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Supplementary Information

A Green Recycling Process Designed for $LiFePO_4$ Cathode Materials for Li-ion Batteries†

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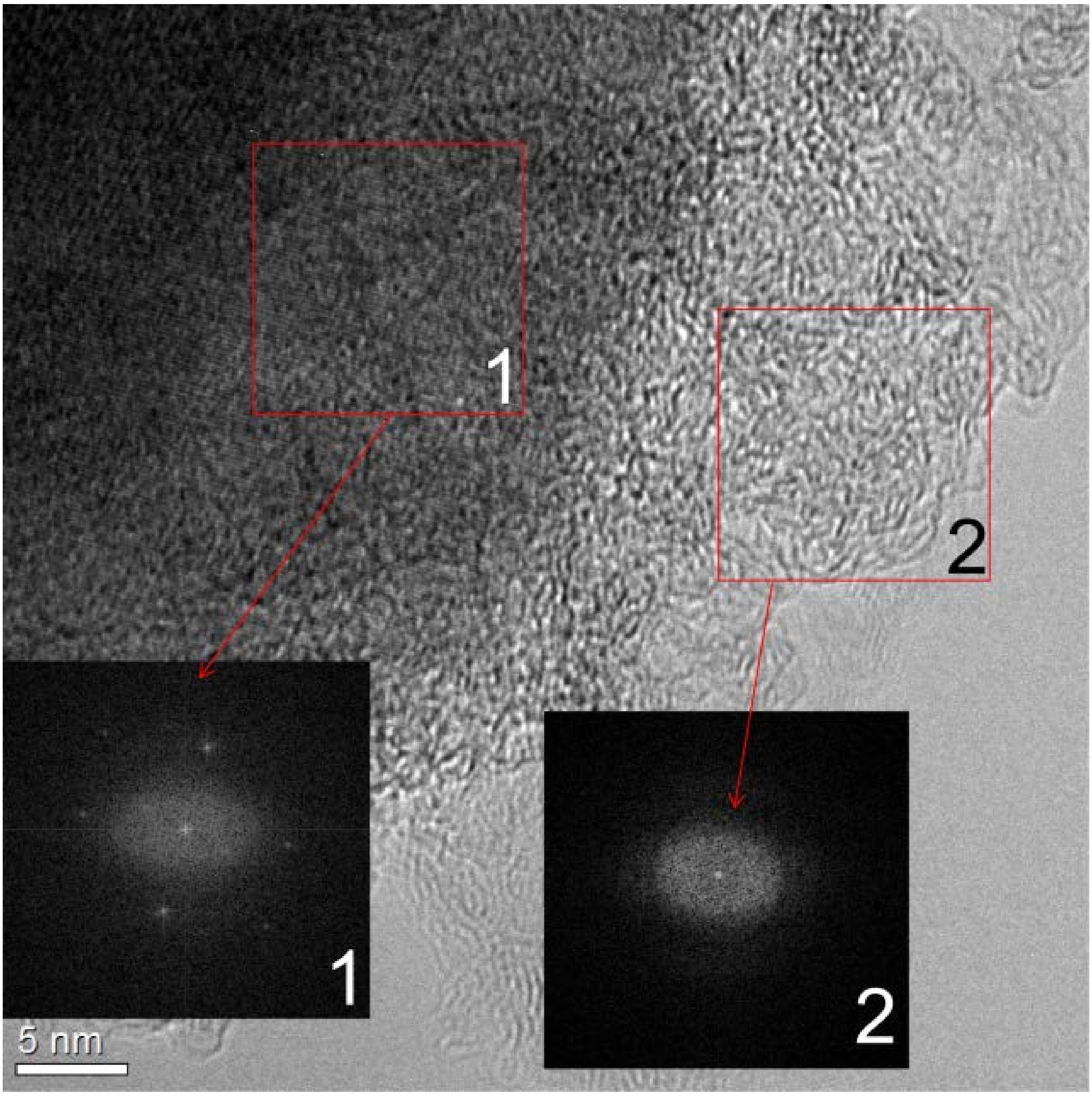

Fig. S1 HRTEM image of $LiFePO_4$ synthesized at 700 °C.

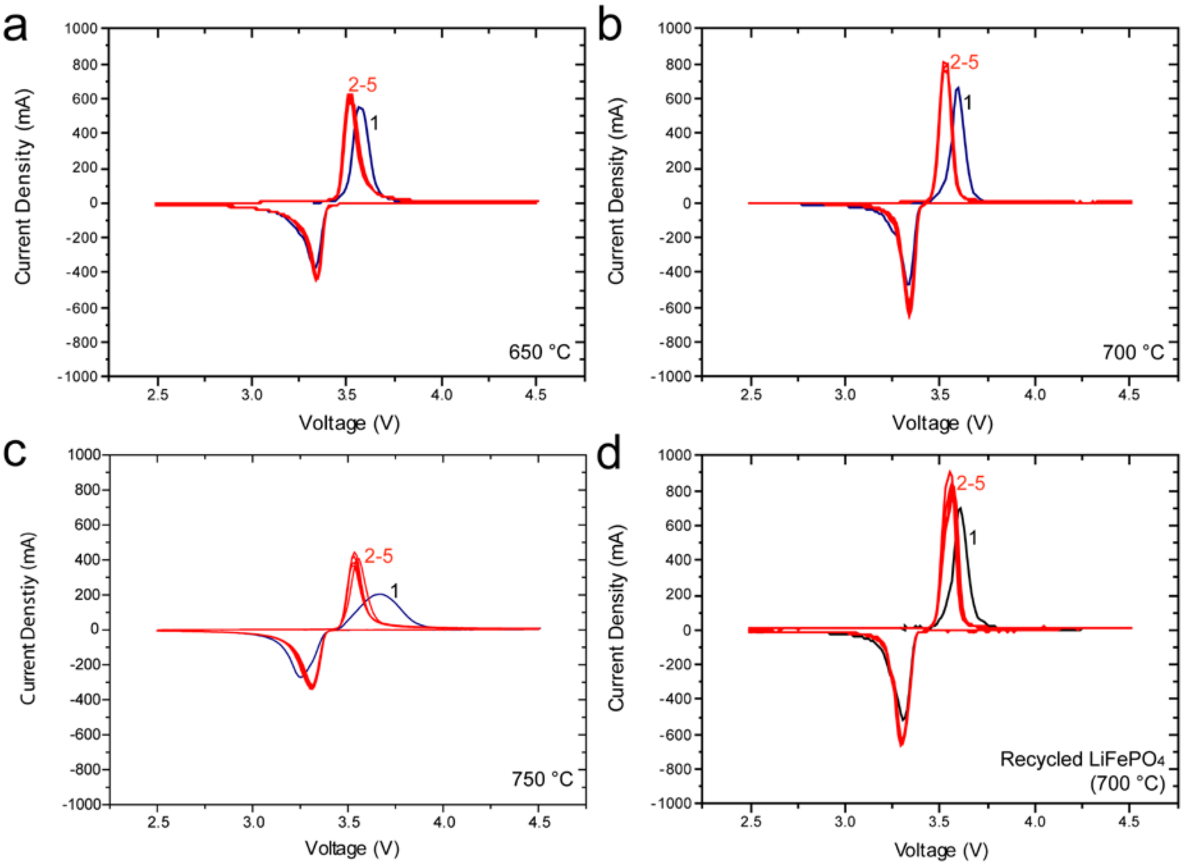

Fig. S2 Cyclic voltammetries of $LiFePO_4$ synthesized at (a) 650 °C (b) 700 °C (c) 750 °C (d) recycled $LiFePO_4$ (700 °C).

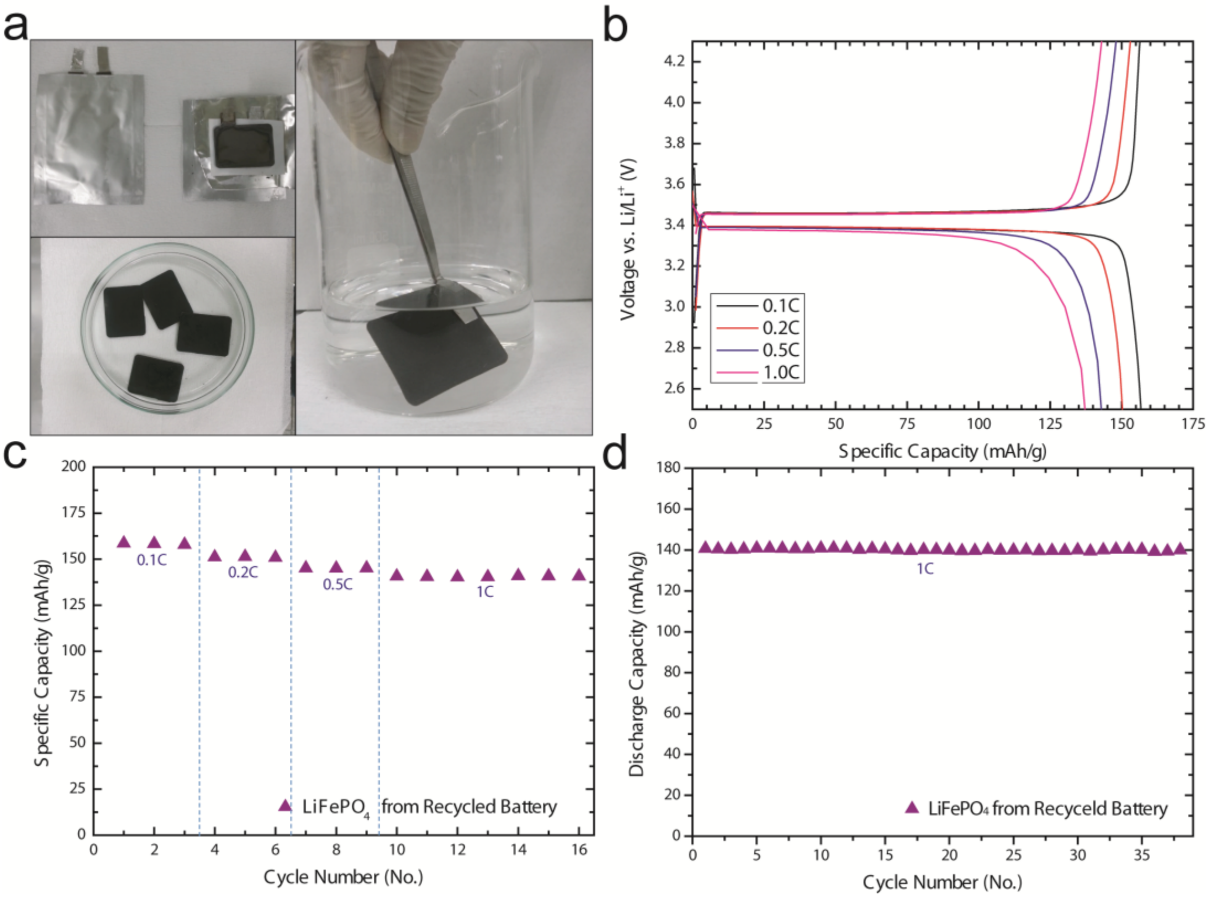

Fig. S3 (a) Process to recover used $LiFePO_4$ from the fully-cycled pouch cells (disassembled $LiFePO_4$ electrode materials washed in DMC solution) (b) electrochemical performance of $LiFePO_4$ from recycled battery (c) rate capabilities (d) cycle characteristics. Because each pouch cell only contains very small amount of active cathode materials, we disassembled several pouch cells and combined all of these recovered powders in order to carry out the electrochemical test measurements.

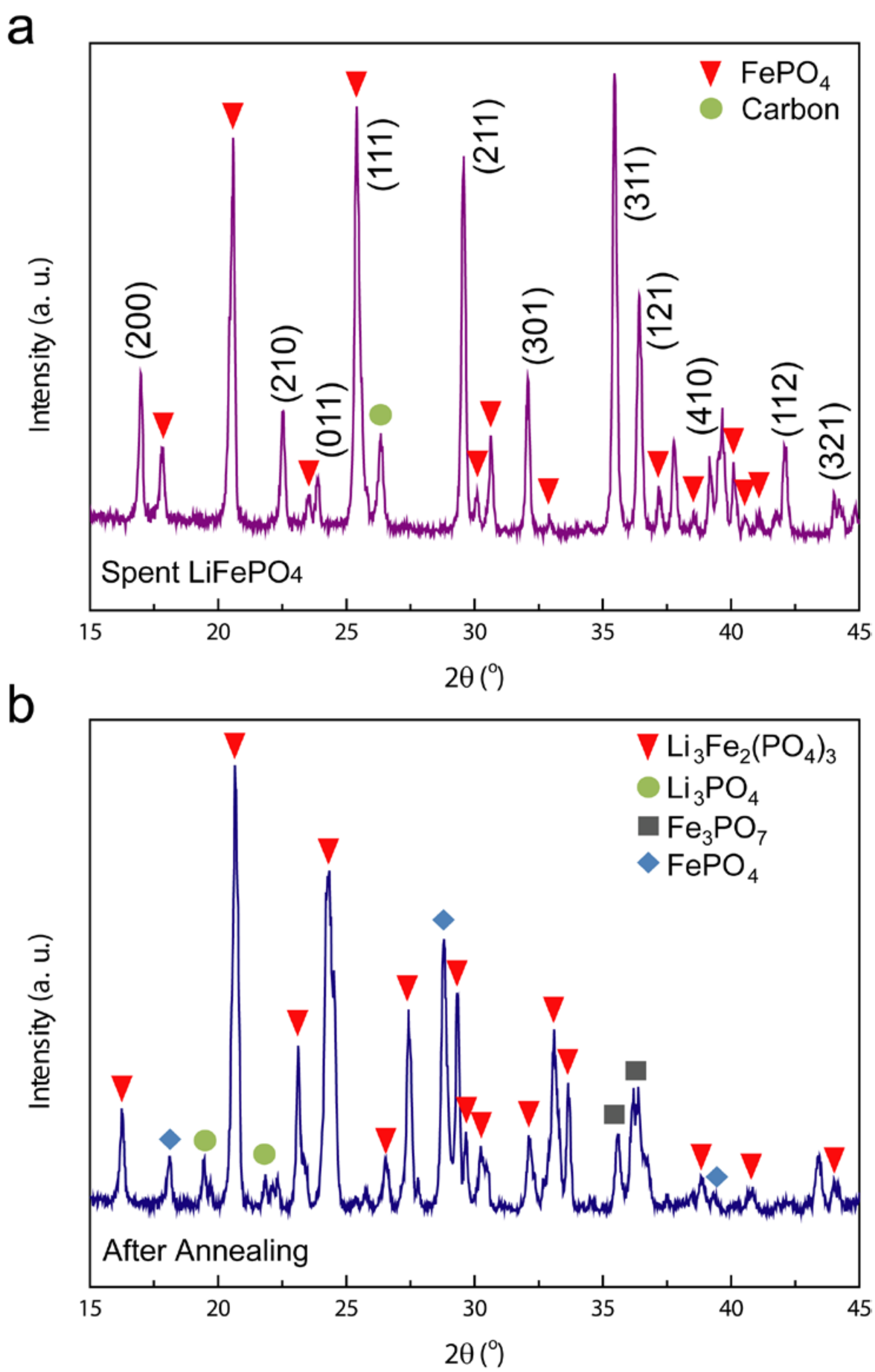

Fig. S4 X-ray diffraction patterns of (a) recovered spent $Li_{1-x}FePO_4$ powders (b) after annealing process at 700 °C in a box furnace, where all the Fe^{2+} sources are oxidized to Fe^{3+}.

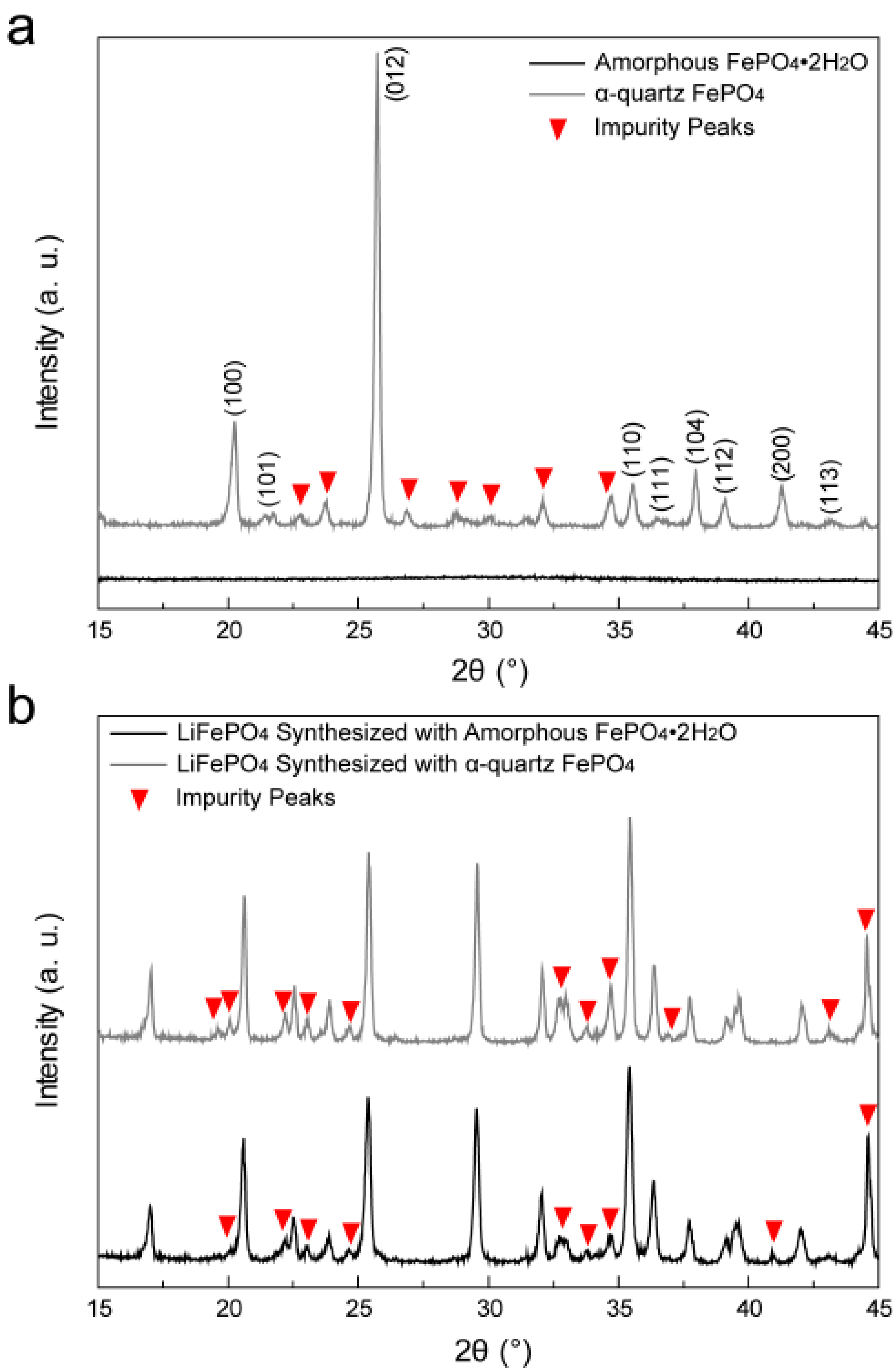

Fig. S5 X-ray diffraction patterns of (a) amorphous $FePO_4 \cdot 2H_2O$ (Aldrich) and α-quartz $FePO_4$ after heat treatment (600 °C, 6 hr) (b) $LiFePO_4$ synthesized at 700 °C with amorphous $FePO_4 \cdot 2H_2O$ and α-quartz $FePO_4$.

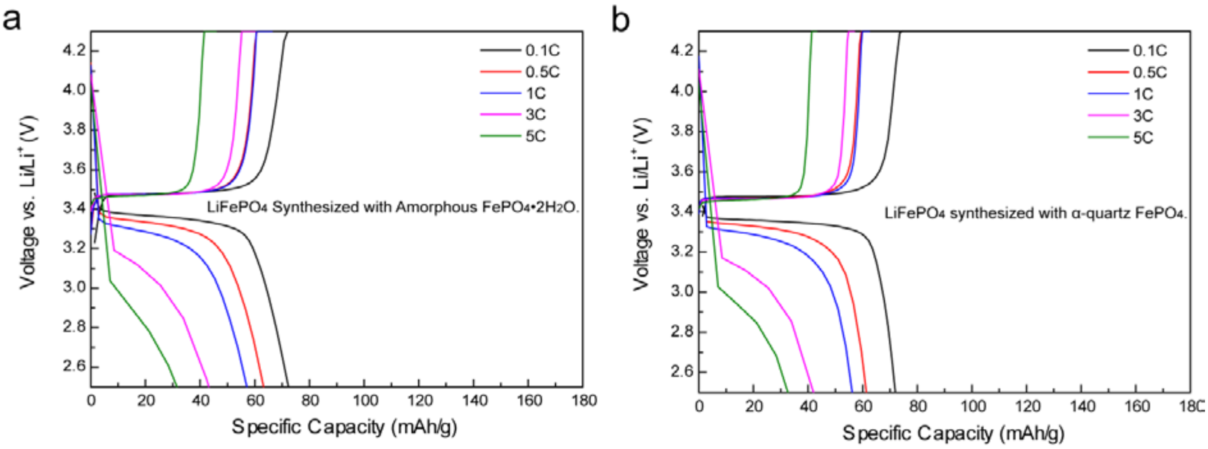

Fig. S6 Capacity vs. voltage curves of (a) $LiFePO_4$ synthesized with amorphous $FePO_4{\cdot}2H_2O$ (b) $LiFePO_4$ synthesized with α-quartz $FePO_4$.