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Supplementary Information

Benzylamine-Directed Growth of Olivine-type $LiMPO_4$ Nanoplates by Supercritical Ethanol Process for Lithium-ion Battery

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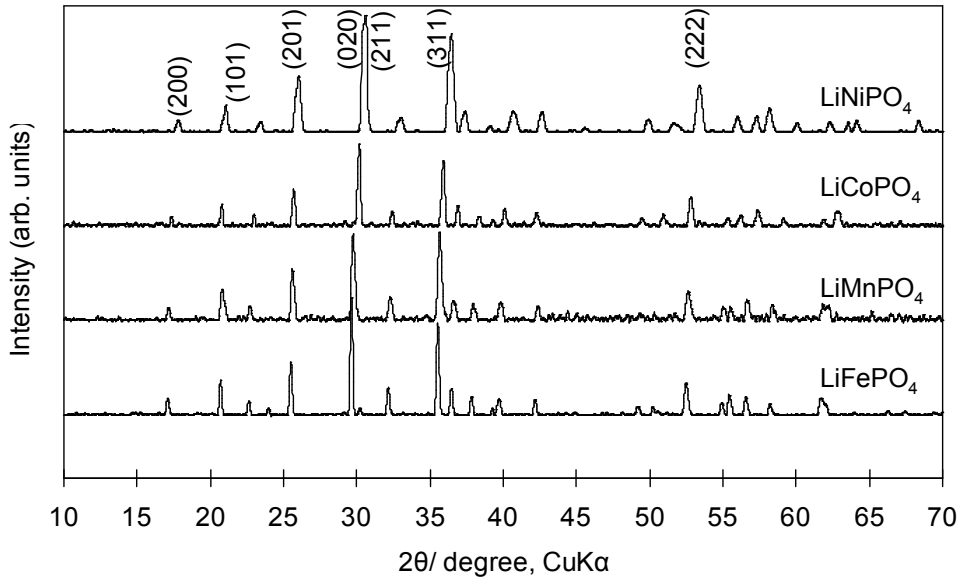

Fig. S1 XRD patterns of the synthesized lithium metal phosphates by supercritical ethanol processing.

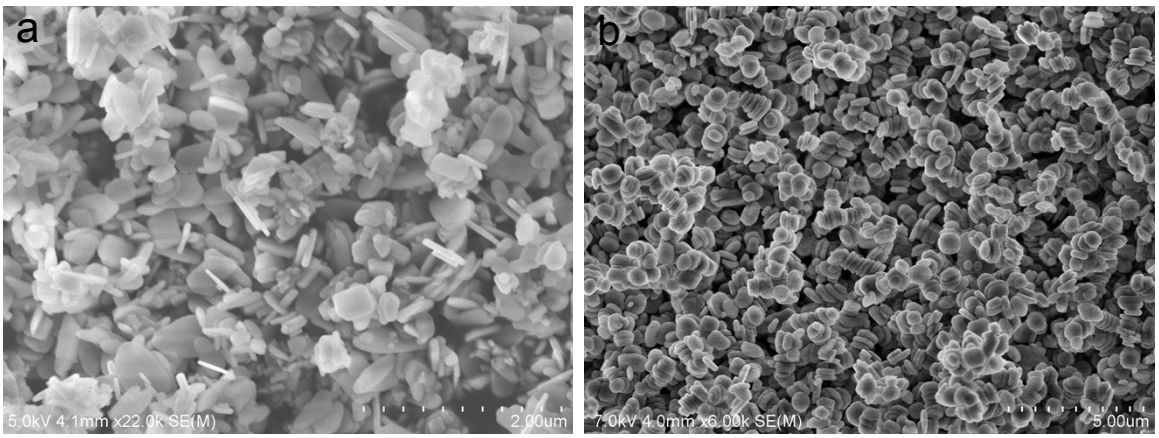

Fig. S2 SEM images of a) $LiMnPO_4$ and b) $LiCoPO_4$.

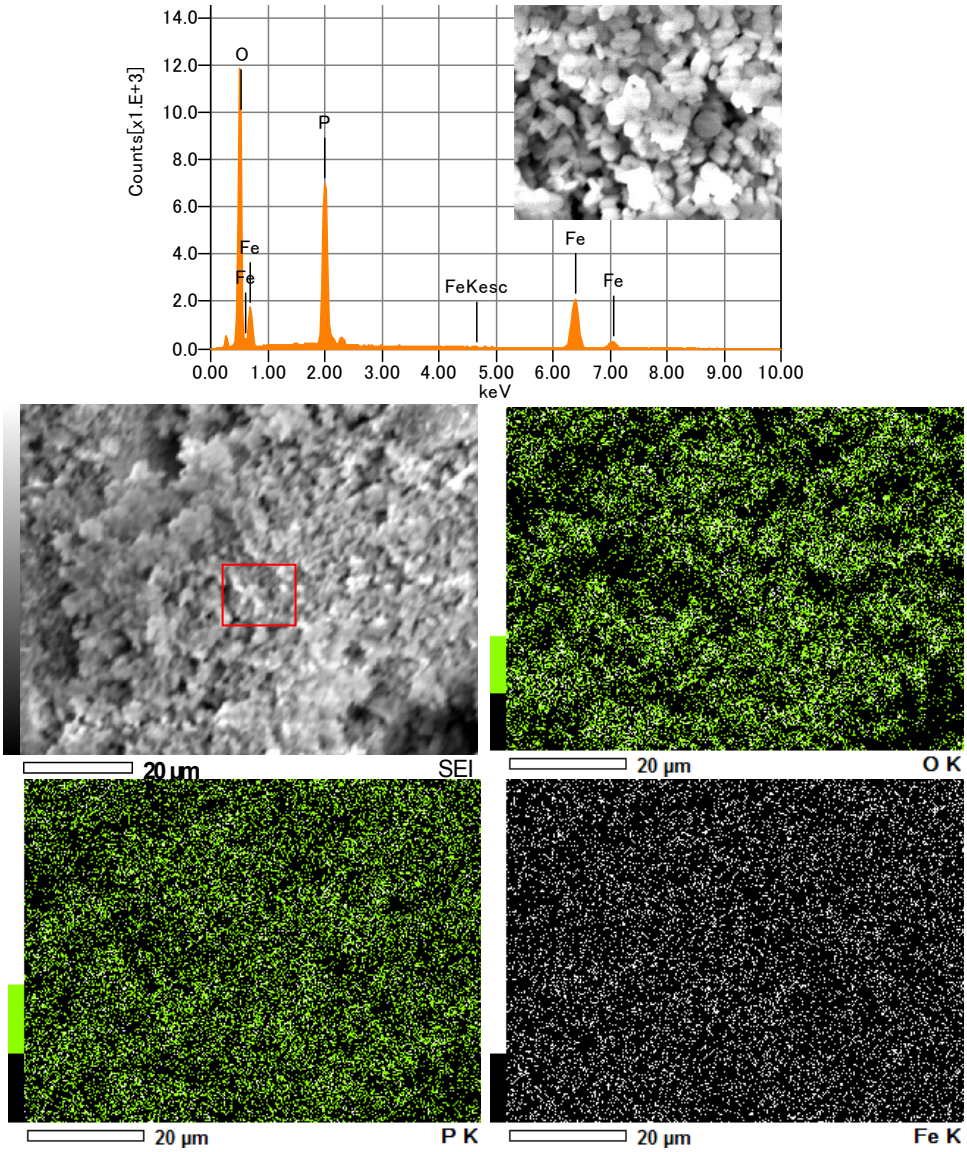

Fig. S3 EDS spectrum, SEM image and elemental mapping of Fe, P, O of the synthesized $LiFePO_4$ nanoplates.

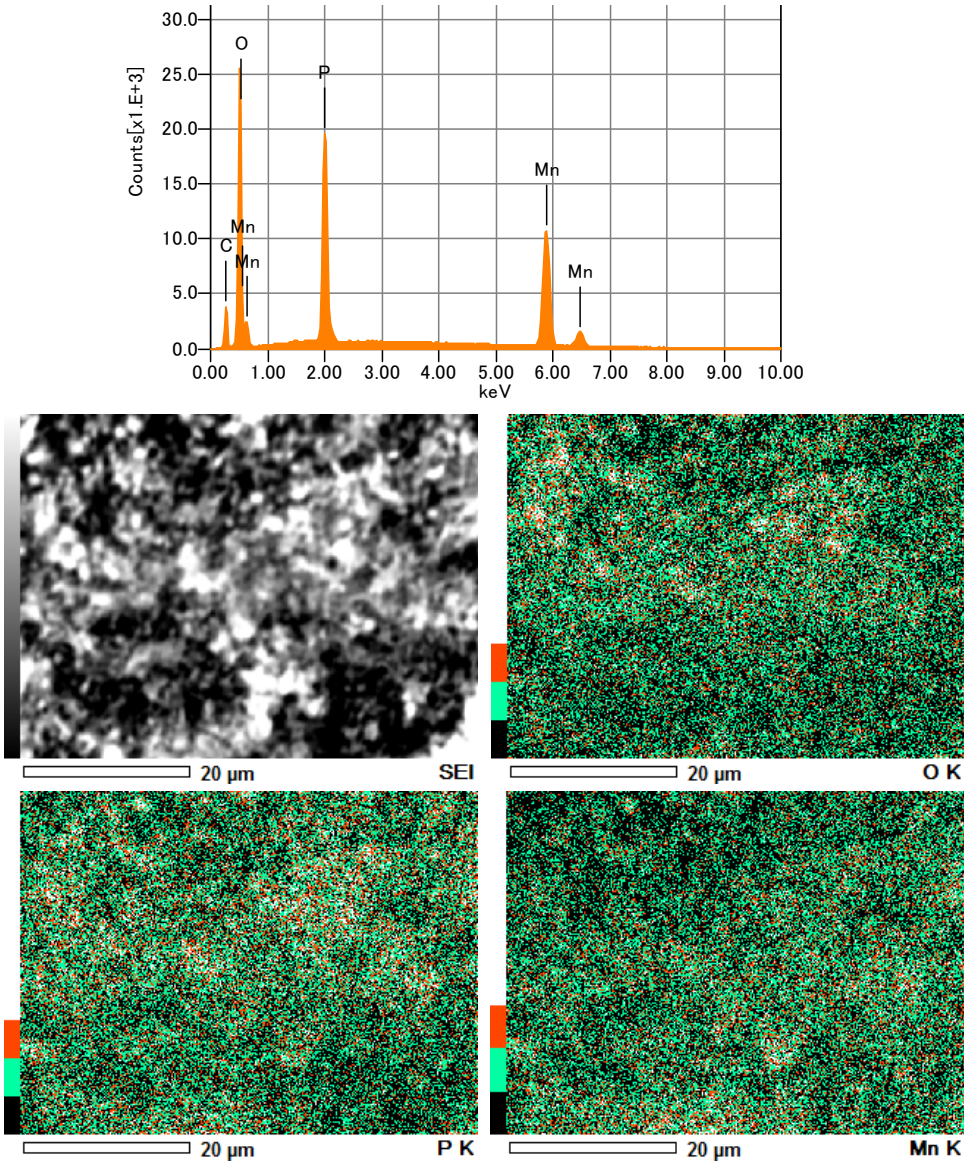

Fig. S4 EDS spectrum, SEM image and elemental mapping of Mn, P, O of the synthesized $LiMnPO_4$ nanoplates.

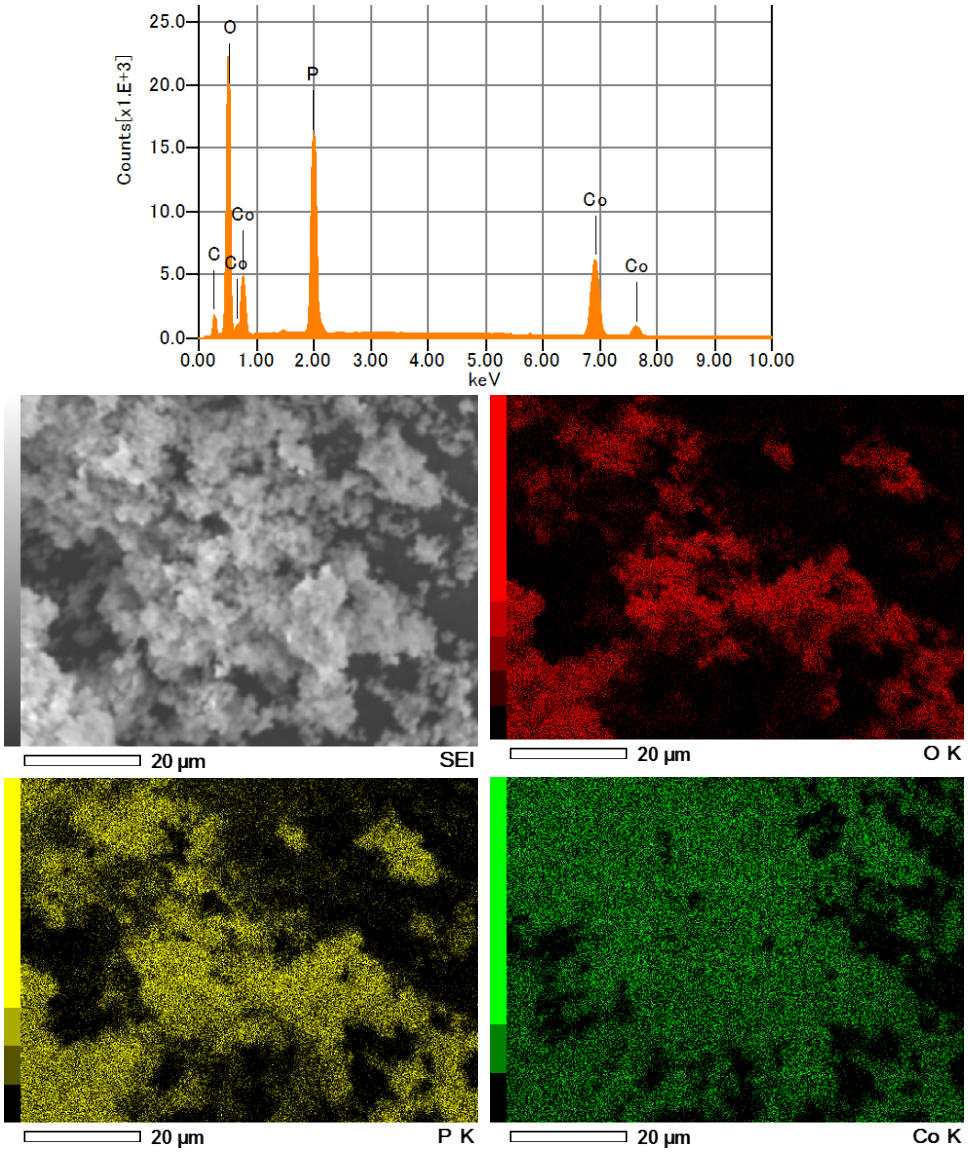

Fig. S5 EDS spectrum, SEM image and elemental mapping of Co, P, O of the synthesized $LiCoPO_4$ nanoplates.

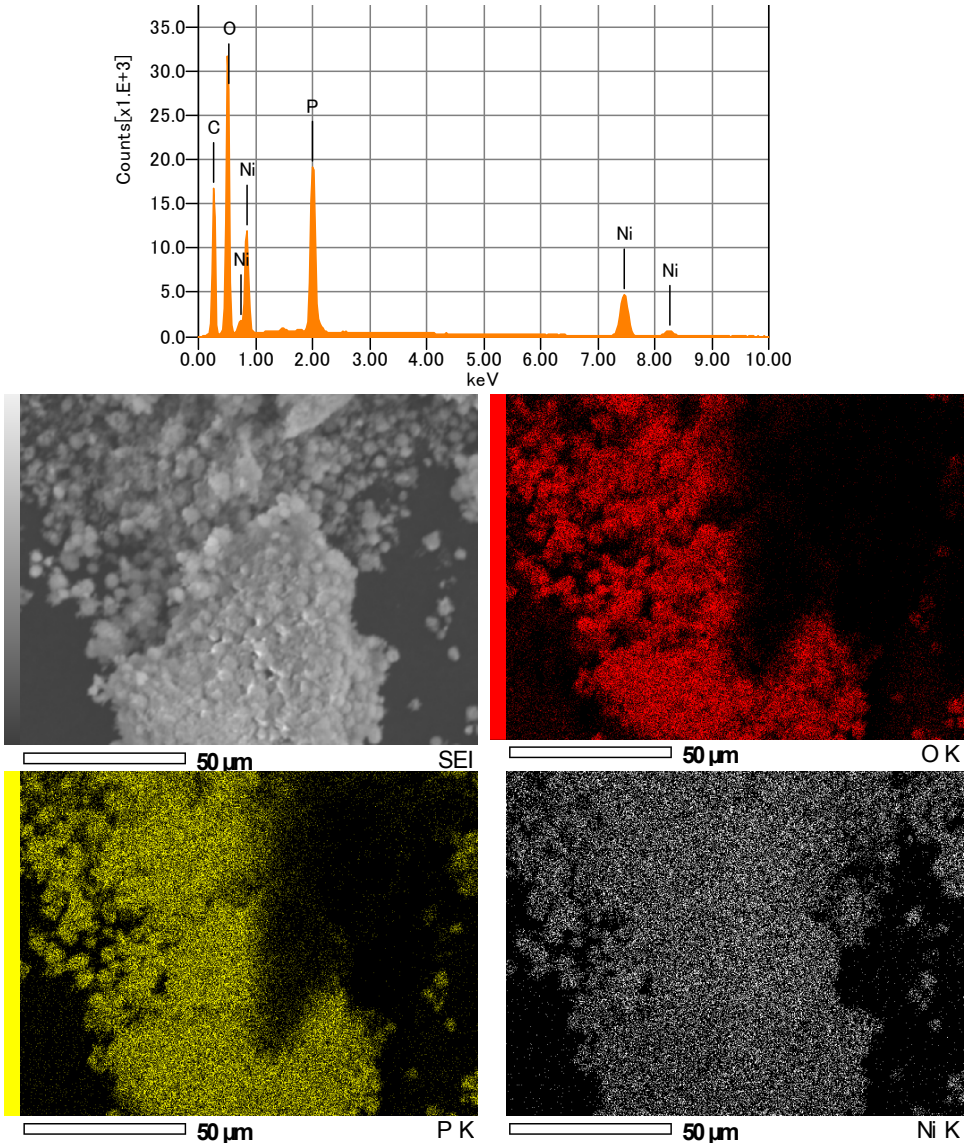

Fig. S6 EDS spectrum, SEM image and elemental mapping of Ni, P, O of the synthesized $LiNiPO_4$ nanoplates.

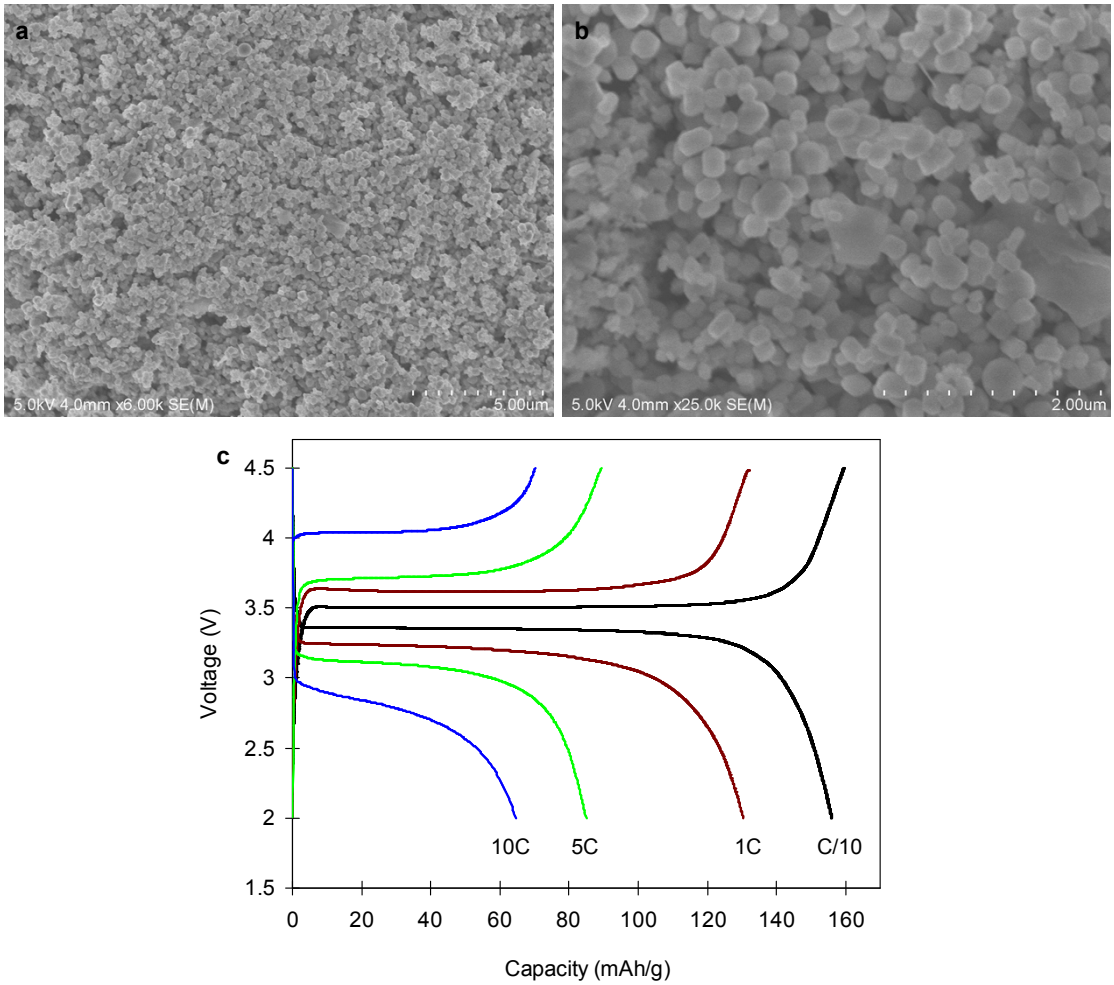

Fig. S7 a, b) SEM images of the synthesized $LiFePO_4$ nanoparticles, c) typical first charge/discharge profiles of the $LiFePO_4$ nanoparticles at current rates of C/10-10 C.

Fig. S7 shows SEM images and typical charge/discharge profiles of the $LiFePO_4$/C nanoparticles synthesized by supercritical ethanol at current rates ranging from C/10-10 C as a control sample. The $LiFePO_4$ nanoparticles were synthesized by the same method without the addition of benzylamine. SEM images indicate the presence of uniform nanoparticles with size of 150-200 nm. The nanoparticles exhibited high reversible capacities at low current rate, however, at higher current rate of 5 C, the nanoparticles showed discharge capacity of 85.0 mA h g^{-1} and 64.7 mA h g^{-1} which are much lower than that of nanoplates at same current rates (Fig. 8).

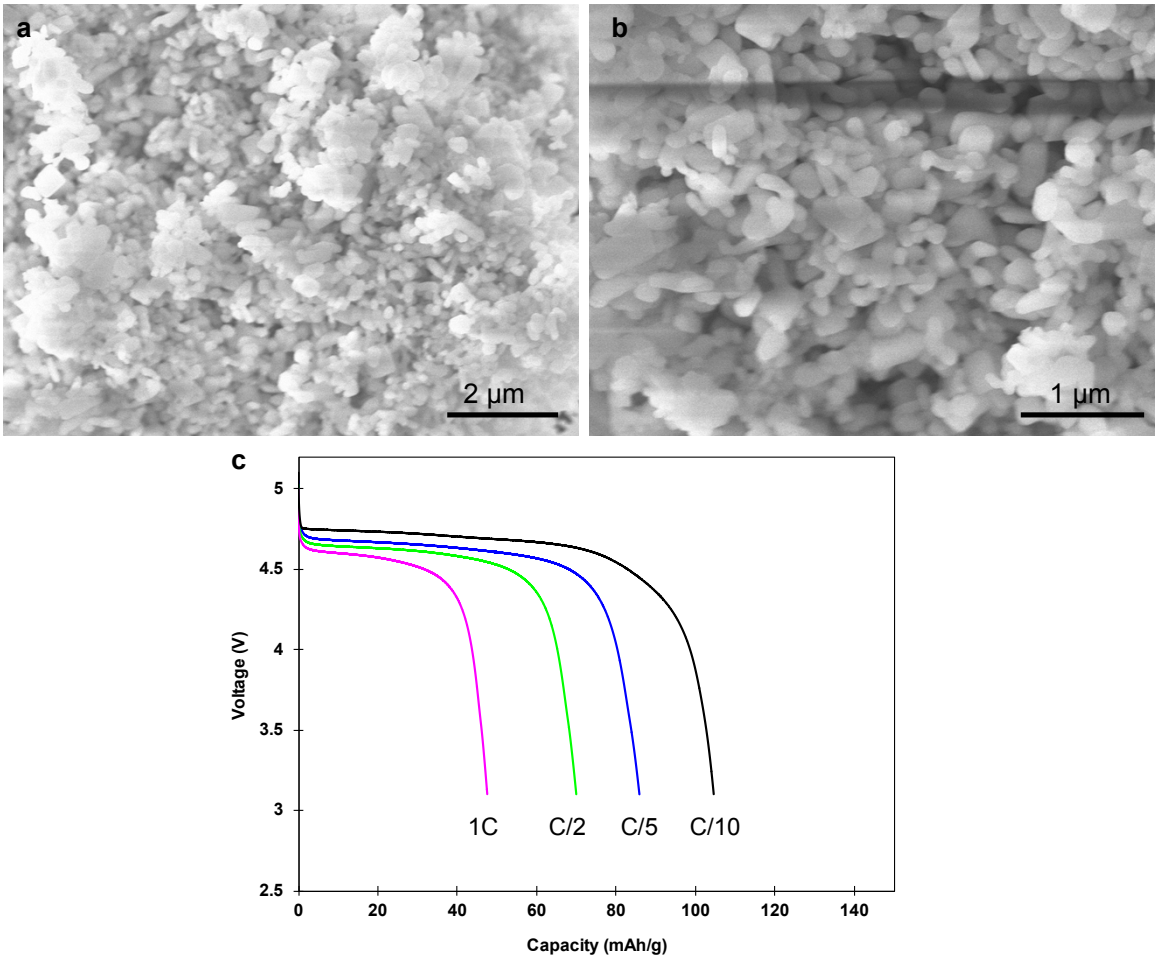

Fig. S8 a, b) SEM images of the synthesized $LiCoPO_4$ nanoparticles, c) typical first charge/discharge profiles of the $LiCoPO_4$ nanoparticles at current rates of C/10-10 C.

Fig. S8 shows SEM images of the $LiCoPO_4$ nanoparticles synthesized by supercritical ethanol with small amount of benzylamine (2 mL) as *in situ* OH^- source. It can be cleanly seen that particles are well-dispersive with size of 100-150 nm. Fig. S8c shows the typical discharge profiles of the $LiCoPO_4$/C nanoparticles at current rates ranging from C/10-1 C. The nanoparticles exhibited initial discharge capacity of 105, 86, 70, 48 mA h g^{-1} at C/10, C/5, C/2, 1 C, respectively which are lower than that of nanoplates at same current rates (Fig. 9).

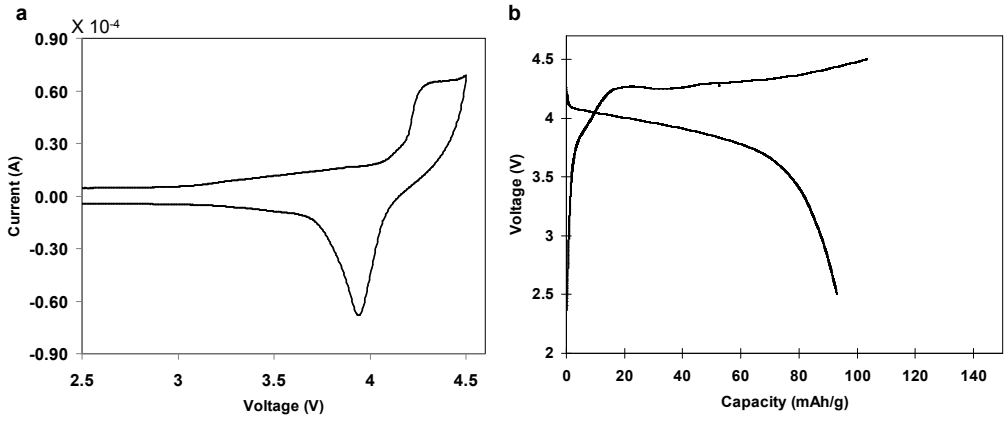

Fig. S9 Electrochemical performances of the synthesized $LiMnPO_4$ nanoplates in Li-ion batteries tested in the potential range of 2.0–4.5 V. a) cyclic voltammograms of the cells containing $LiMnPO_4$ nanoplates at a sweeping rate of 0.1 mV s^{-1}. b) typical first charge/discharge profiles at current rate of C/10.

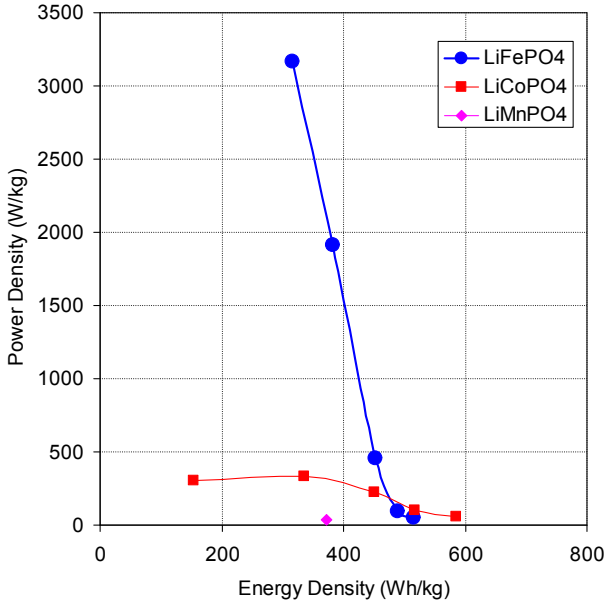

Fig. S10 Performances, in terms of energy density and power density of different cathode materials for Li-ion batteries.