Supplementary data

Lithium iron phosphate/nitrogen-doped reduced graphene oxide nanocomposite as a cathode material for high power lithium ion batteries

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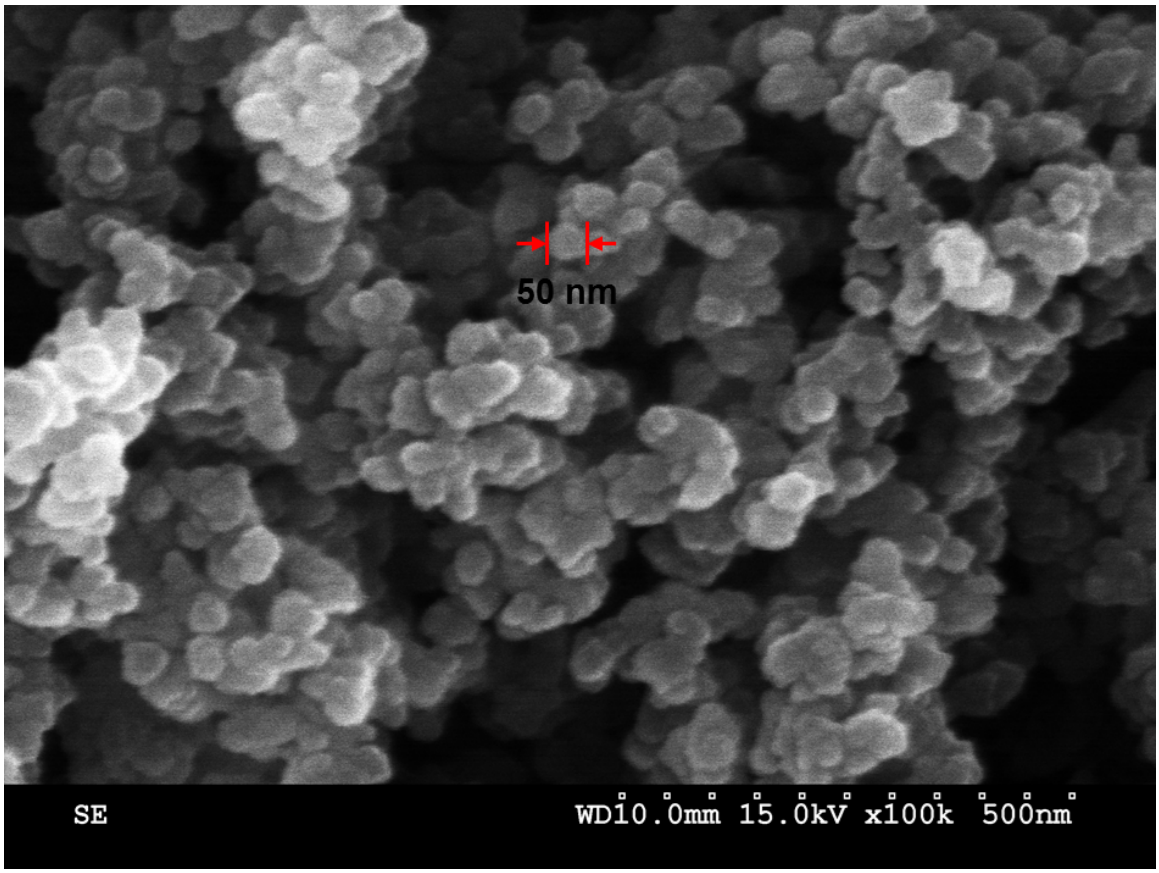

Figure S1. SEM image of the $FePO_4 \cdot H_2O$ nanoparticles synthesized by a simple precipitation method using H_2O_2 as the oxidizing agent

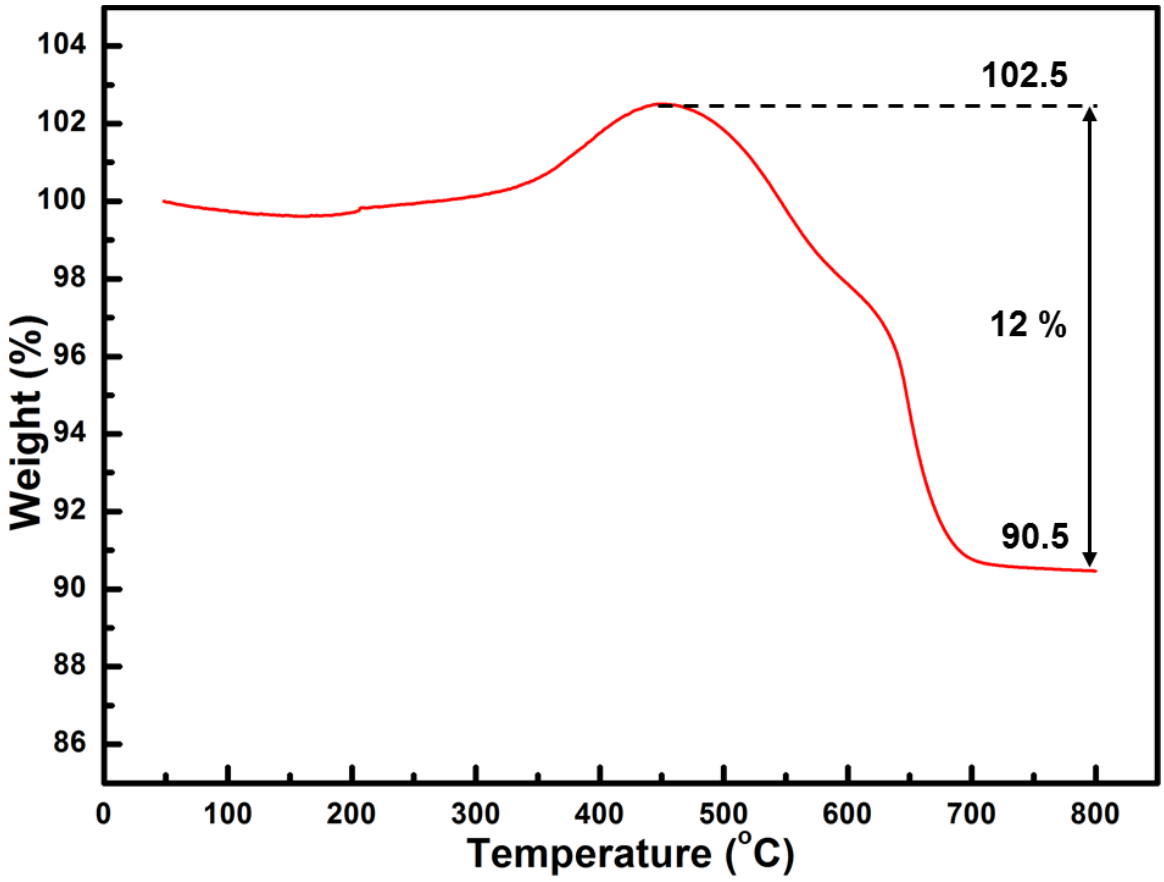

Figure S2. TGA curve of the $LiFePO_4$/NrGO nanocomposite

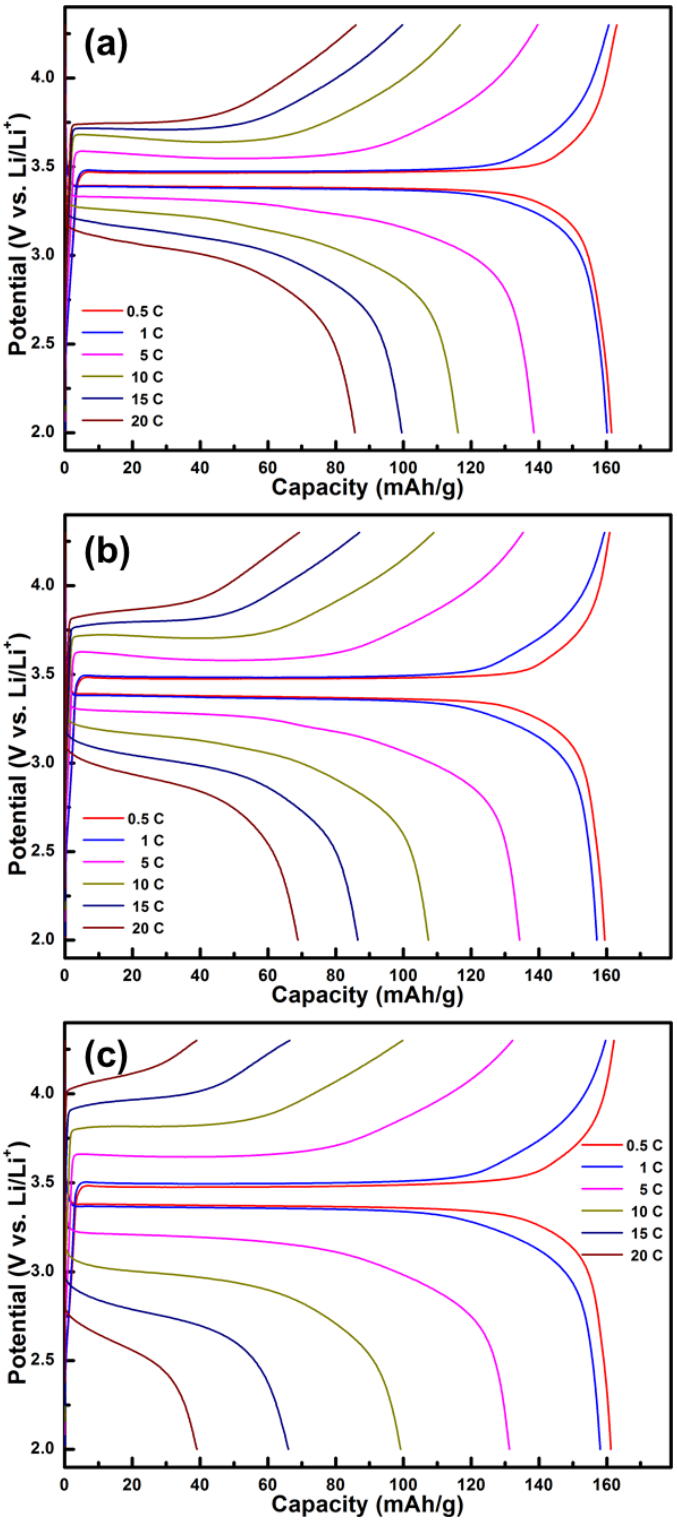

Figure S3. Charge-discharge profiles of the control electrode fabricated with commercial $LiFePO_4$ nanoparticles at the electrode thickness of (a) 8, (b) 21, and (c) 37 μm.

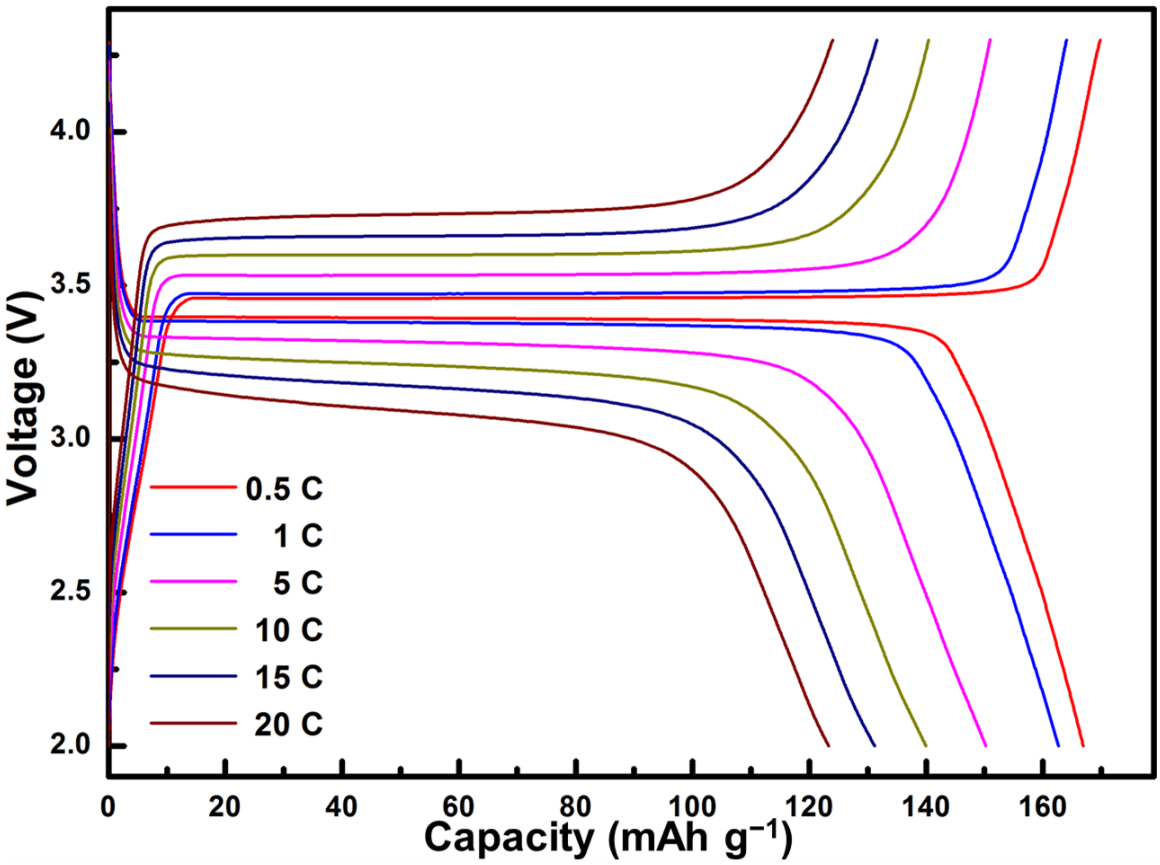

Figure S4. Charge-discharge profiles of the $LiFePO_4$/rGO synthesized with the same synthetic method except the addition of urea at the electrode thickness of 11 μm.

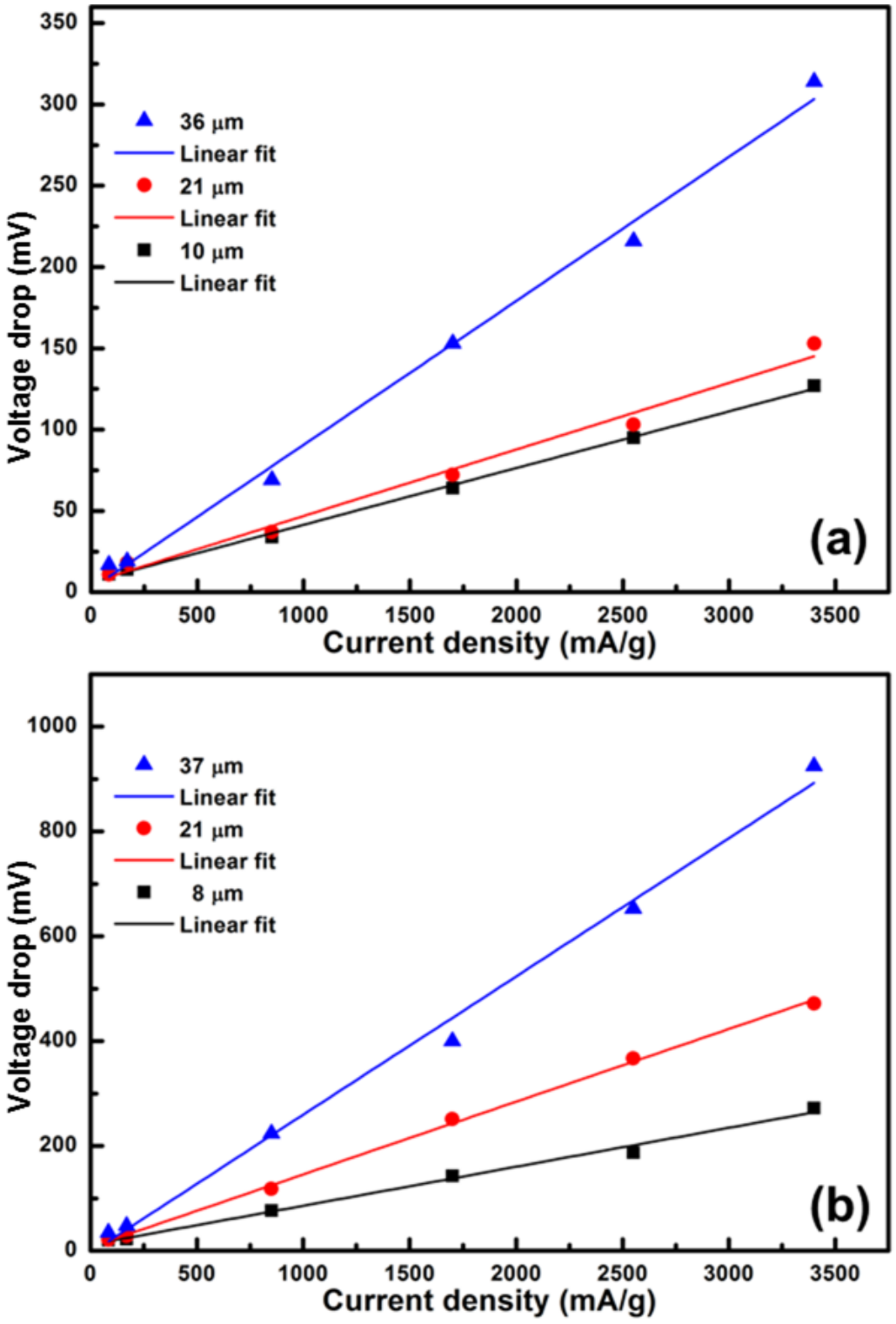

Figure S5. Initial voltage drop of electrodes fabricated with (a) $LiFePO_4$/NrGO nanocomposite, and (b) commercial $LiFePO_4$ nanoparticles.

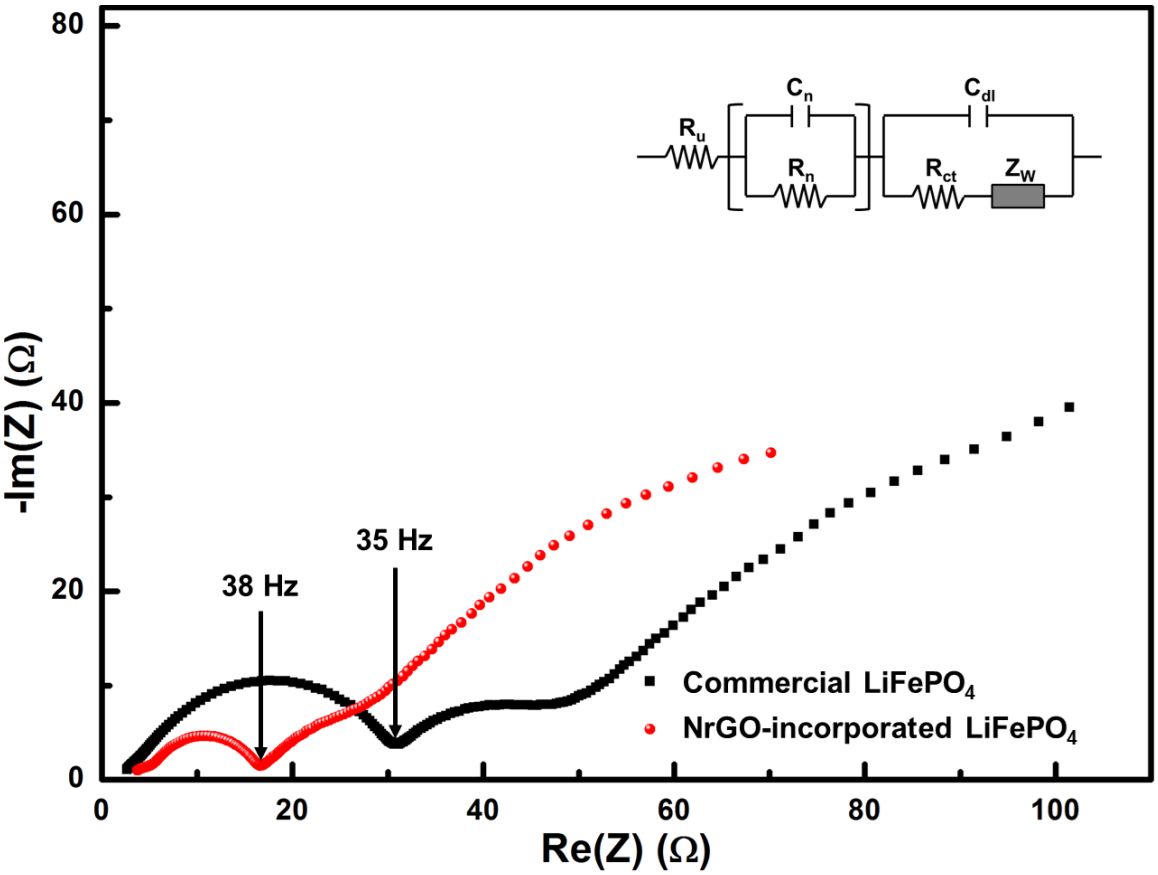

Figure S6. EIS data for the electrodes fabricated with the $LiFePO_4$/NrGO nanocomposite and the commercial $LiFePO_4$ nanoparticles.

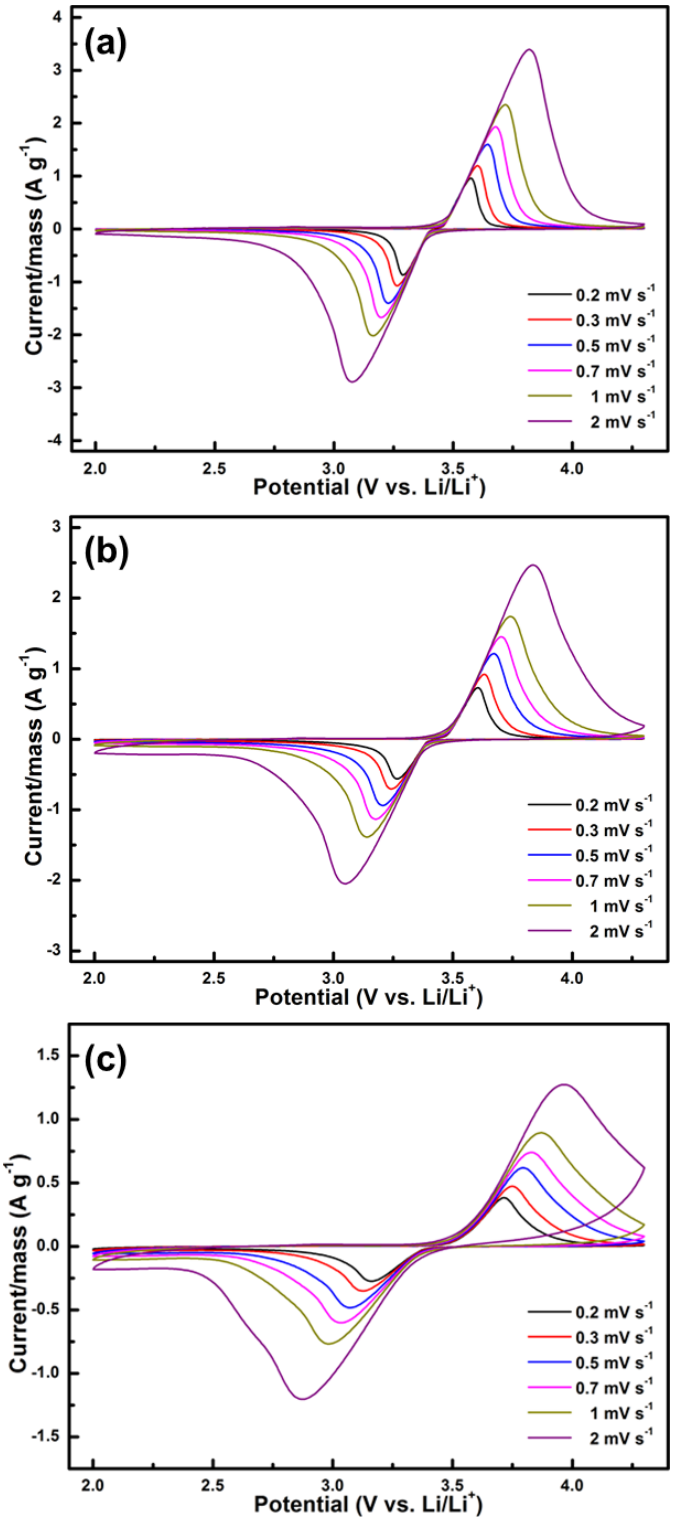

Figure S7. Cyclic voltammograms of the $LiFePO_4$/NrGO nanocomposite measured at (a) 25, (b) 0, and (c) −20 °C.

Table S1a. Apparent diffusion coefficients of the $LiFePO_4$/NrGO nanocomposite according to the temperatures.

Temperature (°C)	$D_{cathodic}$ ($cm^2\ s^{-1}$)	D_{anodic} ($cm^2\ s^{-1}$)
25	9.27×10^{-15}	1.29×10^{-14}
0	4.66×10^{-15}	6.80×10^{-15}
−20	1.62×10^{-15}	1.80×10^{-15}

Table S1b. Apparent diffusion coefficients of the commercial $LiFePO_4$ obtained at 25 °C.

Temperature (°C)	$D_{cathodic}$ ($cm^2\ s^{-1}$)	D_{anodic} ($cm^2\ s^{-1}$)
25	8.94×10^{-15}	1.09×10^{-14}

Apparent diffusion coefficients of the Li^+ ions in the $LiFePO_4$/NrGO nanocomposite and the commercial $LiFePO_4$ were calculated using Randle-Sevcik equation as follows:

$$I_p/m = 0.4463F(F/RT)^{1/2}A_e(D_{app})^{1/2}C_{Li}^{*}\nu^{1/2}$$

where, I_p is the peak current in amperes, m is the mass of electrodes, F is the Faraday constant, R is the gas constant, A_e is the surface area of the electrode, D_{app} is the apparent diffusion coefficient, C_{Li}^{*} is the initial concentration of Li in $LiFePO_4$ (0.0228 mol cm^{-3}), and ν is the scan rate in V/s.