Dependence of electrochemical properties of spinel $LiMn_2O_4$ on Li_2CO_3 with micro-flaky, micro-flower and nanorod morphologies

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Table S1 The comparison of raw material (LiCl) and Li_2CO_3

Sample	Li (%)	Na (%)	Mg (%)	K (%)	Fe (%)	Cl (%)
LiCl	99.52	0.0125	0.6×10^{-5}	0.0025	0.0005	-
Standard-Li_2CO_3	≥99.5	≤0.025	≤0.008	≤0.001	≤0.001	≤0.003
Our Li_2CO_3	99.95	0.0015	0.8×10^{-5}	0.0007	null	0.0018

(- represents the element is not considered because it exists in the material.)

Explanation of crystal mechanism

At a low concentration of LiCl, the synthesized crystals mainly consisted of the flaky and the flower-like morphologies, while the nanorod particles are obtained with a high concentration of LiCl solution. The different morphologies of Li_2CO_3 is mainly because of the difference of the lithium ion concentration in organic phase (figure S1a). Two kinds of crystal mechanism are involved in the reaction process[1-2], at a low concentration of LiCl, Li_2CO_3 growth is of the typical radial form, which means that growth occurs by diffusion around a nucleus as starting point. Radial growth can occur again with a new grown raised point. Thus, large particles that cannot easily be broken can be obtained by this type of growth. In contrast, the nanoparticles exist as the concentration of Li ion gets high, the crystallization mechanism is different from that of lower concentration of Li ion in organic phase. The water-in-oil structure is formed in the high concentration solution. Small particles are formed with significant growth space constraints. This can prevent continuous radial crystal growth, resulting in particles of morphology are in nano level, figure S1b shows the SEM image of MnO_2.

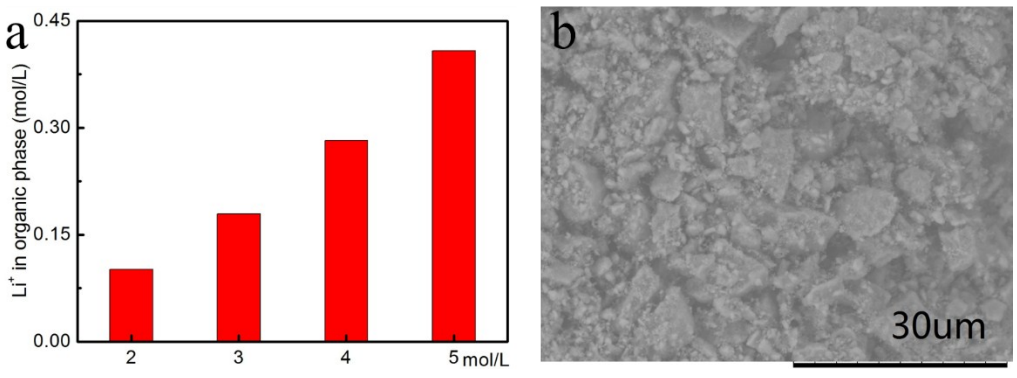

Figure S1 (a) The Li ion concentration in organic phase, (b) SEM images of MnO_2.

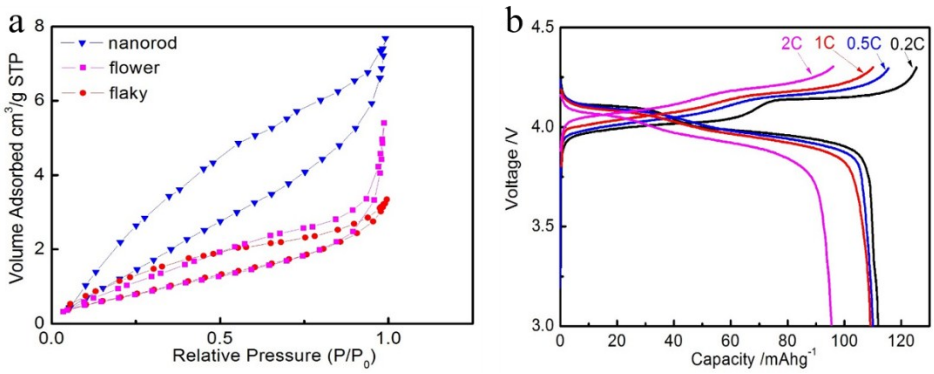

Figure S2 (a) Adsorption-desorption curve of $LiMn_2O_4$, (b) charge-discharge voltage profile of $LiMn_2O_4$ E2 at different power rates.

References

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2 Yi WT, Yan CY, Ma PH, Li FQ. Chem Eng, 2009, 37, 16-19.