

Supporting information

Ethylene glycol-assisted nanocrystallization of LiFePO_4 for a rechargeable lithium-ion battery cathode

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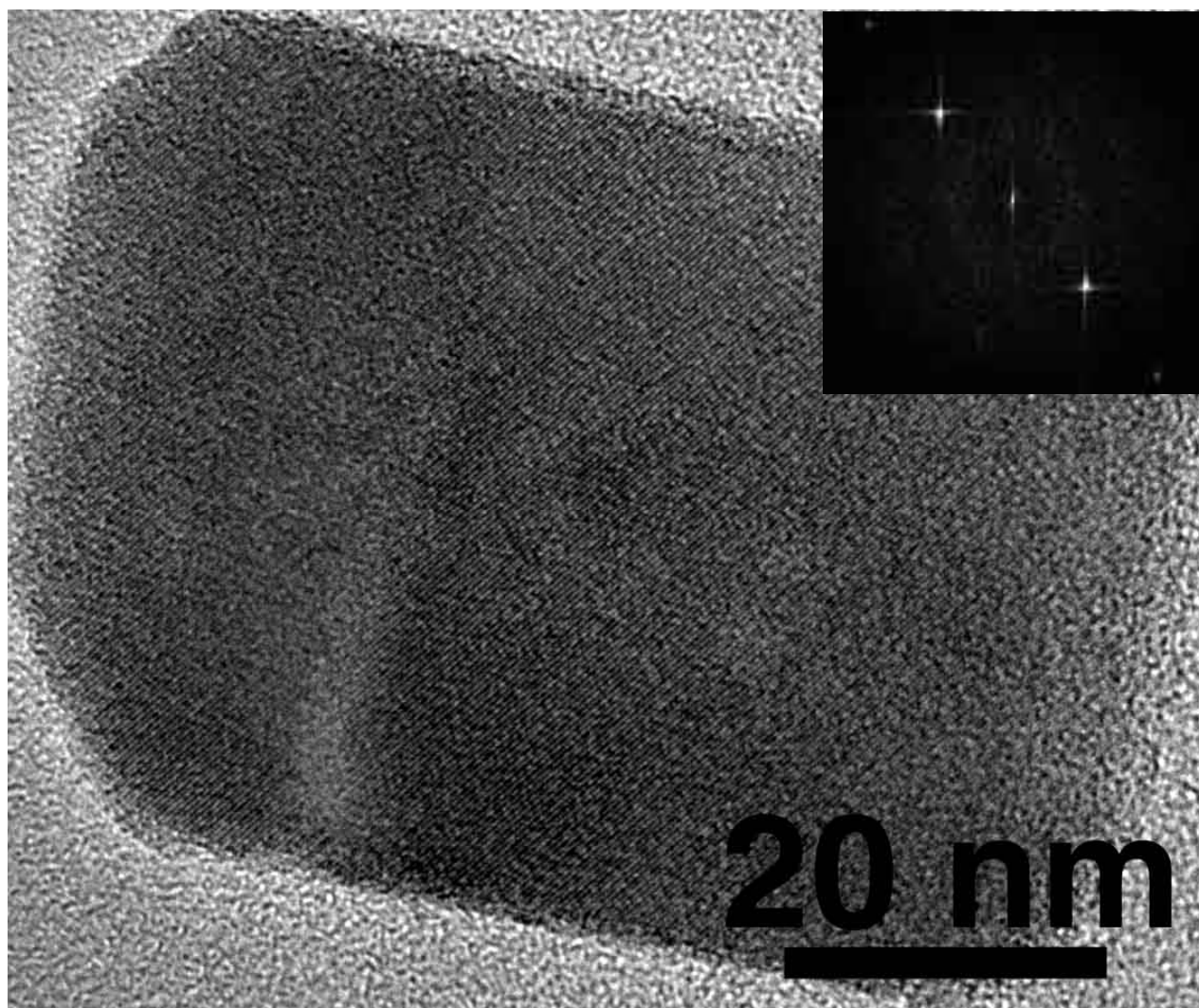


Fig.S1. TEM image and inserted FFT pattern of an individual LiFePO_4 single-crystalline nanoparticle obtained at the solvothermal reaction time of 12 h, showing one-dimensional strip structure.

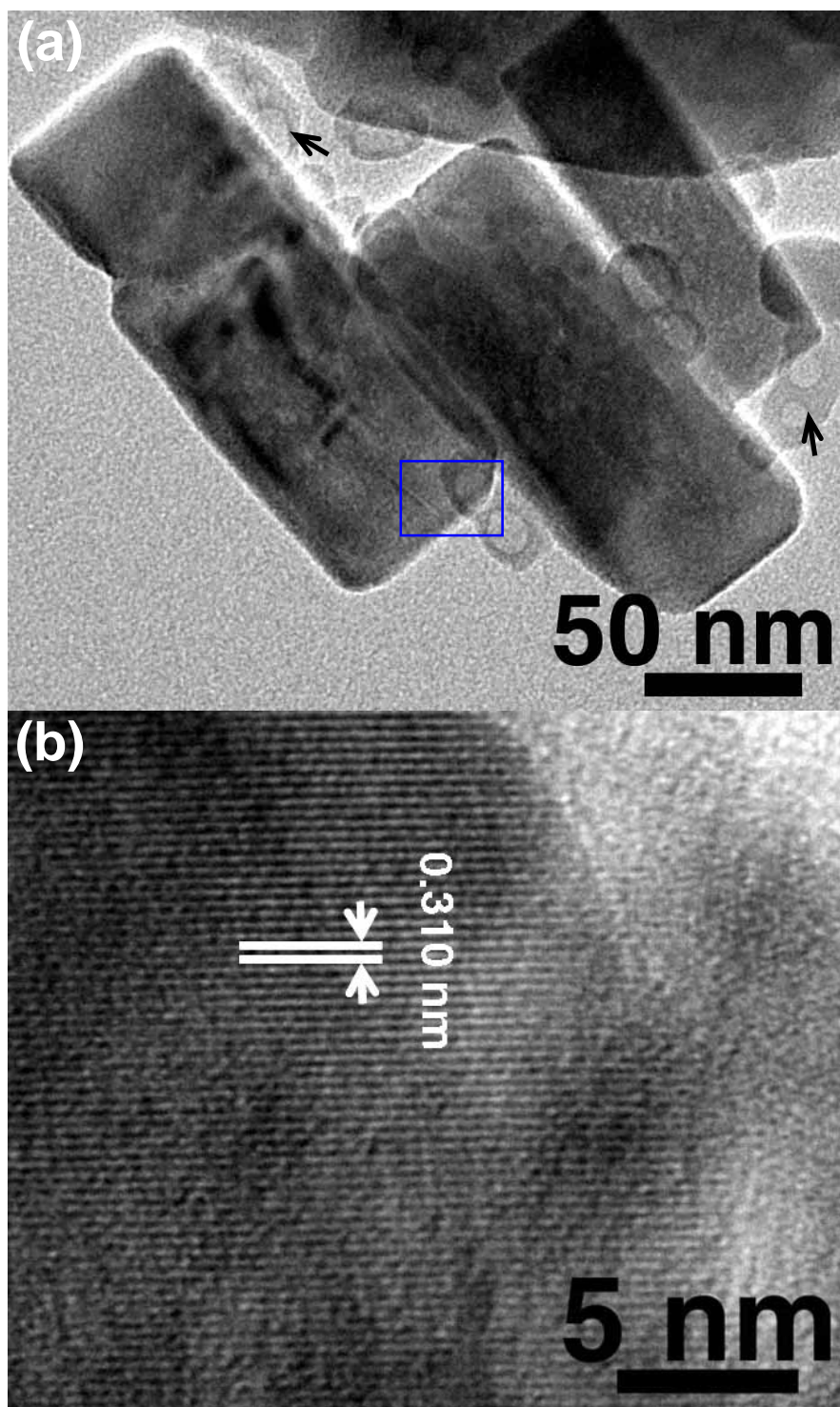


Fig.S2. (a) TEM and (b) HR TEM images of LiFePO_4 nanoparticles fished at the solvothermal reaction time of 12 h. In panel (a), the blue square was magnified and shown in panel (b), while black arrows represent the visually determined residua of amorphous precursors.

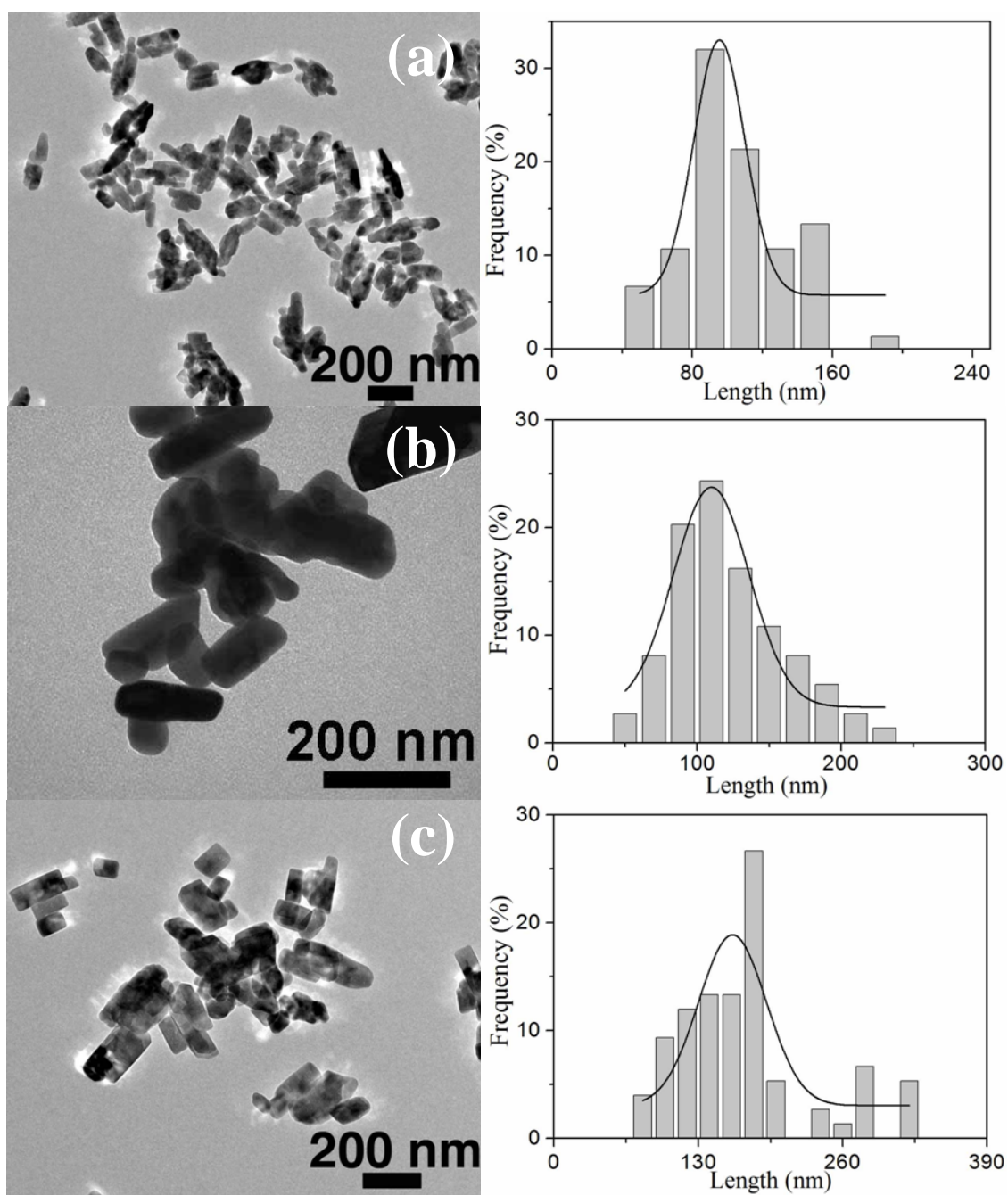


Fig.S3. (left) TEM images and (right) size histograms of LiFePO₄ nanoparticles obtained at a solvothermal reaction time of (a) 2, (b) 3, or (c) 12 h.

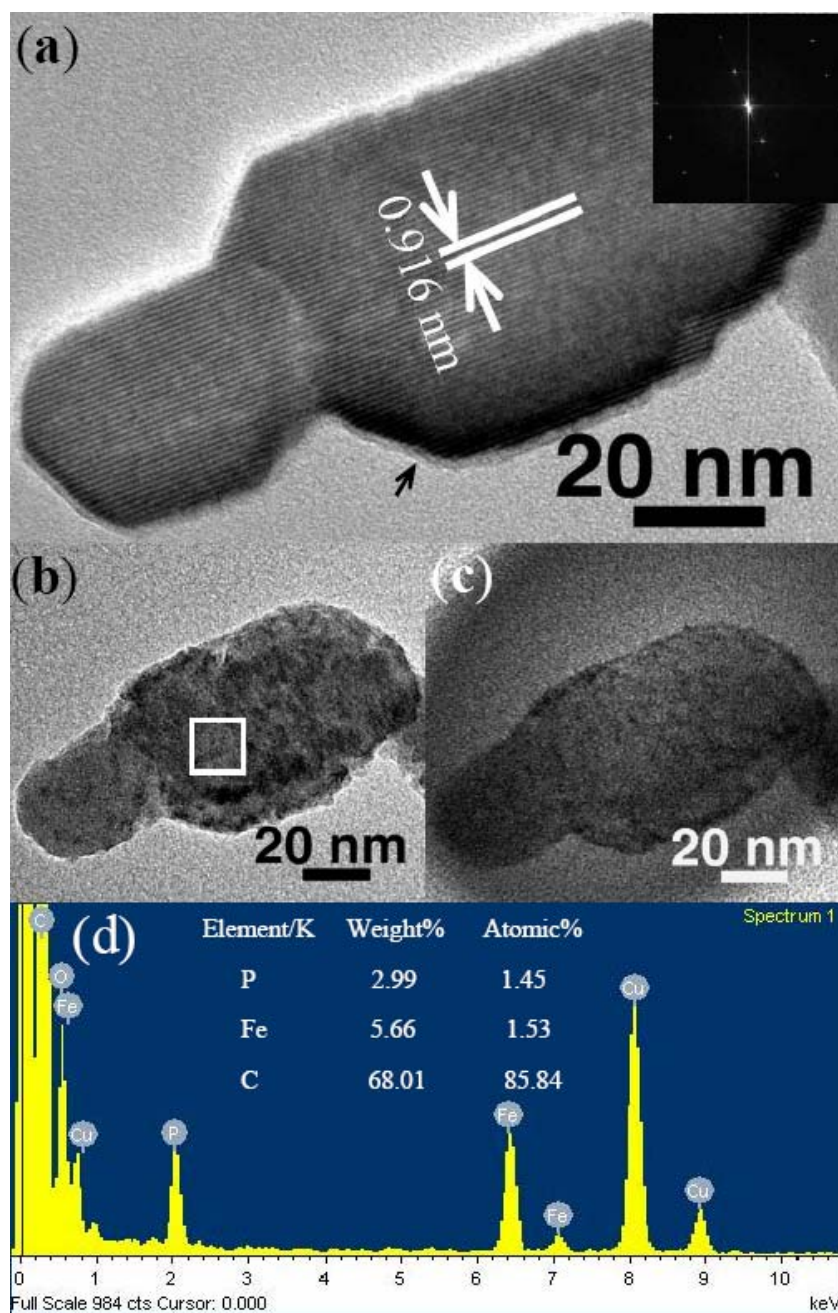


Fig. S4. (a) TEM image and inserted FFT pattern of LiFePO₄ nanoparticles obtained at a reaction time of 2 h, showing an arrow-marked amorphous coating and indicating single-crystalline nature. (b, c) TEM images of the LiFePO₄ particle taken after a relatively short- and long-time irradiation of electron beam, respectively, indicating the gradual surface irradiation damage. (e) Energy dispersive spectrum analysis of the square region marked in panel (c) displays the almost equal atomic ratio of Fe/P and the doping of carbon, suggesting that the amorphous coating is the gel-like composite of ethylene glycol and precursors.

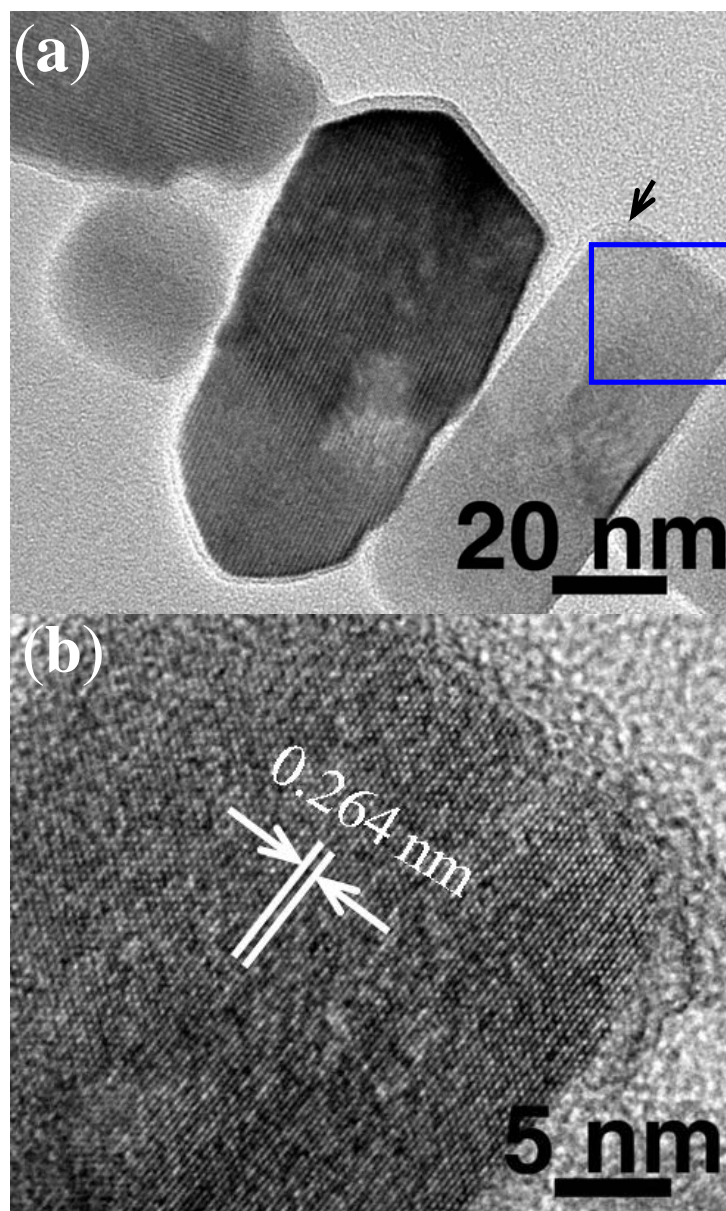


Fig. S5. (a) TEM and (b) HRTEM images of LiFePO_4 nanoparticles obtained at the solvothermal reaction time of 2 h. Panel (b) is the close-up view of an individual nanorod marked in panel (a), indicating the single-crystalline nature of LiFePO_4 . An arrow marked in panel (a) denotes the amorphous coating of gel-like composite of ethylene glycol and precursor.

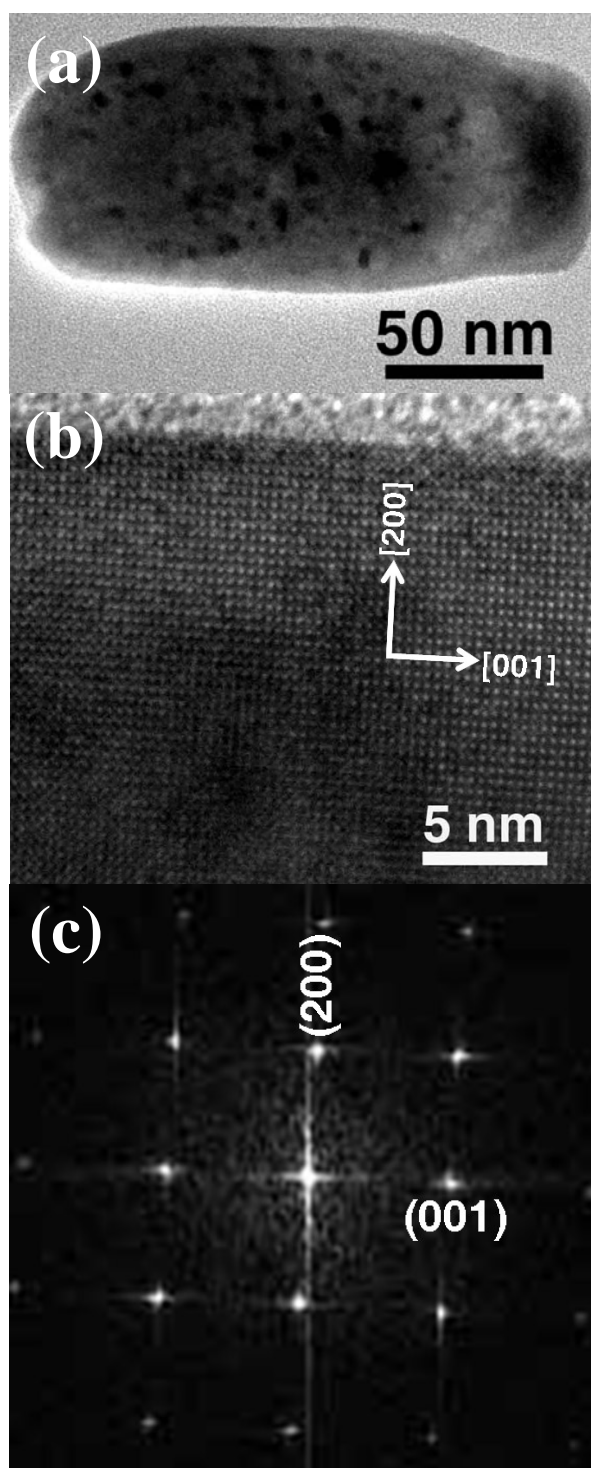


Fig. S6. (a) TEM, (b) HR TEM images and (c) FFT pattern of a representative LiFePO_4 nanoparticle obtained after the decomposition of glucose at 700°C under argon atmosphere, showing the single-crystalline nature of LiFePO_4 .

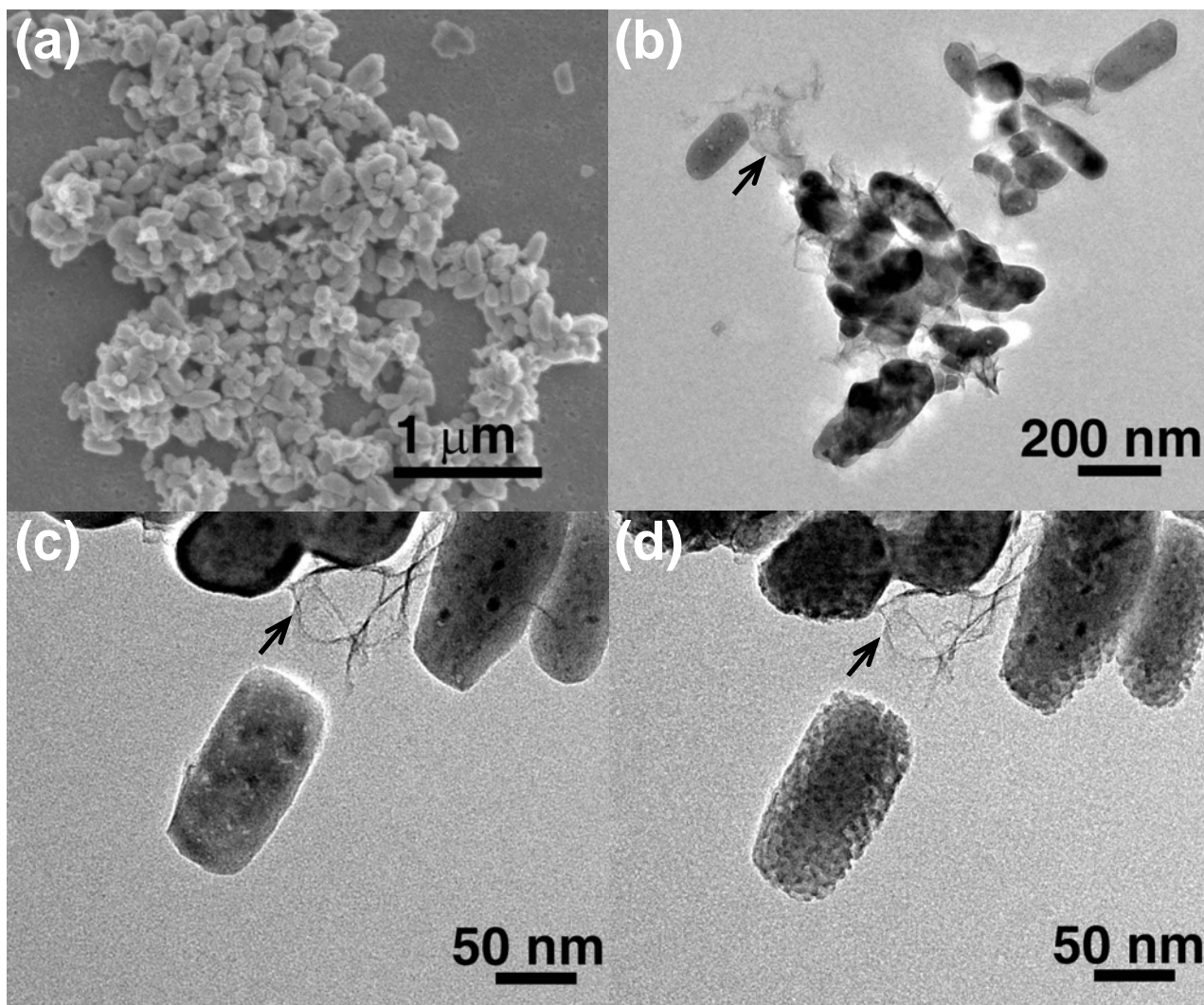


Fig. S7. (a) SEM and (b-d) TEM images of LiFePO₄ nanoparticles heat-treated at 700°C under argon atmosphere through the chemical decomposition of glucose. Panel (d) presents the same nanoparticles as these shown in panel (c), which was taken after a short-time irradiation of electron beam. Black arrows denote the ex-situ carbons after glucose decomposition.

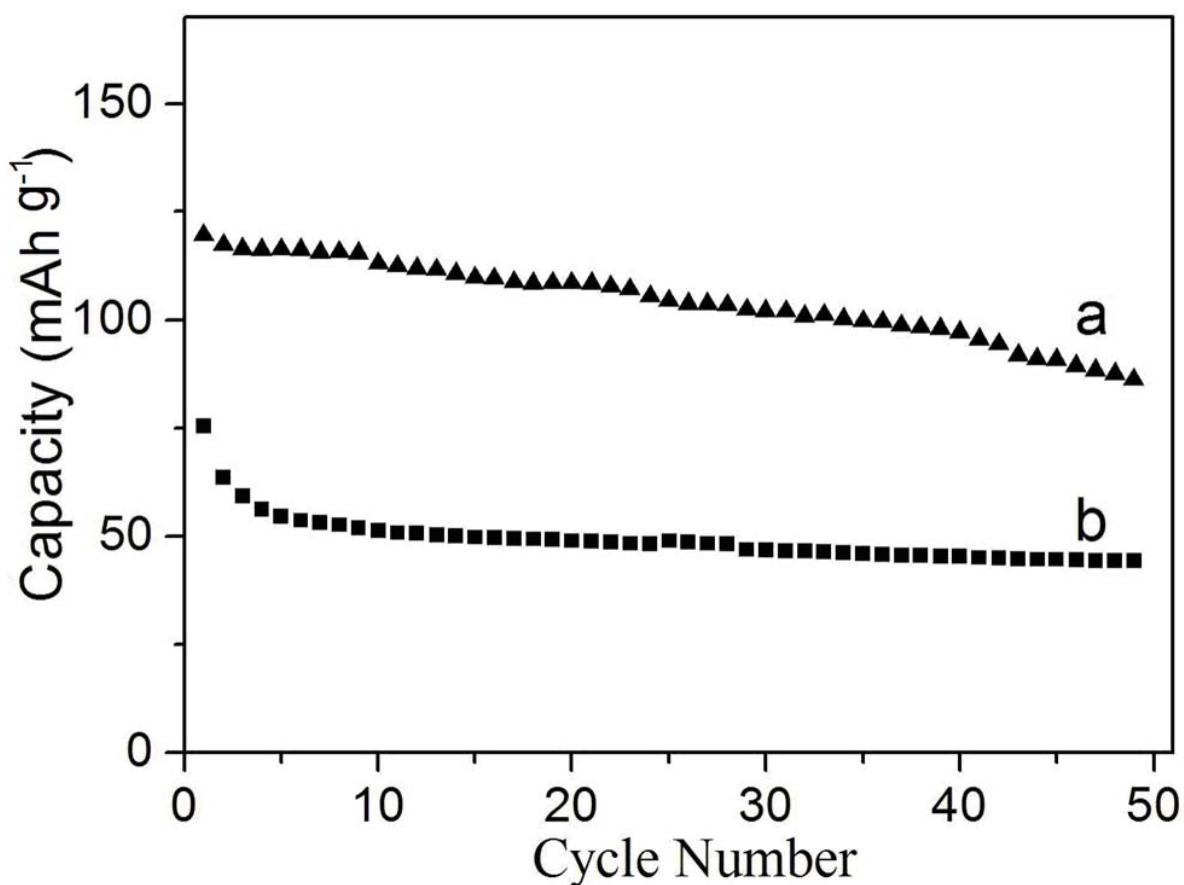


Fig. S8. A relationship of special discharge capacity versus cycle number for different LiFePO₄ cathodes (current = 0.2 C): (a) glucose-assisted heat-treated LiFePO₄ single-crystalline nanoparticles obtained at the solvothermal reaction time of 2 h, showing an initial capacity of 119.7 mAh g⁻¹ and a capacity retention rate of 72.1% over 50 charge-discharge cycles; (b) LiFePO₄ nanoparticles collected at the solvothermal reaction time of 12 h without the subsequent 700°C heat-treatment, showing the initial and 50th discharge capacities of 75.6 and 44.3 mAh g⁻¹, respectively. These indicate that, for this novel crystal-forming engineering, both the ethylene glycol-assisted solvothermal reaction time (12 h) and the glucose-assisted heat-treatment at 700°C play an important role in improving the electrochemical performances of LiFePO₄ as lithium-ion battery cathodes.