Electronic Supplementary Information

Enveloping SiO_x in N-Doped Carbon for Durable Lithium Storage via an Eco-Friendly Solvent-Free Approach

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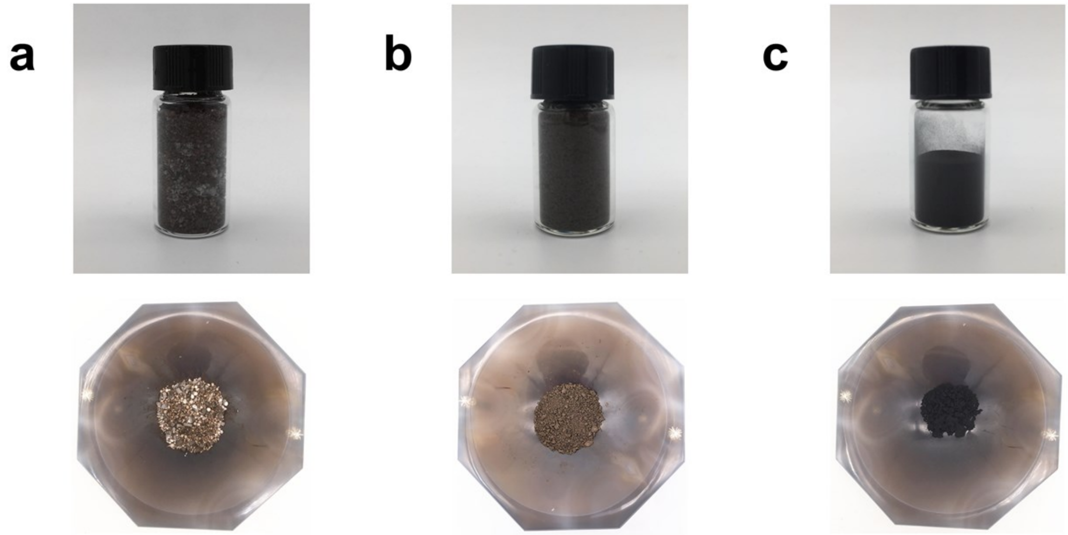

Fig. S1 Digital photos of raw materials before curing (a), SiO_x@NC precursor before calcination (b), and SiO_x@NC powder (c).

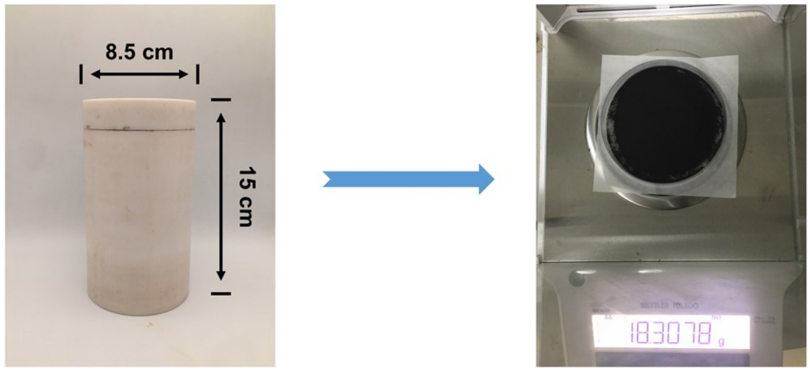

Fig. S2 Digital photos showing the scalable synthesis of SiO_x@NC.

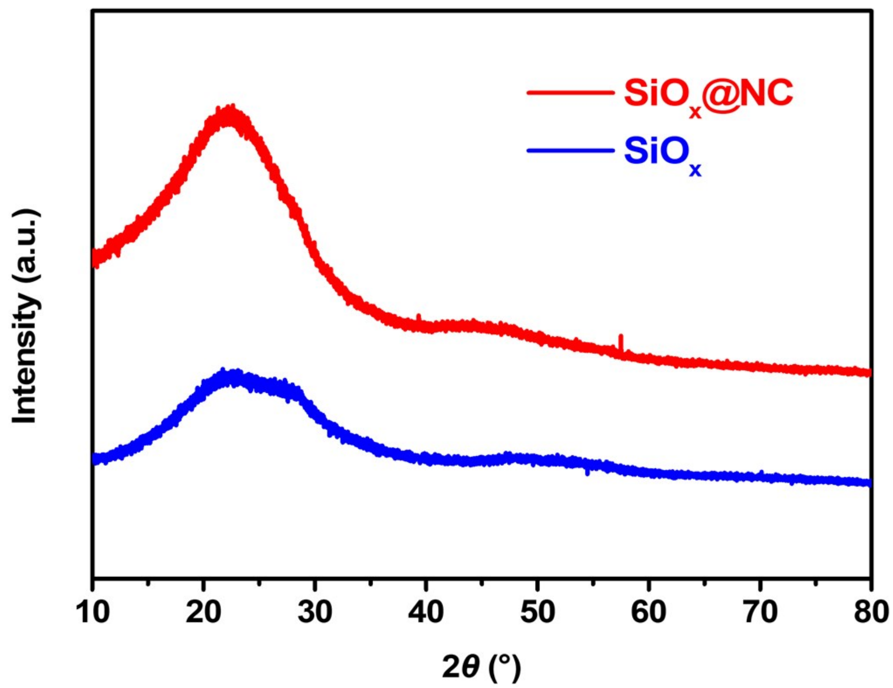

Fig. S3 XRD patterns of SiO_x@NC and bulk SiO_x.

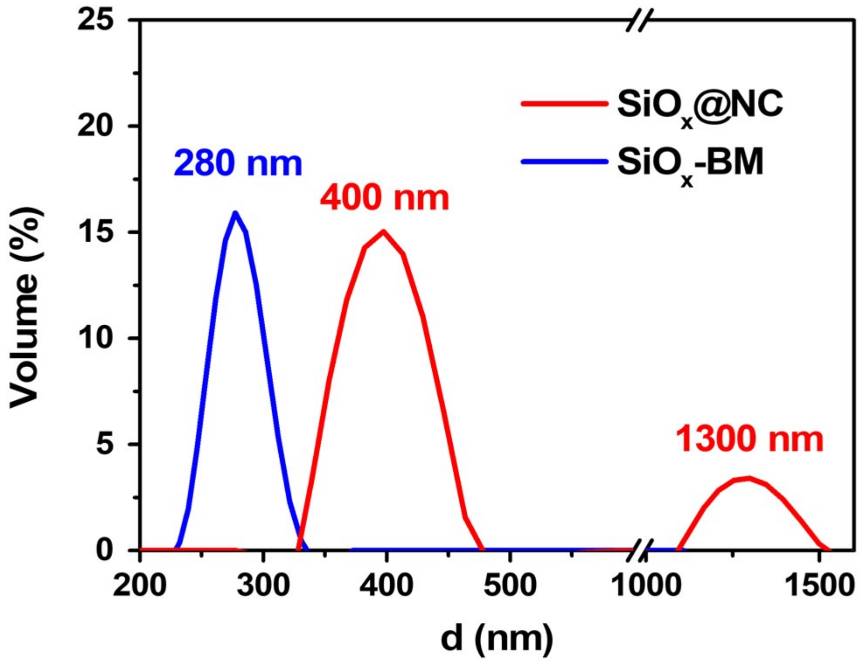

Fig. S4 PSD curves of SiO_x@NC and SiO_x-BM.

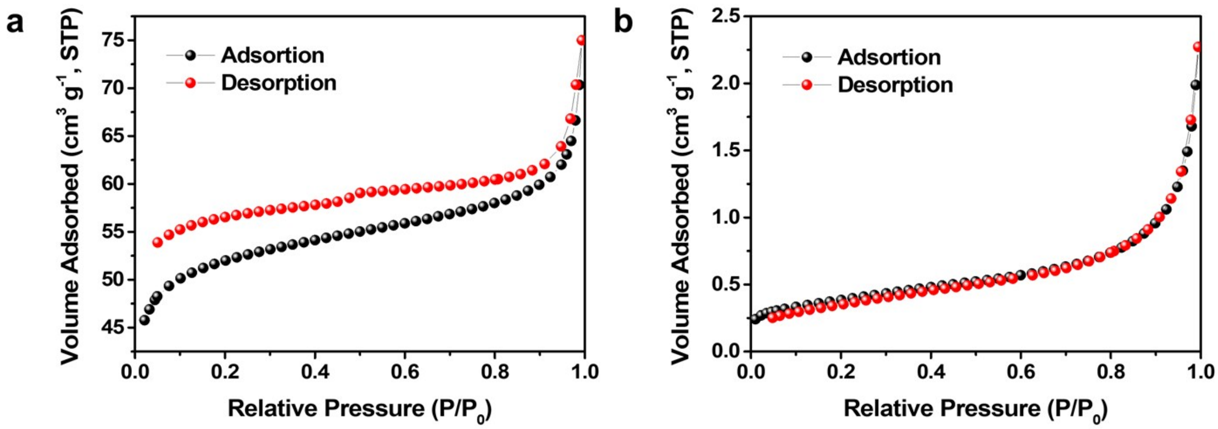

Fig. S5 N_2 adsorption/desorption isotherms of SiO_x@NC (a) and bulk SiO_x (b).

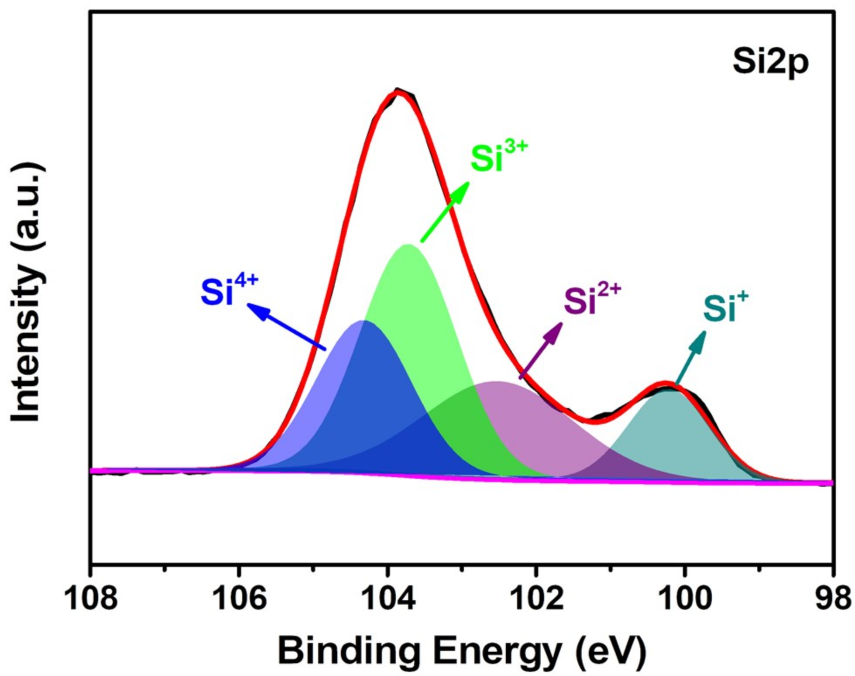

Fig. S6 High-resolution Si2p XPS spectrum of bulk SiO_x.

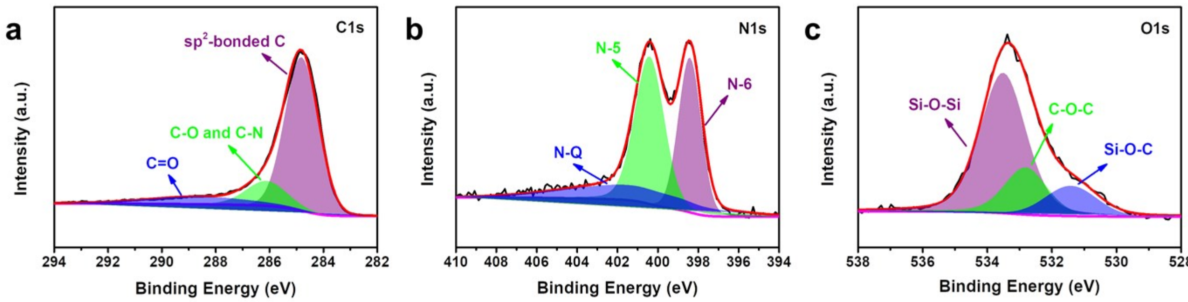

Fig. S7 High-resolution C1s (a), N1s (b), and O1s (c) XPS spectra of SiO_x@NC.

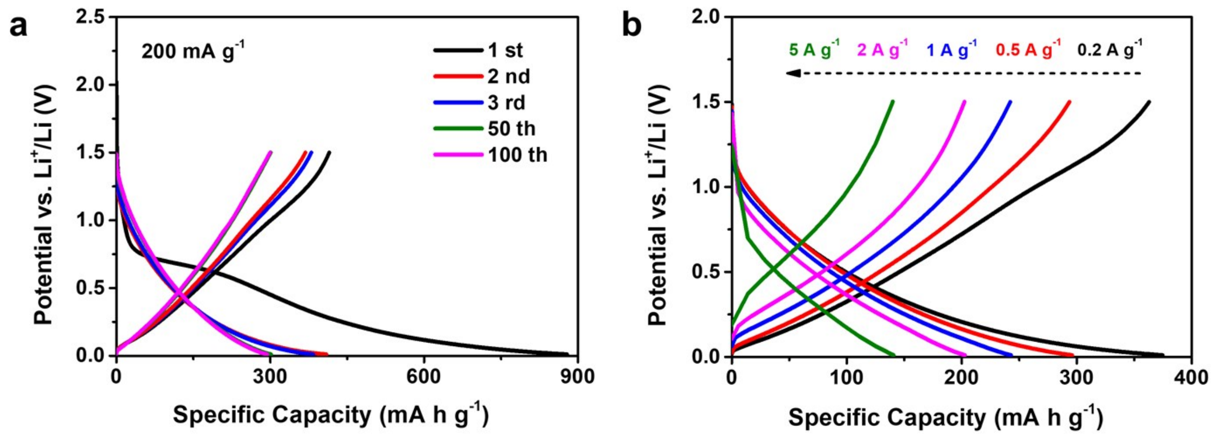

Fig. S8 Selected galvanostatic charge-discharge profiles of NC at 200 mA g^{-1} (a), charge-discharge curves of NC at various current densities (b).

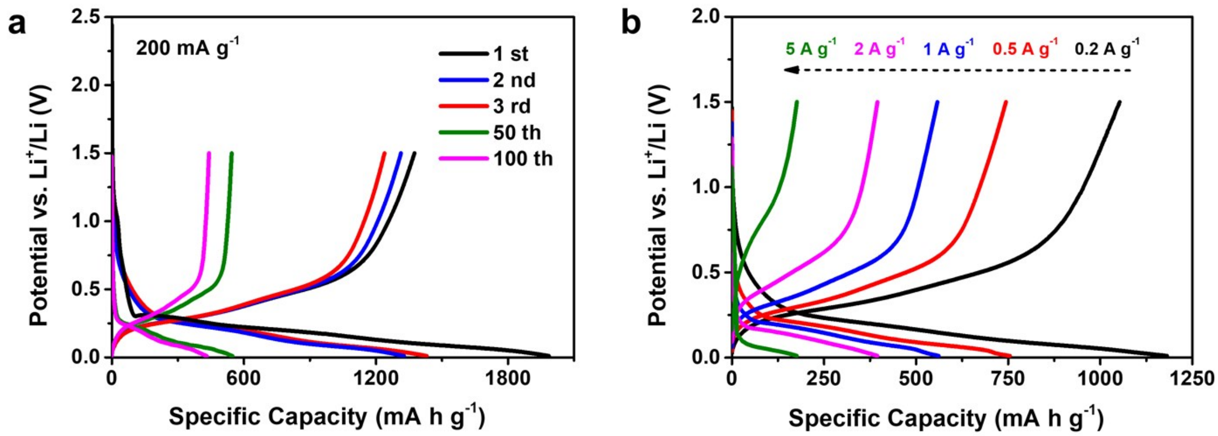

Fig. S9 Selected galvanostatic charge-discharge profiles of bulk SiO_x at 200 mA g^{-1} (a), charge-discharge curves of bulk SiO_x at various current densities (b).

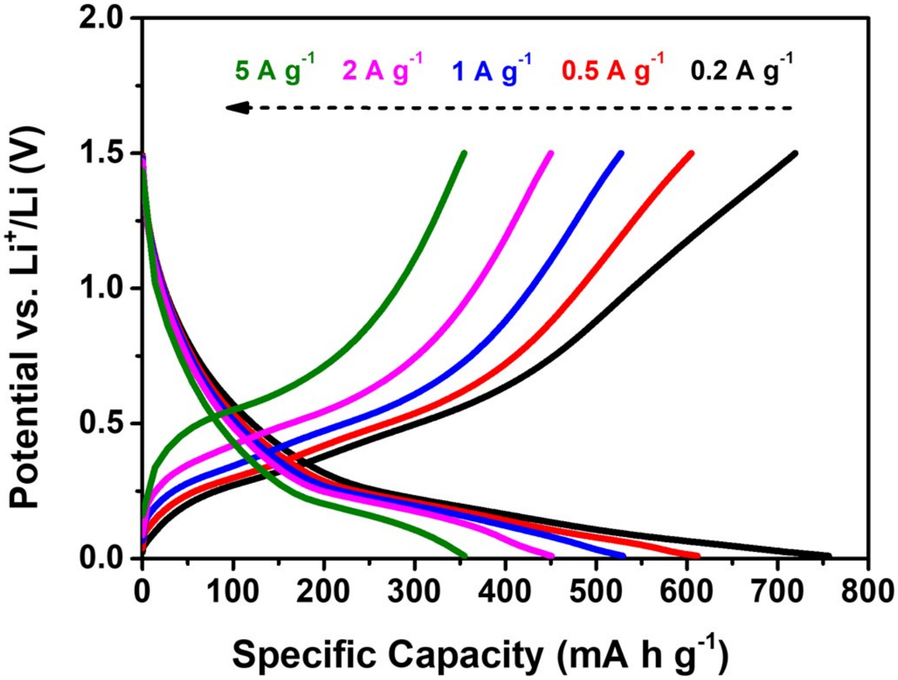

Fig. S10 Charge-discharge curves of SiO_x@NC at various current densities.

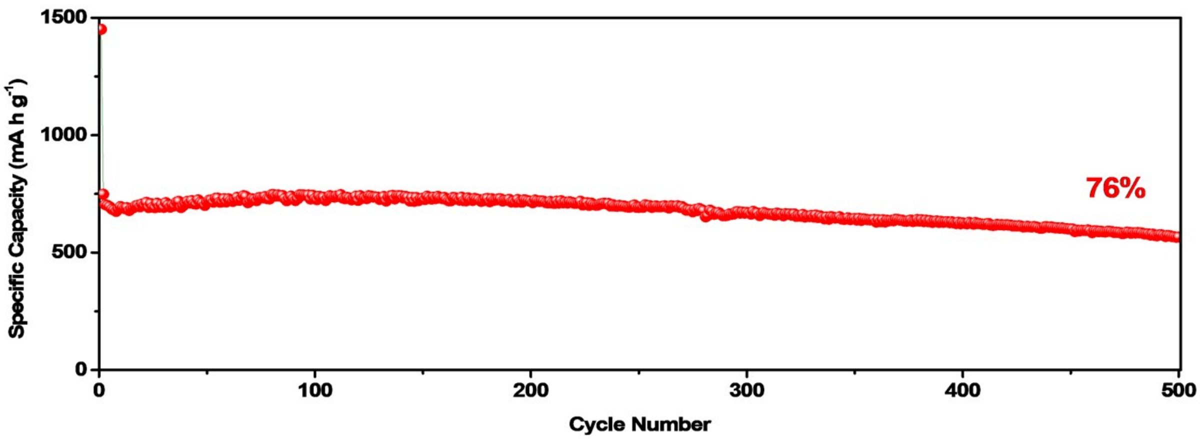

Fig. S11 Long-term cycling performance of SiO_x@NC with a lower carbon content at 500 mA g^{-1}.

Tab. S1 Lithium storage performances of various SiO_x-based anode materials.

Ref.	Reversible Capacity (mAh g^{-1})	Cycling Performance (mAh g^{-1})	Rate Capability (mAh g^{-1})	Electrochemical Window
This work	774 (200 mA g^{-1})	112 % (500 mA g^{-1}, 500 cycles)	345 (5 A g^{-1})	0.01 – 1.5 V
[S1]	570 (100 mA g^{-1})	≈ 102 % (100 mA g^{-1}, 100 cycles)	673 (800 mA g^{-1})	0.01 – 2.5 V
[S2]	906 (100 mA g^{-1})	≈ 80 % (100 mA g^{-1}, 350 cycles)	410 (800 mA g^{-1})	0.0 – 3.0 V
[S3]	530 (500 mA g^{-1})	≈ 70 % (500 mA g^{-1}, 500 cycles)	231 (2 A g^{-1})	0.01 – 3.0 V
[S4]	1032 (100 mA g^{-1})	≈ 104 % (500 mA g^{-1}, 150 cycles)	309 (1 A g^{-1})	0.01 – 3.0 V
[S5]	1107 (200 mA g^{-1})	≈ 133 % (1 A g^{-1}, 1000 cycles)	532 (2 A g^{-1})	0.01 – 3.0 V
[S6]	645 (65 mA g^{-1})	90 % (325 mA g^{-1}, 500 cycles)	549 (3.25 A g^{-1})	0.005 – 2.0 V
[S7]	965 (100 mA g^{-1})	91 % (500 mA g^{-1}, 400 cycles)	620 (600 mA g^{-1})	0.01 – 3.0 V
[S8]	1168 (100 mA g^{-1})	≈ 99 % (500 mA g^{-1}, 500 cycles)	725 (1 A g^{-1})	0.01 – 3.0 V
[S9]	653 (120 mA g^{-1})	≈ 76 % (300 mA g^{-1}, 500 cycles)	582 (3 A g^{-1})	0.005 – 2.0 V
[S10]	765 (500 mA g^{-1})	79 % (200 mA g^{-1}, 200 cycles)	350 (5 A g^{-1})	0.01 – 2.0 V

References:

[S1] P. Lv, H. Zhao, C. Gao, Z. Du, J. Wang and X. Liu, *J. Power Sources*, 2015, **274**, 542-550.

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[S10] G. Zhu, F. Zhang, X. Li, W. Luo, L. Li, H. Zhang, L. Wang, Y. Wang, W. Jiang, H. K. Liu, S. Dou and J. Yang, *Angew. Chem. Int. Ed.*, 2019, **58**, 6669-6673.

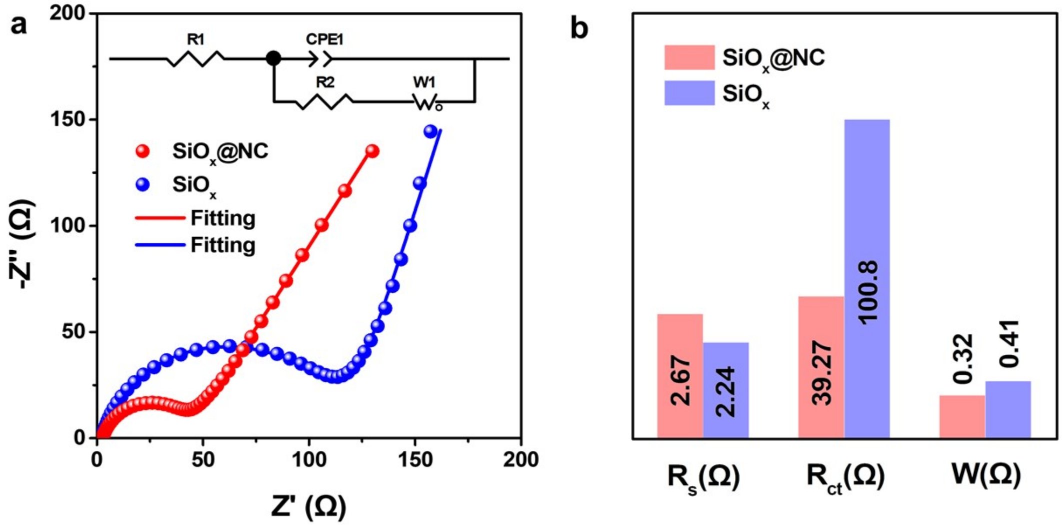

Fig. S12 The electrochemical impedance spectroscopy plots (a) and their results (b) of SiO_x@NC and bulk SiO_x before cycling, the inset of (a) is equivalent circuit for fitting impedance plot.

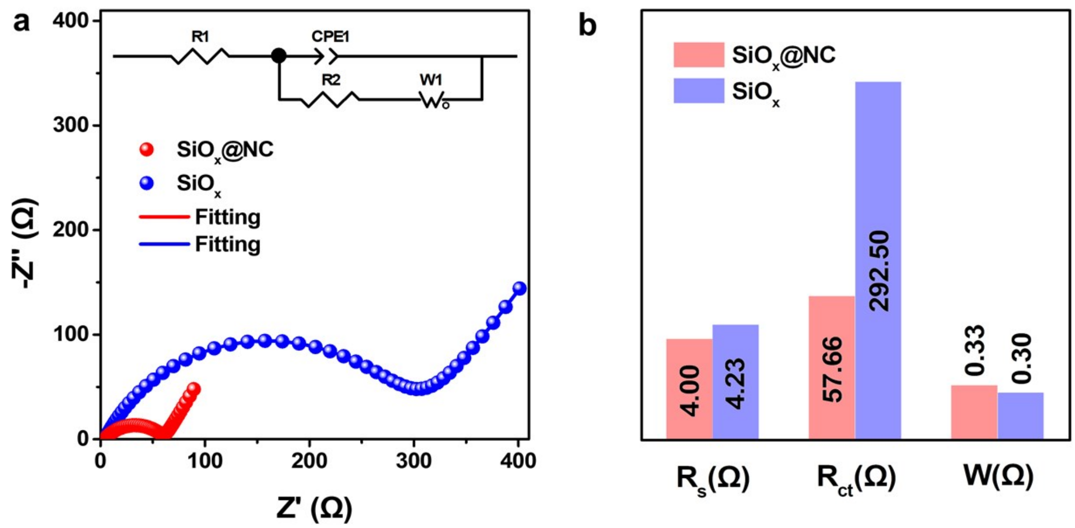

Fig. S13 The electrochemical impedance spectroscopy plots (a) and their results (b) of SiO_x@NC and bulk SiO_x after 100 cycles at 200 mA g^{-1}, the inset of (a) is equivalent circuit for fitting impedance plot.

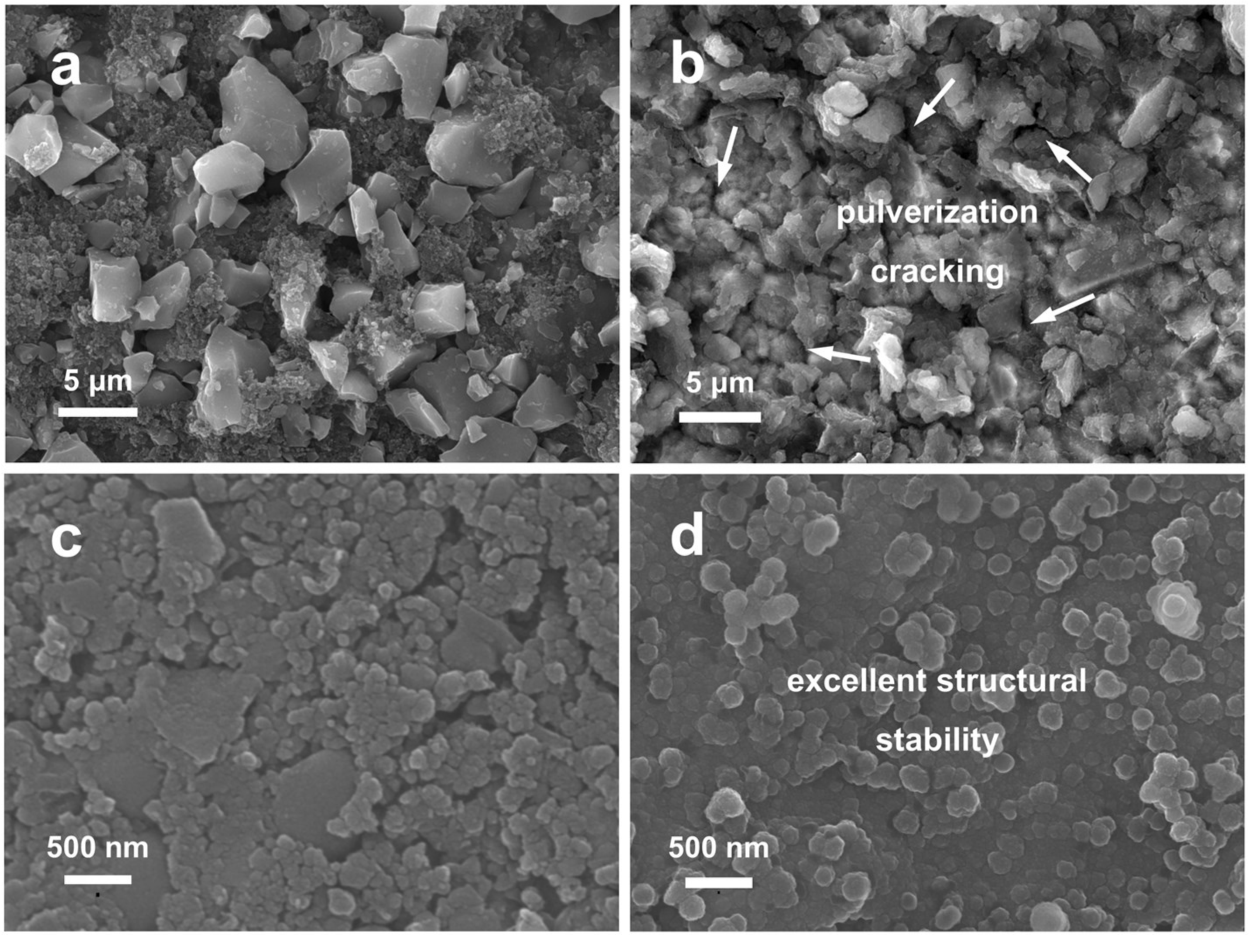

Fig. S14 Top-view SEM images of bulk SiO_x before (a) and after (b) 100 cycles at 200 mA g^{-1}, top-view SEM images of SiO_x@NC before (c) and after (d) 100 cycles at 200 mA g^{-1}.

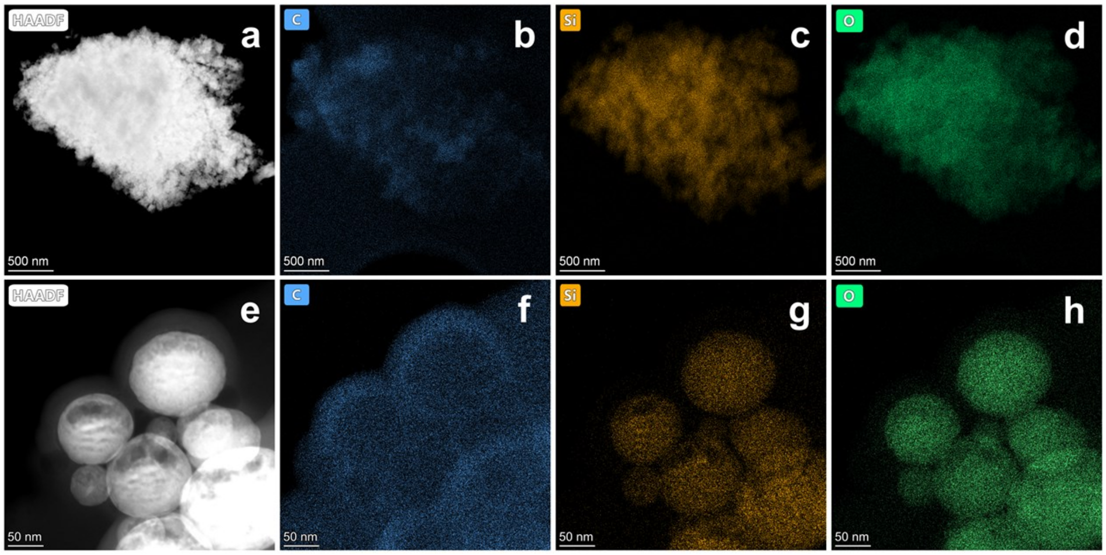

Fig. S15 HAADF-STEM images and EDS mappings of bulk SiO_x (a-d) and SiO_x@NC (e-h) after 100 cycles at 200 mA g^{-1}.

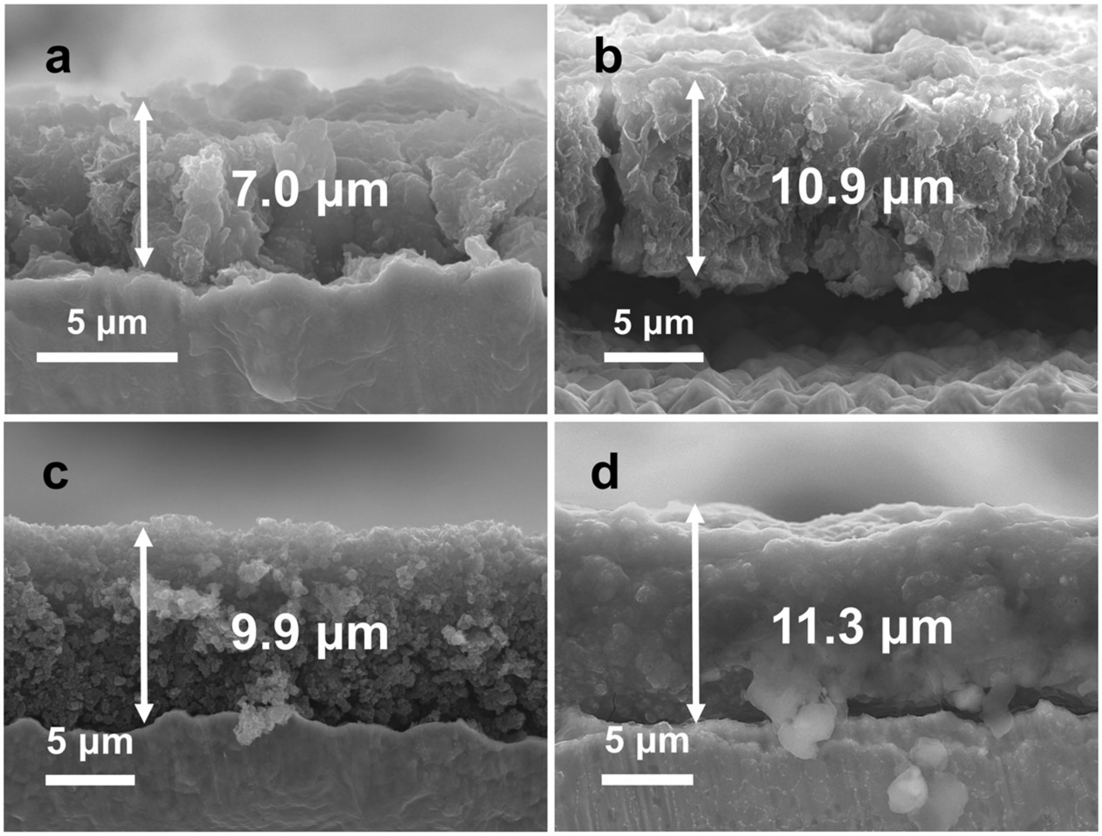

Fig. S16 Cross-sectional SEM images of bulk SiO_x-based electrode before (a) and after (b) 100 cycles at 200 mA g^{-1}, cross-sectional SEM images of SiO_x@NC-based electrode before (c) and after (d) 100 cycles at 200 mA g^{-1}.

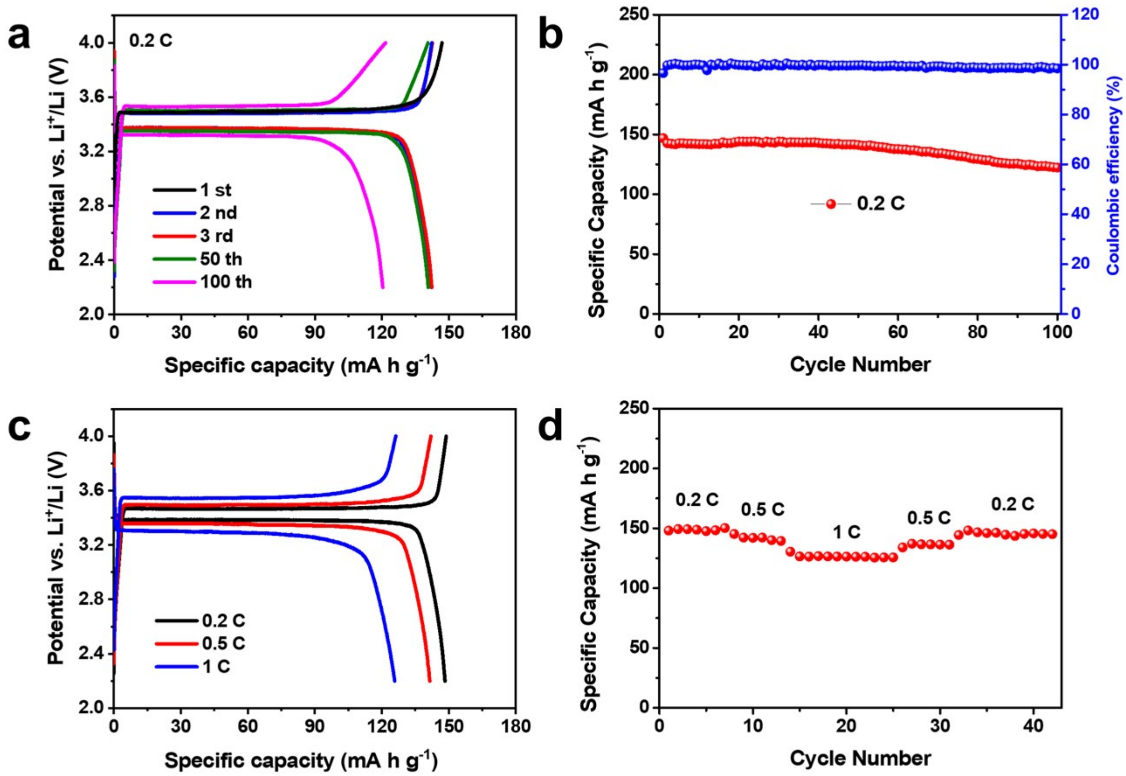

Fig. S17 Selected galvanostatic charge-discharge profiles (a) and cycling performance (b) of $LiFePO_4$ at 0.2 C (1 C = 170 mA g^{-1}), charge-discharge curves (c) and rate performance (d) of $LiFePO_4$ at various current densities.