodko, Henry Auer, Kristian Nikolowski, Mareike Partsch, Alexander Michaelis

One of the challenges in the future of lithium battery recycling technology is to obtain a stable resynthesis process of recycled materials which leads to new usable active materials (e.g. NCM). Besides that, this process should be robust to contaminations such as iron, aluminum, copper, and other ions, coming from battery casings, current collectors or electronic circles. In the hydrometallurgical recycling process the discharged battery cells are being dismantled, crushed and leached. After separation from undissolved materials the leached solutions are processed further to remove contaminations and recover the metal ions (nickel, cobalt, manganese) needed for the resynthesis. However small amounts of impurities can remain and affect the resynthesis process afterwards. The impurities may indeed be incorporated during the coprecipitation of NCM precursors leading to an irreversible contamination in the cathode active material. The effects however might vary. The impurities can have positive and negative effects on the active materials depending on the impurity itself and on its content in the NCM structure. Small contents of Fe^{3+} may improve the electro chemical performance due to increased lattice volume in the contaminated NCM allowing better (de)lithiation. The lithium (de)intercalation becomes less reversible if the Fe^{3+} content increases further leading to lower capacities.

To understand the influence of different impurity ions on the performance of resynthesized active materials, aqueous solutions of nickel sulfate, cobalt sulfate and manganese sulfate as the basic ingredients for NCM are prepared and contaminated with small amount of other metal salts like aluminum sulfate or iron sulfate. A coprecipitation with natrium hydroxide is then conducted with ammonia as chelating agent. The coprecipitated precursors obtained are subsequently calcinated with lithium hydroxide, leading to the desired NCM active material.

The synthesized active materials are characterized with SEM to study the morphology and particle size. Particle size distribution is measured using laser diffraction. With EDX and XRD composition and purity of the calcined active material is characterized. Finally, the electrochemical performance of electrodes prepared using resynthesized materials is characterized and compared with cathodes from pure NCM active material.

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German short title: **Einfluss der Verunreinigungen und Maskierungsstrategien im Resyntheseprozess von Aktivmaterialien**