Electronic Supplementary Material (ESI) for RSC Advances.

Nitrogen-Doped Holey Graphene Foams for High-Performance Lithium Storage

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1. Experimental of Absorbance of methylene blue (MB)

The absorption value at 310 nm of methylene blue (MB) ethanol solution was used to evaluate the macroporous surface areas of NHGFs [1] through the UV-vis spectra. Specifically, 0.55 cm^2 of as-prepared Holey graphene foams were added into 0.1 mg mL^{-1} MB ethanol solution and kept for 10 days at room temperature to allow adsorption of MB on the surface of holey graphene foams. UV-vis spectra adsorption experiments were recorded after this long-time absorbance and pure MB solution. The surface area can be calculated through the variation of the absorption value at 310 nm of MB ethanol solution. 1 mg of adsorbed MB represents 2.54 m^2 of covered surface area[2].

2. Calculation of diffusion coefficient (D) of lithium

As shown in Figure 6b in main text, Warburg impedance coefficient, σ_w can be facily calculated. And then, the diffusion coefficient (D) of lithium could be calculated by using equation (1):

$$D=R^2T^2/2A^2n^4F^4C^2\sigma_w^2 \quad (1)$$

Where R is the gas contant, F is the Faraday constant, T is the temperature, A is the surface area, n is the number of moles of charge per ion, and C is the maximum ion concentration, the value of σ_w is shown in Table S1.

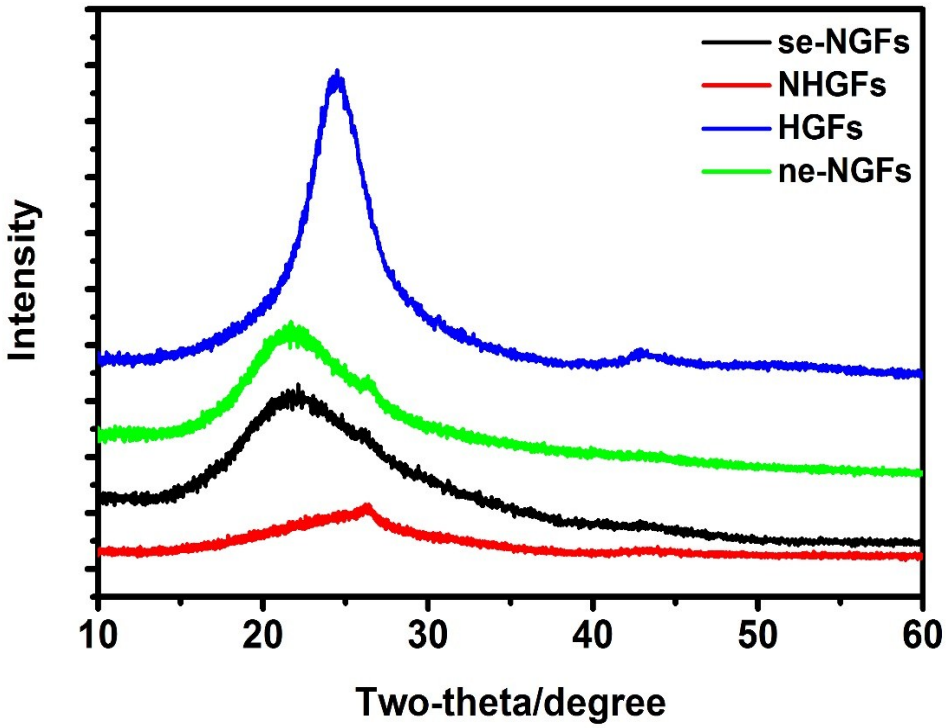

Figure S1. XRD patterns of NHGFs, se-NGFs, ne-NGFs, HGFs.

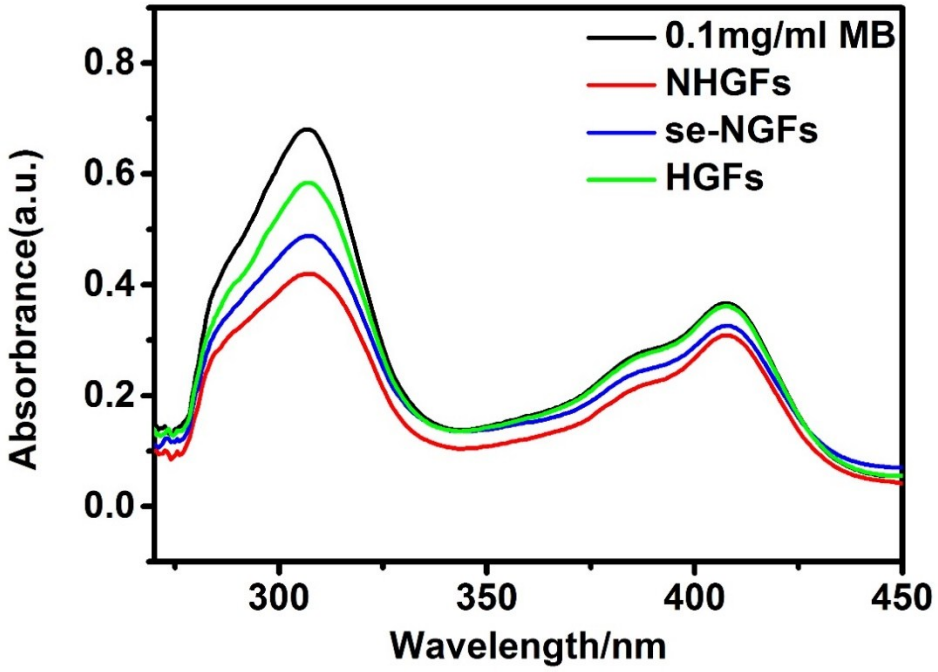

Figure S2. UV-vis spectra of NHGFs, as compared to se-NGFs and HGFs recorded after 10 days until absorption equilibrium during MB adsorption experiments.

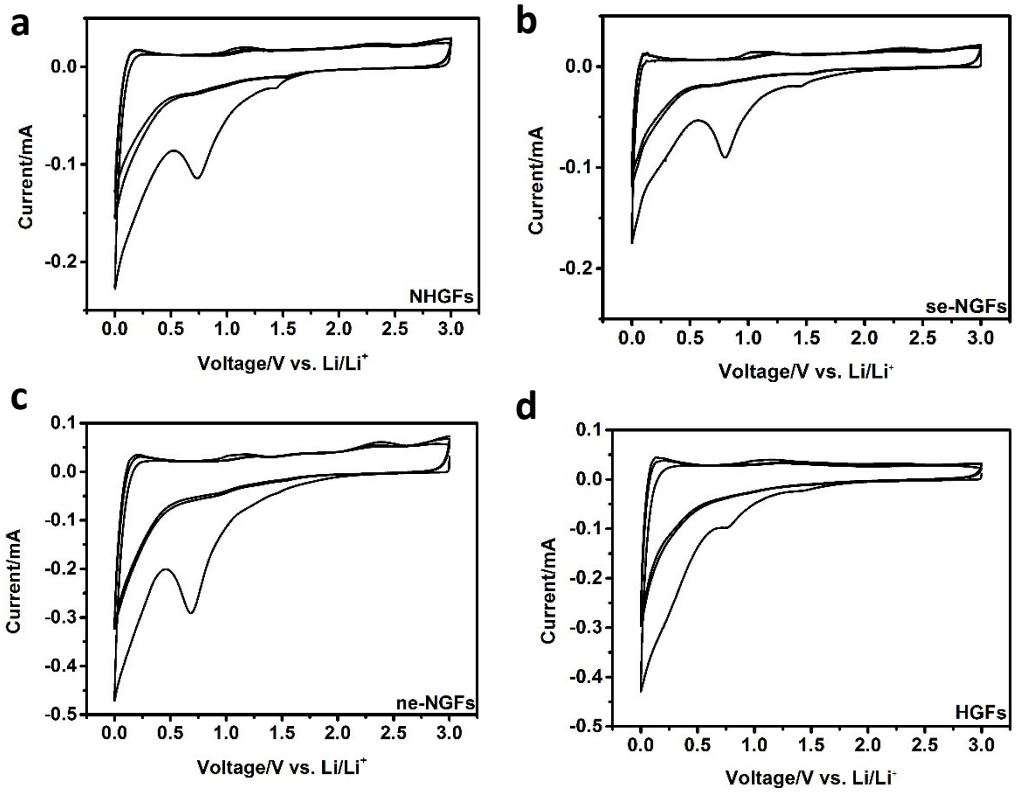

Figure S3. Typical cyclic voltammograms of (a) NHGFs, (b) se-NGFs, (c) ne-NGFs and (d) NGFs.

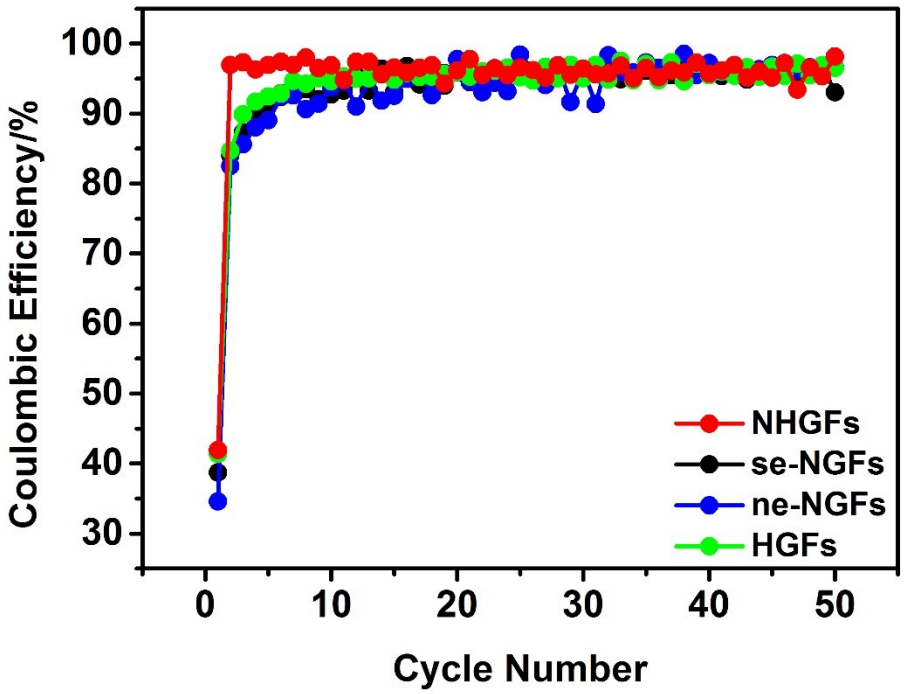

Figure S4. Coulombic efficiency of nitrogen-doped holey graphene foams at 0.1 C.

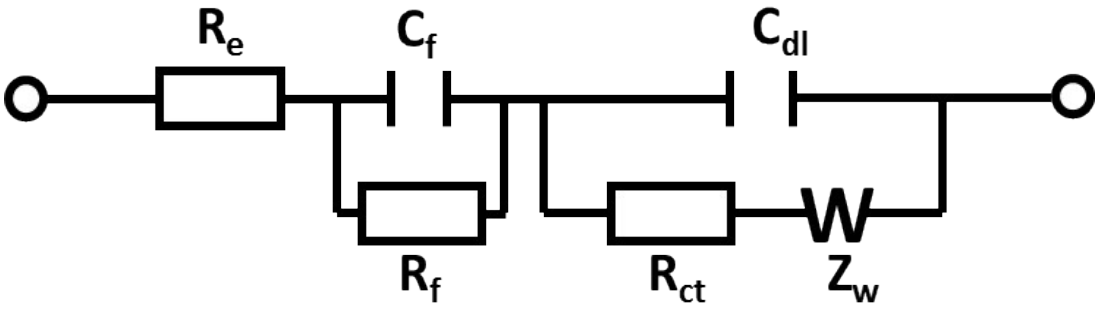

Figure S5. Randles equivalent circuit for NHGFs electrode/electrolyte interface. R_e is the electrolyte resistance, and C_f and R_f are the capacitance and resistance of the surface film formed on the electrodes, respectively. C_{dl} and R_{ct} are the double-layer capacitance and charge-transfer resistance, respectively, Z_w is the Warburg impedance related to the diffusion of lithium ions into the bulk electrodes.

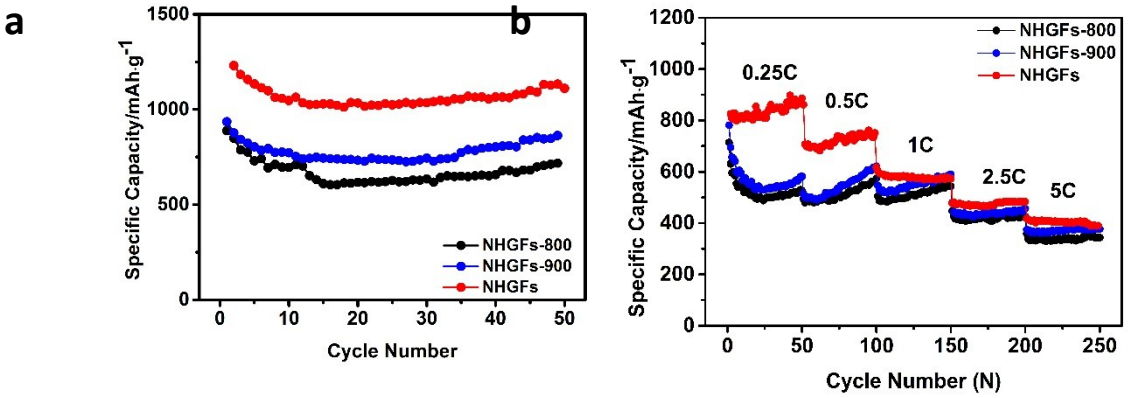

Figure S6. a) Cycle performances of NHGFs-800, NHGFs-900 and NHGFs at a current rate of 0.1C. b) Comparison of rate capacities of NHGFs-800, NHGFs-900 and NHGFs.

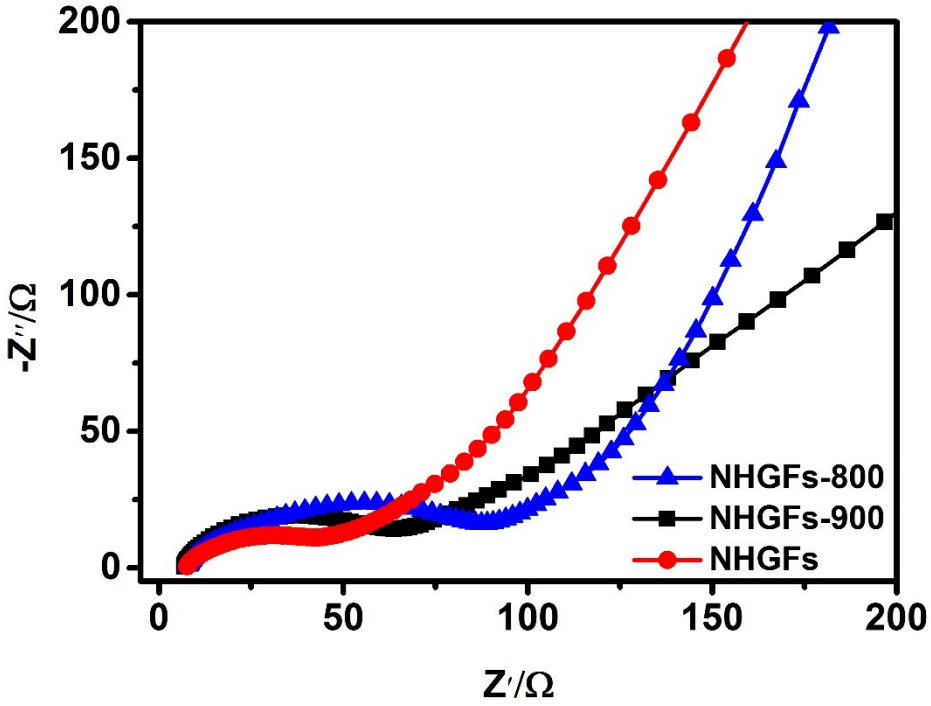

Figure S7. Nyquist plots of NHGFs-800, NHGFs-900 and NHGFs.

Table S1. Warburg impedane coefficient, σ_w, derived from the slope of each line in Fig. 6 in main text.

Samples	σ_w
NHGFs	38.3
se-NGFs	40.1
ne-NGFs	64.2
HGFs	47.4

Table S2. The kinetic parameters of NHGFs, se-NGFs, ne-NGFs and NGFs.

Samples	R_e (Ohms)	R_f (Ohms)	R_{ct} (Ohms)
NHGFs	4.0	9.4	26.7
se-NGFs	5.5	11.1	32.0
ne-NGFs	9.3	14.0	45.8
HGFs	5.3	12.9	39.4
NHGFs-900	7.2	10.8	34.5
NHGFs-800	8.5	16.2	43.5

References

1 J. Duan, S. Chen, M. Jaroniec and S. Z. Qiao, *ACS Nano*, 2015, **9**, 931-940.

2 M. J. McAllister, J. L. Li, D. H. Adamson, H. C. Schniepp, A. A. Abdala, J. Liu, M. Herrera-Alonso, D. L. Milius, R. Car, R. K. Prud'homme and I. A. Aksay, *Chem. Mater.*, 2007, **19**, 4396-4404.