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Supporting information

Confined Synthesis of Hierarchical Structured $LiMnPO_4$/C Granules by a Facile Surfactant-Assisted Solid-State Method for High-Performance Lithium-Ion Batteries

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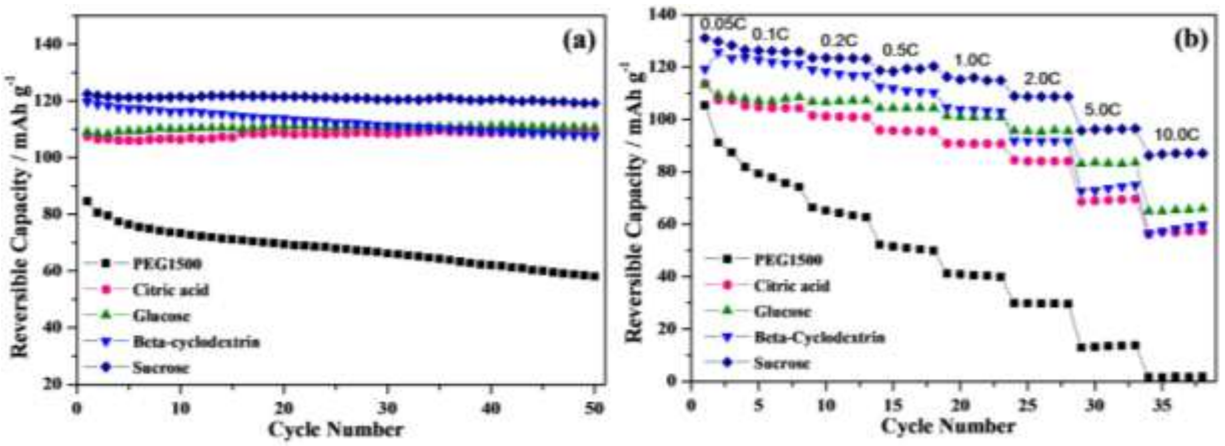

Fig. S1 (a) Cycling performance and (b) rate performance of THS LMP-NC prepared with different precursors as carbon sources.

The cycling performance of THS LMP/C-NC with different carbon precursors at 0.1 C are illustrated in Fig. S1a. Although the added carbon content was calculated as 15 wt% of the resulting product, the residual carbon content of THS LMP/C-NC with sucrose, beta-cyclodextrin, glucose and citric acid as carbon sources were ca. 7.5% while that using polyethylene glycol 1500 (PEG1500) was ca. 1% measured by TGA tests. The initial discharge capacities of THS LMP/C-NC utilizing different carbon precursors were 122.38 mAh g^{-1} (sucrose), 119.65 mAh g^{-1} (beta-cyclodextrin), 109 mAh g^{-1} (glucose), 107.48 mAh g^{-1} (citric acid) and 84.61 mAhg^{-1} (PEG 1500), respectively. After 50 cycles, the sample utilizing sucrose as the carbon precursor showed a superior capacity retention of 97.4%, higher than 89.8% of that with beta-cyclodextrin as the carbon precursor, although the initial capacity of them were almost identical. THS LMP/C-NC using glucose and citric acid as carbon precursors showed no capacity decay after 50 cycles, which arose from the longer activated process needed. Due to the extremely low carbon content of the sample using PEG1500 as the carbon precursor, it only retained 68.7% of the initial capacity.

As depicted in Fig. S1b, the rate capability of THS LMP/C-NC with sucrose as the carbon precursor surpassed that of THS LMP/C-NC using other carbon precursors. It possessed a capacity of 108.8 mAh g^{-1} at 2 C, 95.7 mAh g^{-1} at 5 C and 86.2 mAh g^{-1} at 10 C, which was much higher than 91.7 mAh g^{-1}, 72.6 mAh g^{-1} and 56.6 mAh g^{-1} of that with beta-cyclodextrin as the carbon precursor. The rate performance of THS LMP/C-NC with glucose as the carbon precursor was better that with citric acid and exceeded that with beta-cyclodextrin above 2 C. THS LMP/C-NC with PEG 1500 as the carbon precursor showed the worst rate capability, with only 41.1 mAh g^{-1} at 1 C. Based on the above electrochemical properties, it can be concluded that sucrose is the most ideal carbon precursor in our work. This may originate from the different chemical constructions of carbon precursors, therefore the cohesion between the resulting carbon network and $LiMnPO_4$ nanoparticles may vary differently.

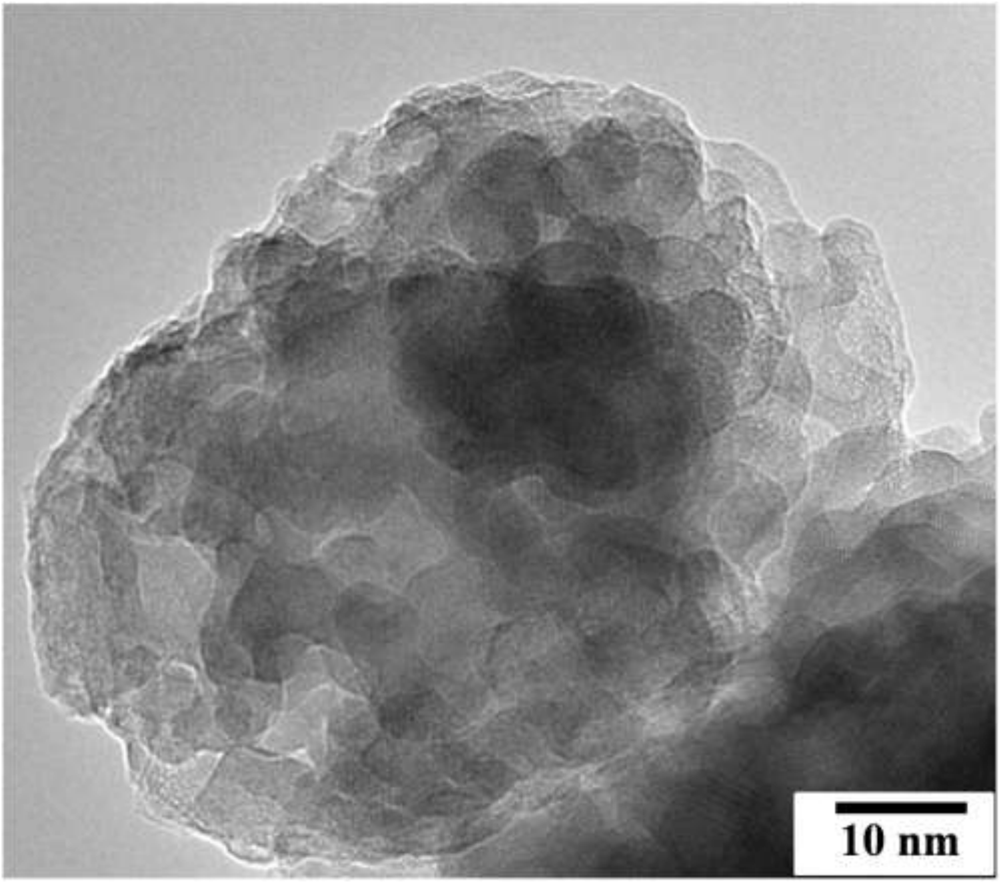

Fig. S2 TEM images of THS LMP/C-NC with low carbon content (<1 wt%).

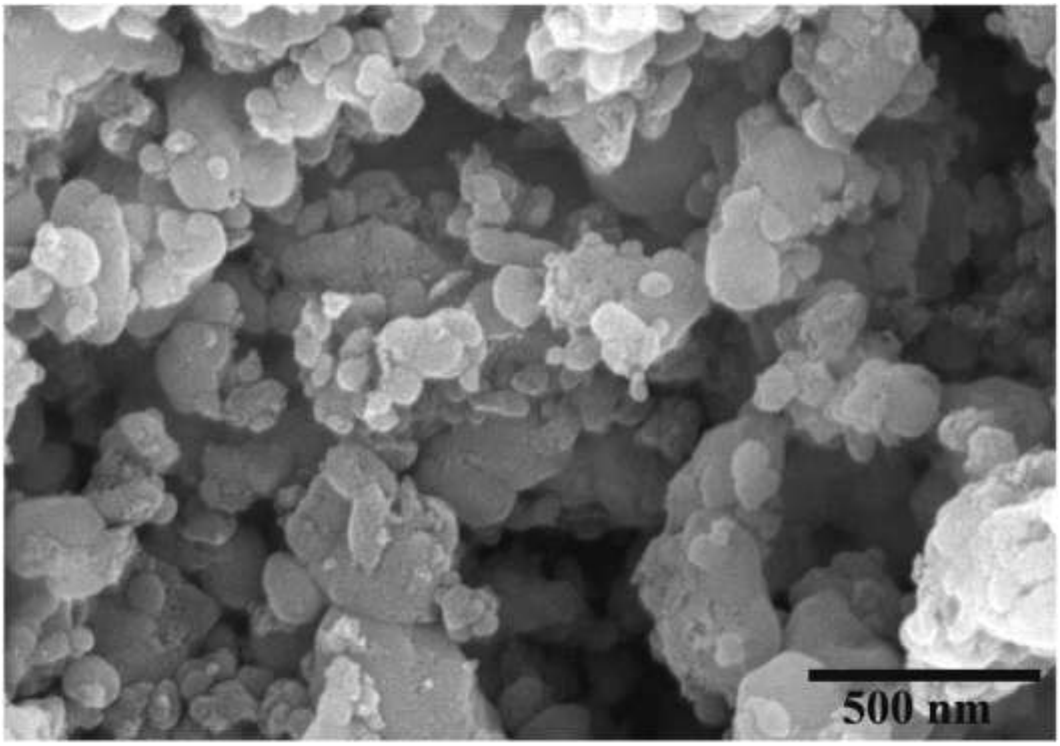

Fig. S3 SEM image of traditional LMP/C synthesized without the addition of oleic acid.