Supporting Information

Stable Li-ion storage in Ge/N-doped Carbon Microspheres Anodes

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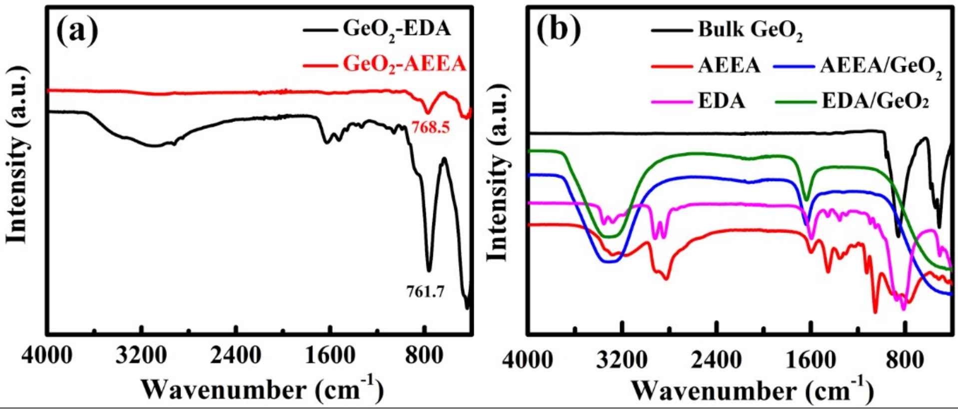

Fig. S1 FTIR spectra of the samples.

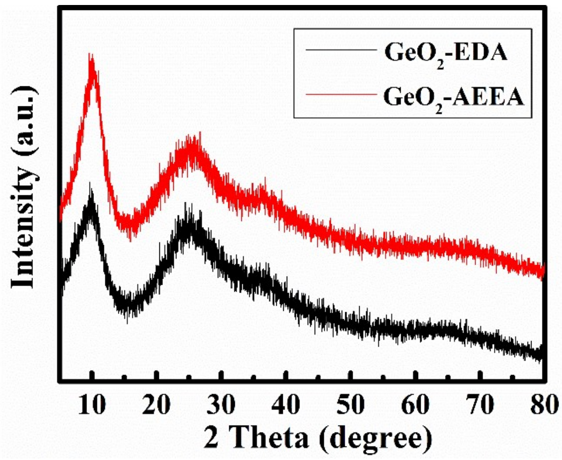

Fig. S2 XRD patterns of GeO_2-EDA and GeO_2-AEEA precursors.

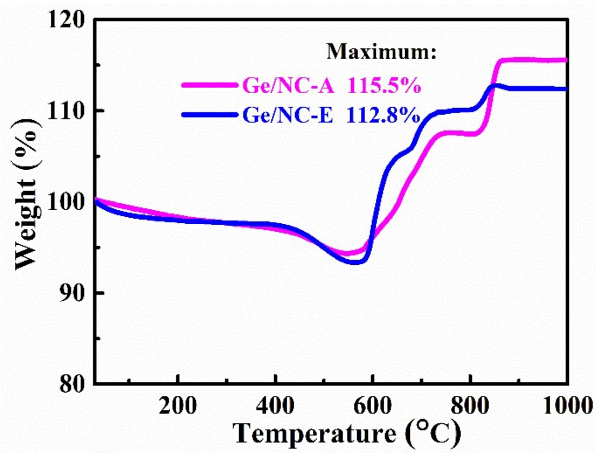

Fig. S3 Thermogravimetric analysis (TGA) of Ge/NC-A and Ge/NC-E in air at the heating rate of 10 ^{o}C min^{-1}.

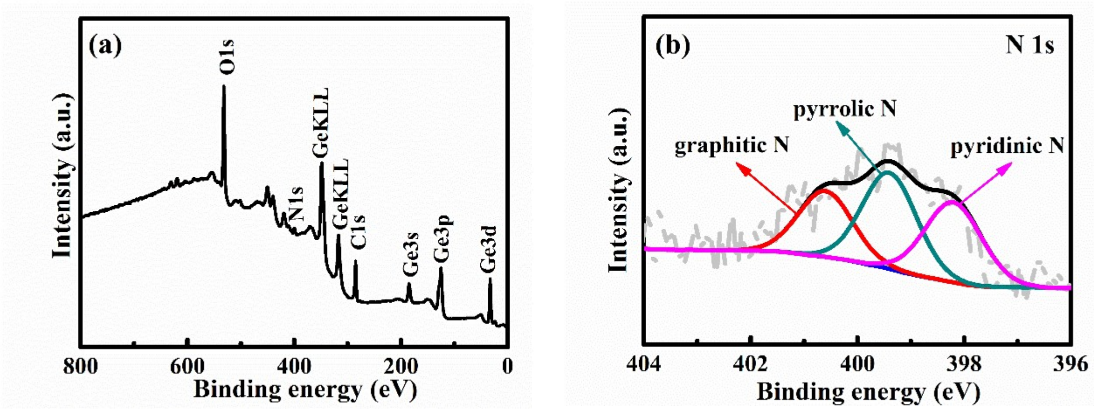

Fig. S4 (a) Typical XPS survey spectrum, and (b) High-resolution N 1s XPS spectrum of Ge/NC-A.

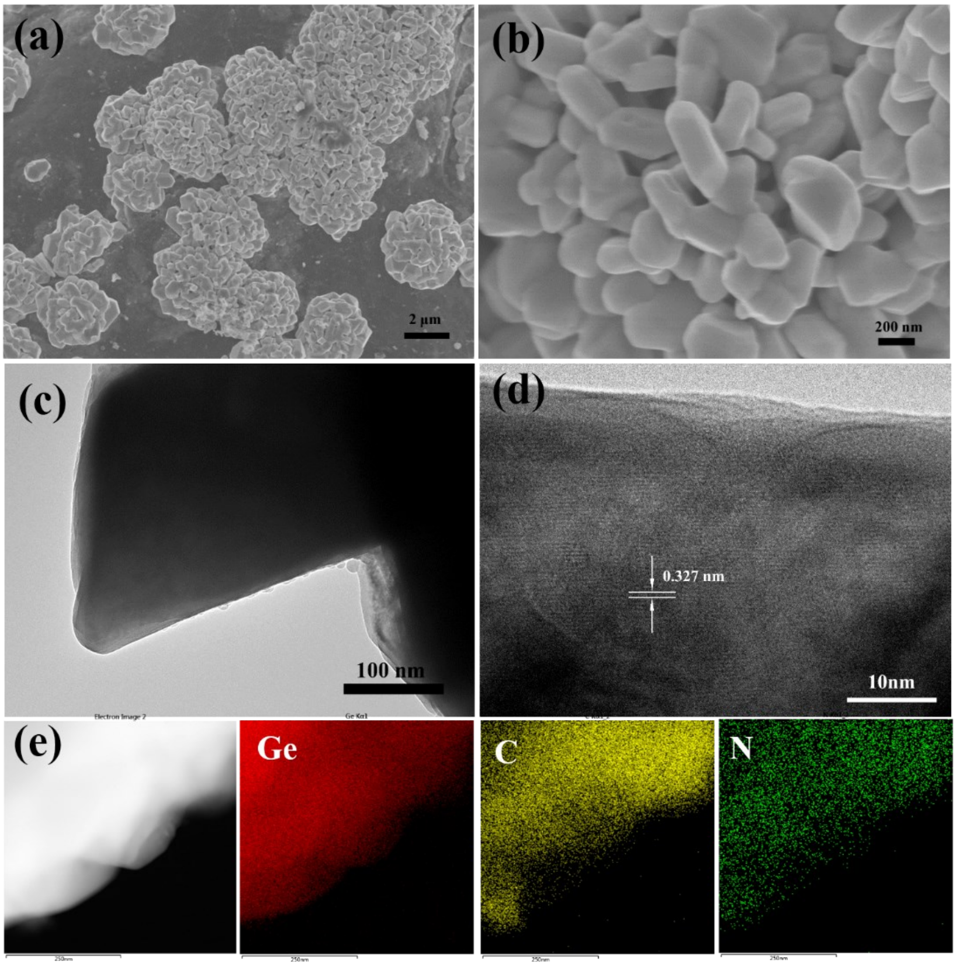

Fig. S5 (a, b) SEM images, (c-d) TEM images and HRTEM image of the Ge/NC-E microspheres, and (e) Elemental mapping images of Ge, C and N.

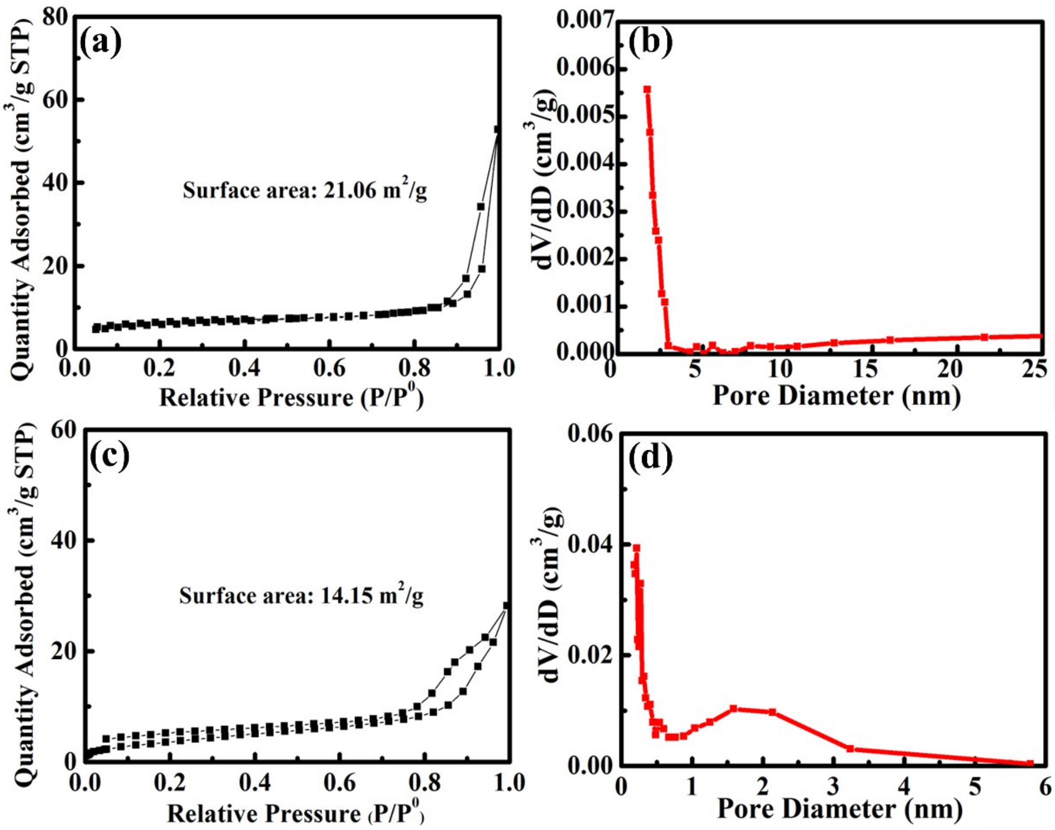

Fig. S6 N_2 adsorption-desorption isotherms and pore size distributions from the adsorption branch through the BJH method of (a, b) Ge/NC-A and (c, d) Ge/NC-E.

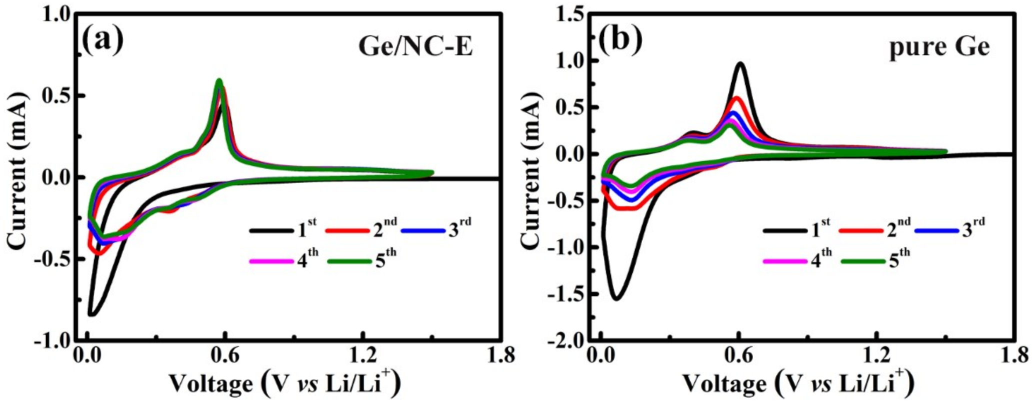

Fig. S7 CV curves at a scan rate of 0.2 mV s^{-1} for Ge/NC-E and pure Ge.

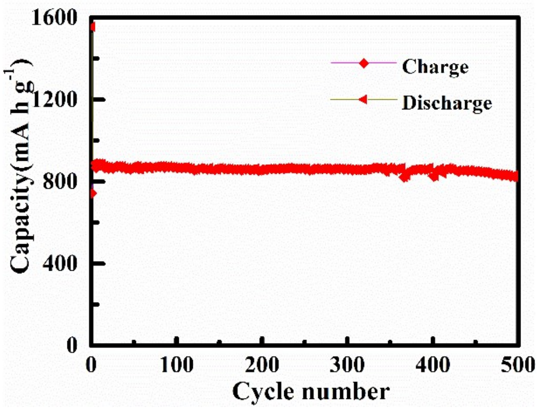

Fig. S8 Long-term cycling performance at a current density of 5 A g^{-1} for Ge/NC-A.

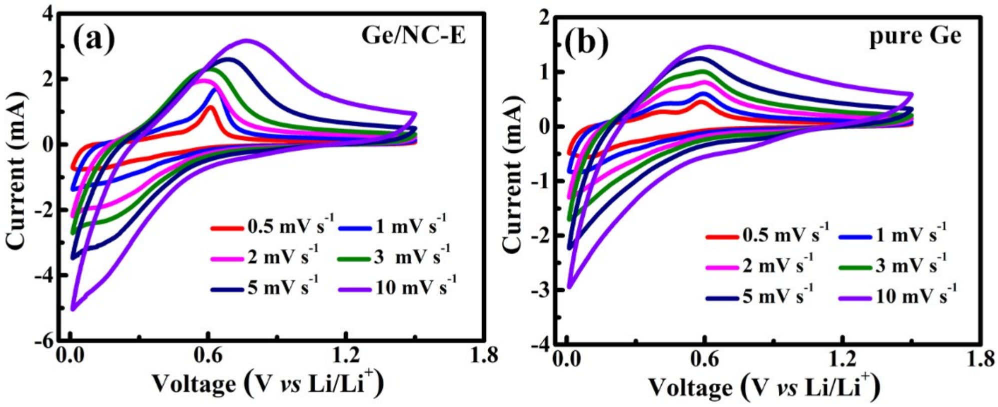

Fig. S9 CV curves of the Ge/NC-E and pure Ge anode at various scan rates from 0.5 to 10 mV s^{-1}.

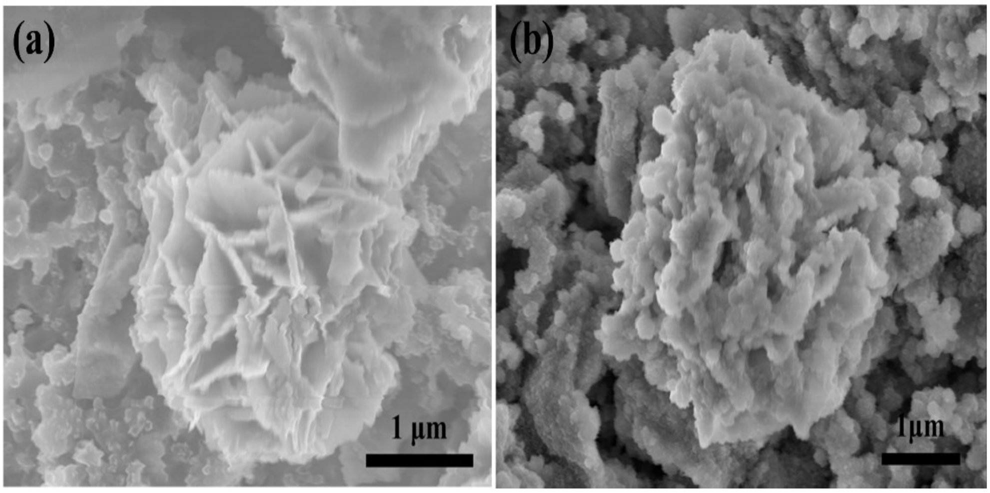

Fig. S10 The SEM images of Ge/NC-A anode (a) before and (b) after cycling.

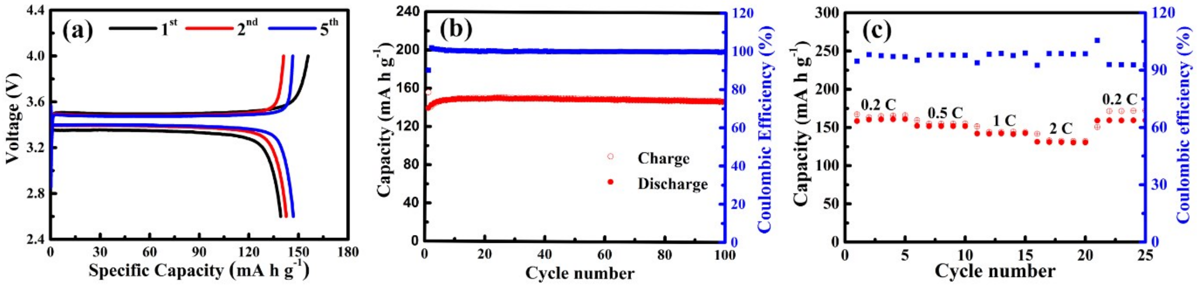

Fig. S11 Electrochemical performances of $LiFePO_4$ cathode in half-cell: (a) discharge-charge curves, (b) cycle life at current density of 0.5 C and (c) rate performance (1 C = 170 mA h g^{-1}).

Table S1. Comparison of electrochemical properties of Ge-C anodes.

Anode	**Cycle stability**			**Ref.**
	Current Density (mA g^{-1})	**After nth cycle**	**Charge Capacity (mA h g^{-1})**	
3DOP Ge@N-C	1	200	1145	*Adv. Funct. Mater.* **2020**, 30, 2000373.
Ge@NC	1.6	1000	917	*Chem. Eng. J.* **2019**, 360, 1301.
	8	400	806	
Ge⊂C spheres	1.6	860	980	*ACS Nano* **2019**, 13, 9511.
Ge–C framework	0.1	50	833.6	*Adv. Energy Mater* **2019**, 9, 1900081.
	1	3000	618.3	
Ge/OMC-N-S	2	1000	641	*Electrochim. Acta* **2019**, 318, 737.
Ge@G@TiO_2 NFs	0.1	100	1050	*Adv. Funct. Mater.* **2016**, 26, 1104.
Ge@C	0.5	150	878.1	*Chem. Eng. J.* **2017**, 322, 188.
H-Ge@NC	1	300	1067	*J.Electroanal. Chem.* **2019**, 832, 182.
Ge/NC	0.2	200	1113.2	This work
	1	1000	965.0	
	5	500	823.1	

Table S2. Impedance parameters of Ge and Ge/NC electrodes after 100 cycling at fully charge state.

Sample (after cycling)	Re (Ω)	Rf (Ω)	Rct (Ω)
Ge	5.736	45.36	95.16
Ge/NC-E	1.447	25.31	56.88
Ge/NC-A	1.368	24.81	49.02