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Enhanced electrochemical performances of $LiNi_{0.5}Mn_{1.5}O_4$spinel in half-cell and full-cell via yttrium doping

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Abstract: Pristine and yttrium-doped $LiNi_{0.5-x}Y_xMn_{1.5}O_4$ spinel powders (x=0, 0.005, 0.01, 0.02, 0.04) were synthesized by a facile solid-state method. The effect of yttrium doping content on the electrochemical properties of $LiNi_{0.5-x}Y_xMn_{1.5}O_4$ was investigated by using half-cells paired with lithium metal and full-cells paired with graphite. XRD and FT-IR analysis shows that the cation disordering degree (Mn^{3+} content) first increase (x≤0.02) and then decrease with Y doping content and the Y doping can effectively inhibit the formation of $Li_xNi_{1-x}O$ impurity phase. Electrochemical results show that in half-cells, appropriate Y doping (x=0.01) exhibits optimal rate capability and cycling stability of $LiNi_{0.5}Mn_{1.5}O_4$ cathode material, due to higher phase purity, enlarged lattice parameter, higher disordering degree, higher structural stability by introducing Y-O bond, lower charge transfer resistance and higher lithium ion diffusion coefficient, although the 0.2C discharge capacity is slightly lower than pristine $LiNi_{0.5}Mn_{1.5}O_4$. Atomic Absorption Spectroscopy result shows that appropriate Y doping can effectively decrease the transition metal dissolution to certain extent, despite of higher Mn^{3+} content. All above factors lead to the improved cycling

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