# Synthesis and Electrochemistry of Layered-Spinel Composite $Li_{1.2}M_{0.4}Mn_{0.4}O_2$-$LiMMnO_4$ (M=Co and Cr) Cathode Materials

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The key to realize the next generation LIBs with 300wh•$kg^{-1}$ is to develop the high specific energy cathode materials. Among the reported cathode materials, layered Li-rich material $Li_{1.2}Ni_{0.2}Mn_{0.6}O_2$ and high-power spinel material $LiNi_{0.5}Mn_{1.5}O_4$ have been extensively investigated [1-3]. The former can provide a high capacity of more than 250 mAh $g^{-1}$ and the latter is of special interest for its high-potential reaction plateau and outstanding rate capability. Thackeray *et al.* have found that the spinel $LiNi_{0.5}Mn_{1.5}O_4$ and the layered $Li_{1.2}Ni_{0.2}Mn_{0.6}O_2$ materials can be structurally integrated to form stable composites, presumably because the valences of transition metal are +2 (Ni) and +4 (Mn) and the ratios of transition metal ions are same in both layered and spinel materials [4]. Besides, the change of Li content only influences the ratio of layered and spinel phases. Along a same logic, it may be possible to synthesis a new composite electrode material based on the layered $Li_{1.2}M_{0.4}Mn_{0.4}O_2$ and spinel $LiMMnO_4$ (M=Co and Cr) materials to achieve the complementary performance and synergistic effect. In this work, novel layered-spinel composites cathode materials $Li_{1.2}M_{0.4}Mn_{0.4}O_2$- $LiM_{0.5}Mn_{0.5}O_4$ (M=Co and Cr) were controllably synthesized via sol-gel method and investigated.

Fig.1 shows the XRD patterns of the synthesized composites $Li_{1.2}M_{0.4}Mn_{0.4}O_2$-$LiMMnO_4$ (M=Co, Cr). The diffraction peaks of spinel materials are obviously in case of x=1. With the increase of Li content, the peaks for the layered phase appear and the intensities are increased with much clearer and stronger superstructure, which demonstrates the formation of structurally integrated composites. When x=0, the pure Li-rich layered phase is observed. The detailed results will be presented in the coming meeting.

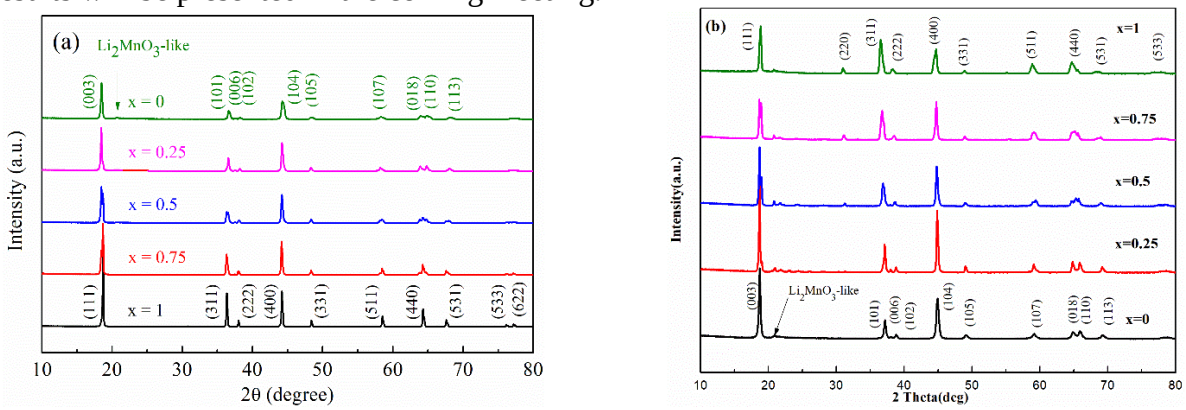


Fig.1 XRD patterns of (1-x)[$Li_{1.2}M_{0.4}Mn_{0.4}O_2$]·x[$Li(M_{0.5}Mn_{0.5})O_4$] [M=Co (a) and Cr (b), x=0, 0.25, 0.5, 0.75 and 1].

**References:**

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