Study on K^+- Doped Modification of $Li_{1.2}Ni_{0.13}Co_{0.13}Mn_{0.54}O_2$ Materials for lithium ion battery

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The lithium-rich ternary materials have received particular attention because of their low cost and high capacity (~300 $mAh \cdot g^{-1}$). However, they have several drawbacks, including the low initial coulombic efficiency and severe capacity fading. These disadvantages hinder their practical commercialization. Therefore, the modification for the lithium-rich ternary materials is particularly important. Doping modification is an effective means to improve the electrochemical properties, especially for the cycling and rate performances of the lithium-rich ternary materials.

In this paper, lithium-rich ternary cathode material $Li_{1.2}Ni_{0.13}Co_{0.13}Mn_{0.54}O_2$ and K^+–doped $Li_{1.2}Ni_{0.13}Co_{0.13}Mn_{0.54}O_2$ materials have been successfully prepared via co–precipitation method, followed by a high-temperature solid state process. The influences of K^+ content to the electrochemical performance of $Li_{1.2}Ni_{0.13}Co_{0.13}Mn_{0.54}O_2$ were investigated.

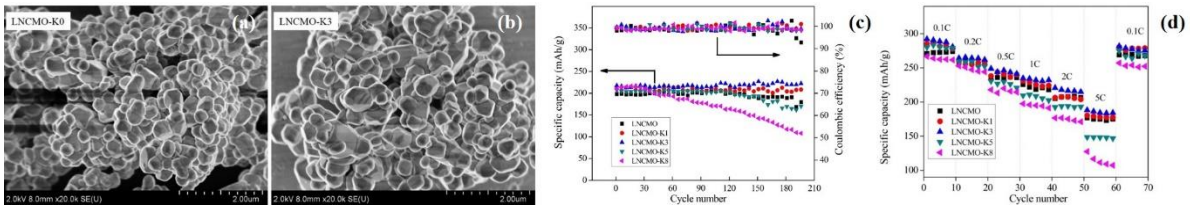

Figure 1 SEM images of **(a)** LNCMO and **(b)** LNCMO-K3 materials; **(c)** the cycling performances and **(d)** rate capabilities of LNCMO-K*x* samples.

The electrochemical experiments show that compared with the undoped $Li_{1.2}[Ni_{0.13}Co_{0.13}Mn_{0.54}]O_2$ electrode, the K-doped $Li_{1.17}K_{0.03}[Ni_{0.13}Co_{0.13}Mn_{0.54}]O_2$ electrode has larger reversible discharge capacity (296.3 $mAh \cdot g^{-1}$) as well as greatly improved rate capability (185 $mAh \cdot g^{-1}$ at 5C) and cycling stability (98% capacity retention after 200 cycles). The superior electrochemical performance of the K^+-doped material can be owing to the enhancement of the structural stability and the enlargement of the Li slab space and improvement of the diffusion of Li ions in the bulk lattice. The results reported in this work are fundamentally important. It might be extended to other classes of layered oxides for excellent cycling performance. And we hope that this study is able to provide certain reference for salt lake lithium purification.[1, 2.]

References:

[1] Yanxia Sun, Yuan Zhou*, Lijuan Zhang, Yue Shen, Jinbo Zeng. Journal of Alloys and Compounds, 2017, 723: 1142-1149.

[2] Yanxia Sun, Lijuan Zhang, Yuan Zhou*, Yue Shen, Chunxi Hai, Xiang Li, Jinbo Zeng, Xiufeng Ren, Luxiang Ma, Xinxing Zhang, Shengde Dong, Guicai Qi. Journal of the Electrochemical Society, DOI: 10.1149/2.1001802jes.