

Electronic Supplementary Information

A Porous LiFePO₄ and Carbon Nanotube Composite

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Experimental Section

Multiwalled carbon nanotubes (CNT) were purchased from Chengdu Alpha Nano Technology Co. Ltd, purified and functionalized by the mixed acid method to achieve better water dispersion. LiFePO₄-CNT composite materials were prepared by using an in situ sol-gel method as follows: first, 0.03 mol of lithium dihydrogen phosphate (LiH₂PO₄) was dissolved in 200 mL of water and stirred at 70 °C for 1 h. Separately, 0.03 mol of iron (III) citrate and 0.2365 g of CNTs were dissolved in 300 mL of water via ultrasonic agitation for 30 min, followed by mechanical agitation (magnetic stir-bar) at 65 °C for 1 h. The two solutions were mixed together and dried at 60 °C for 24 h. After thorough grinding with a mortar and pestle, the obtained material was fired in an inert (argon) atmosphere at 700 °C for 10 h with a heating rate of 10 °C min⁻¹. For the synthesis of pristine porous LiFePO₄, the procedure was similar but CNTs were not added.

XRD measurements were carried out with an ARL X'TRA advance diffractometer using filtered CuK α radiation, and the experimental diffraction patterns were collected at room temperature by step scanning in the range of 10-80°. The morphology of the composites was investigated on a field-emission scanning electron microscope (FESEM, Hitachi S-4800). TEM measurements were performed with a JEOL

JEM-200CX transmission electron microscope. The charge and discharge experiments were carried out using a NEWARE BTS (5V, 50mA) computer-controlled battery test station with coin-shape cells (1.54 cm²) between 2.2 and 4.0 V at different rates. Electrochemical cyclic voltammetry tests were performed using a Princeton Applied Research PARSTAT 2273 advanced electrochemical system with lithium film as both the counter and reference electrode over the potential range of 2.2-4.0 V at the scanning rate of 0.1 mV s⁻¹. Electrochemical complex impedance measurements were also carried out using a Princeton 2273 electrochemical system with an applied perturbation signal of 10 mV over the frequency range of 1 MHz to 100 mHz. Working electrodes were prepared by mixing appropriate amounts of the LiFePO₄ (or LiFePO₄-CNT), Super P, and poly(vinyl difluoride) (PVDF) in the ratio of 80:15:5 by weight, which were then pasted onto pure Al foil. Microporous polypropylene film (Celgard 2400) was used as the separator. The liquid electrolyte consisted of a solution of 1M LiPF₆ in ethylene carbonate (EC)-dimethyl carbonate (DMC) (1:1, v/v). The cells were assembled in an argon-filled glove-box and all the electrochemical measurements were conducted at room temperature.

XRD patterns

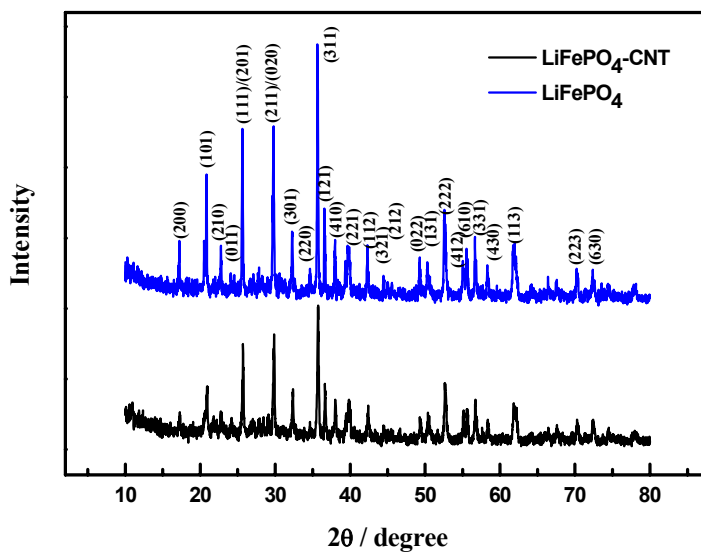


Fig. S1 XRD patterns of porous LiFePO₄ (blue) and LiFePO₄-CNT composite (black).

Impedance spectra

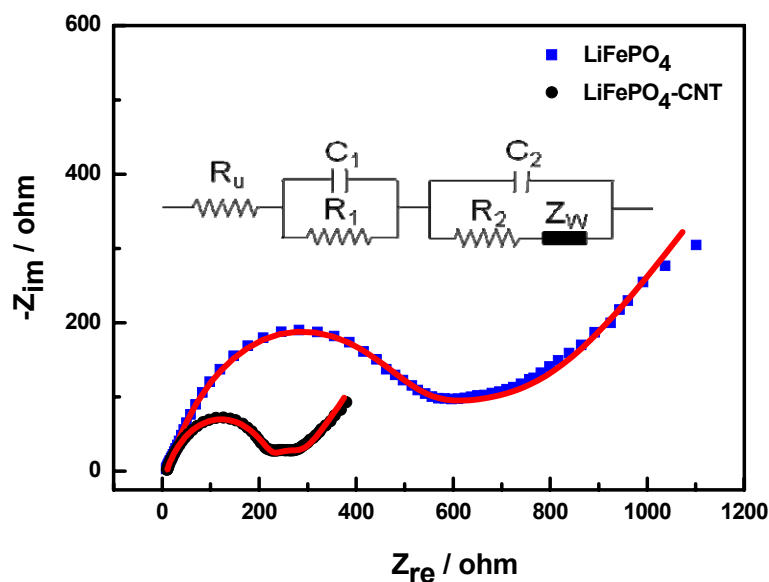


Fig. S2 Impedance spectra of porous LiFePO₄ (blue) and LiFePO₄-CNT composite (black), red solid lines are the fitting curves by using the inset equivalent circuit.

References

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