Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting Information

Bismuth Nanospheres Embedding in Three-Dimensional (3D) Porous Graphene Frameworks as Highly Performance Anodes for Sodium- and Potassium-Ion Batteries

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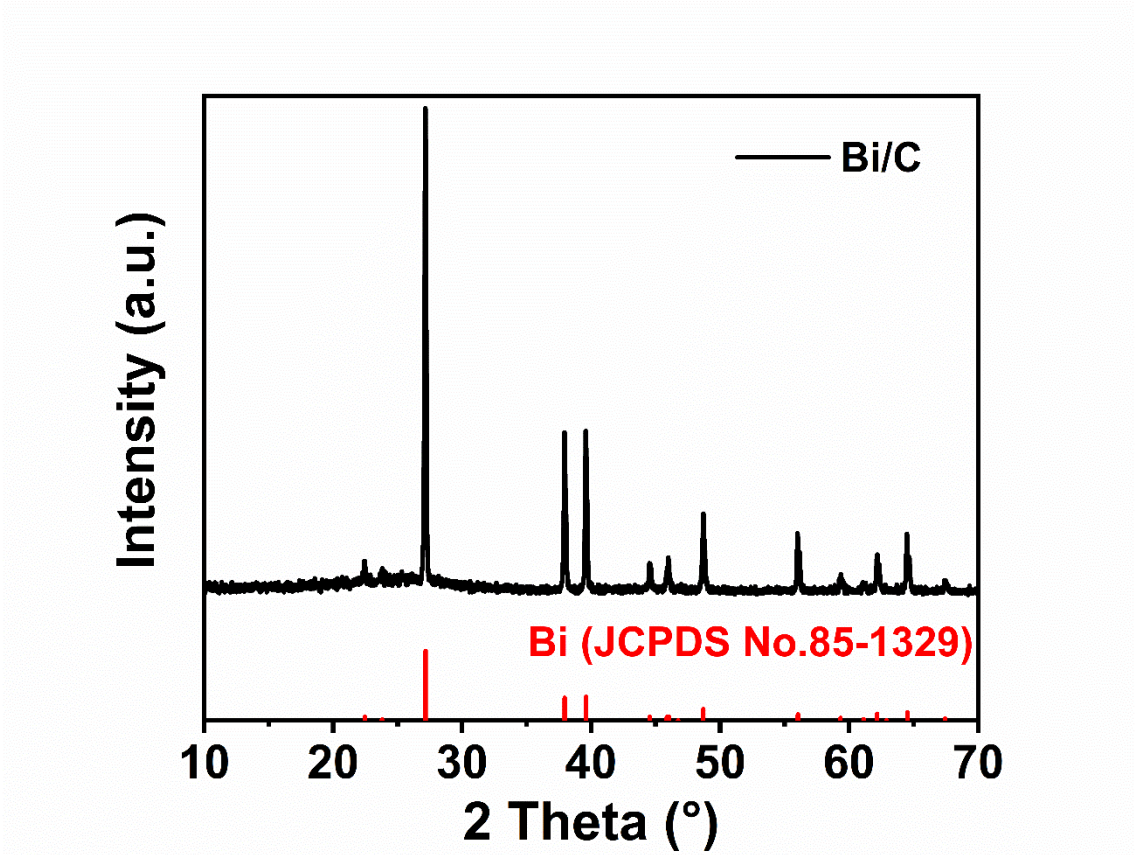

Figure S1. XRD parttern of Bi/C.

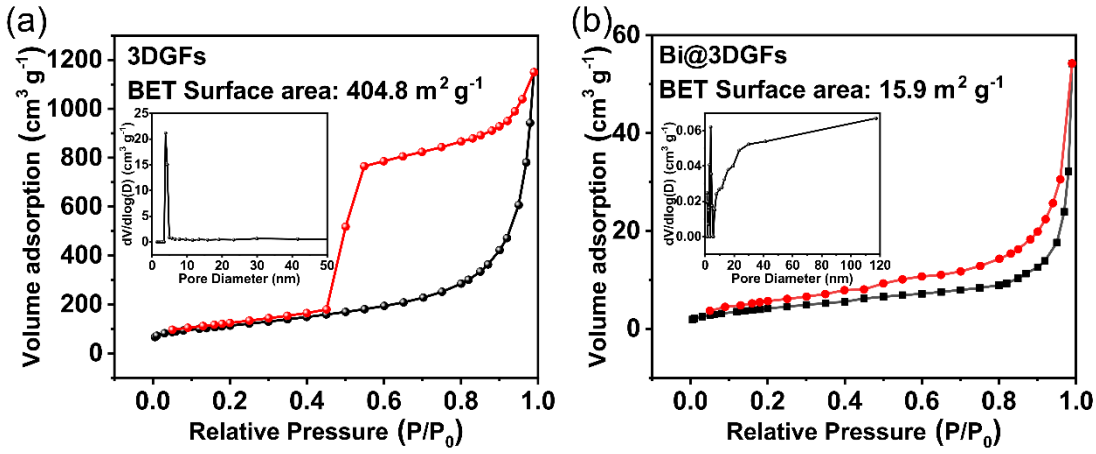

Figure S2. N_2 sorption/desorption isotherm and pore size distribution curves of 3DGFs (a) and Bi@3DGFs (b).

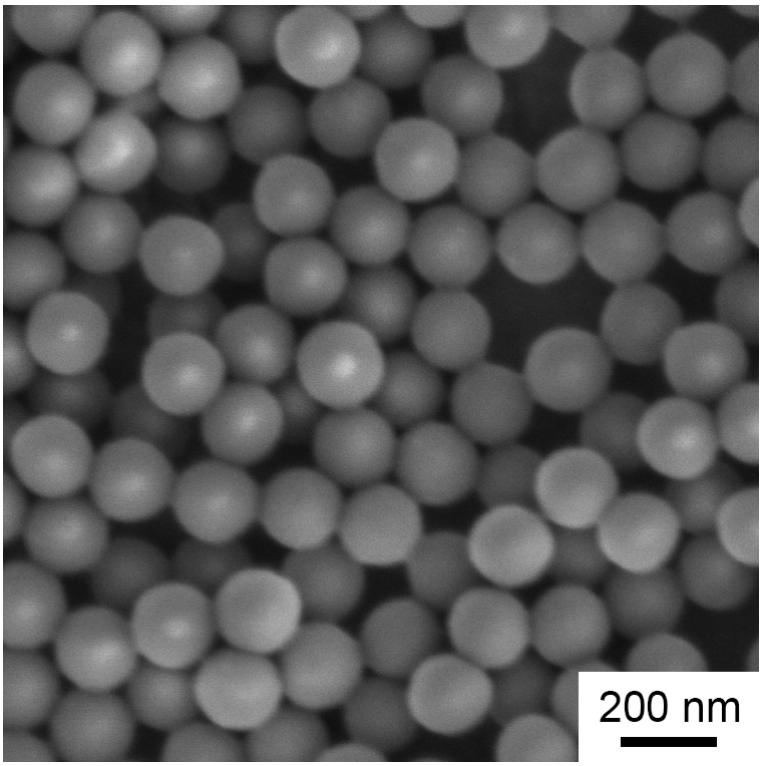

Figure S3. SEM image of Polystyrene.

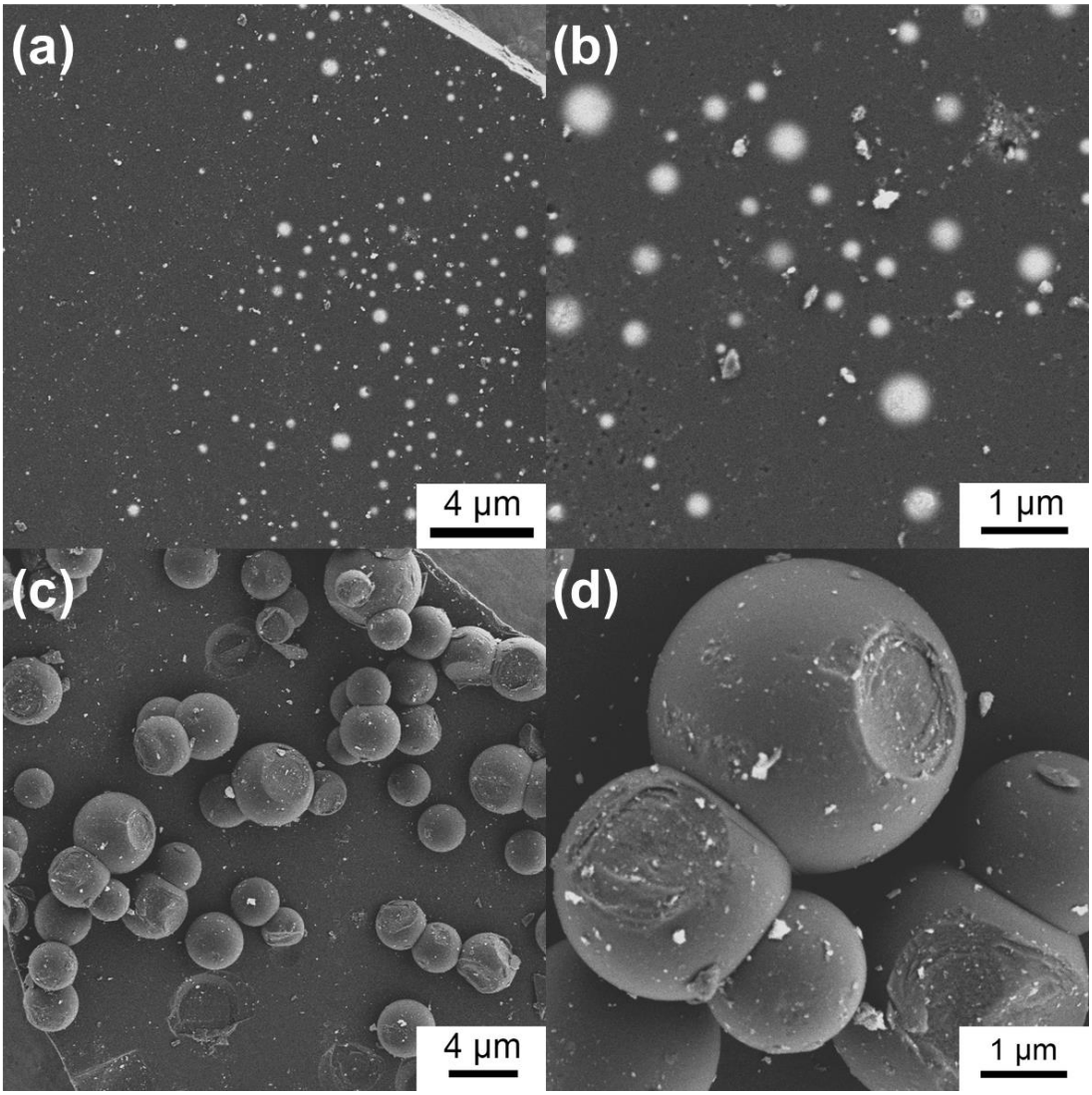

Figure S4. SEM images of Bi/C: (a, b) The surface in contact with the quartz tube; (c, d) The surface opposite the quartz tube.

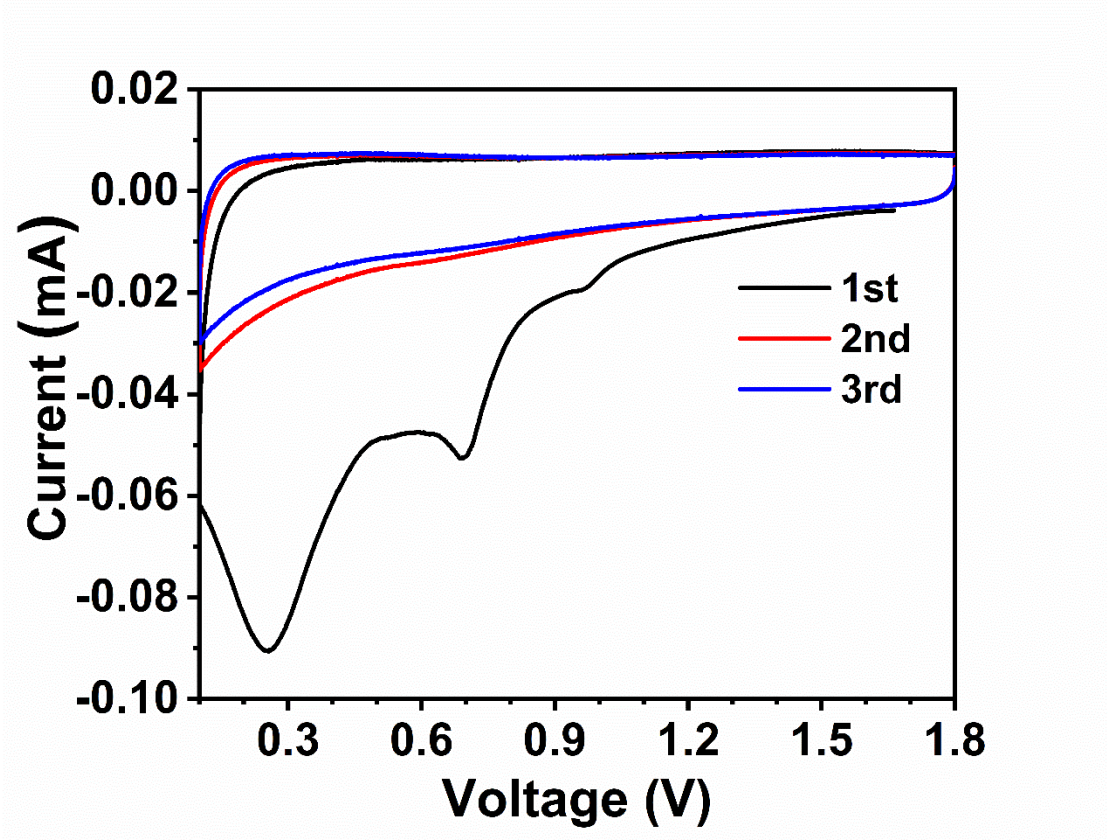

Figure S5. CV curves of 3DGFs anode at 0.1 mV s^{-1} within 0.1–1.8 V.

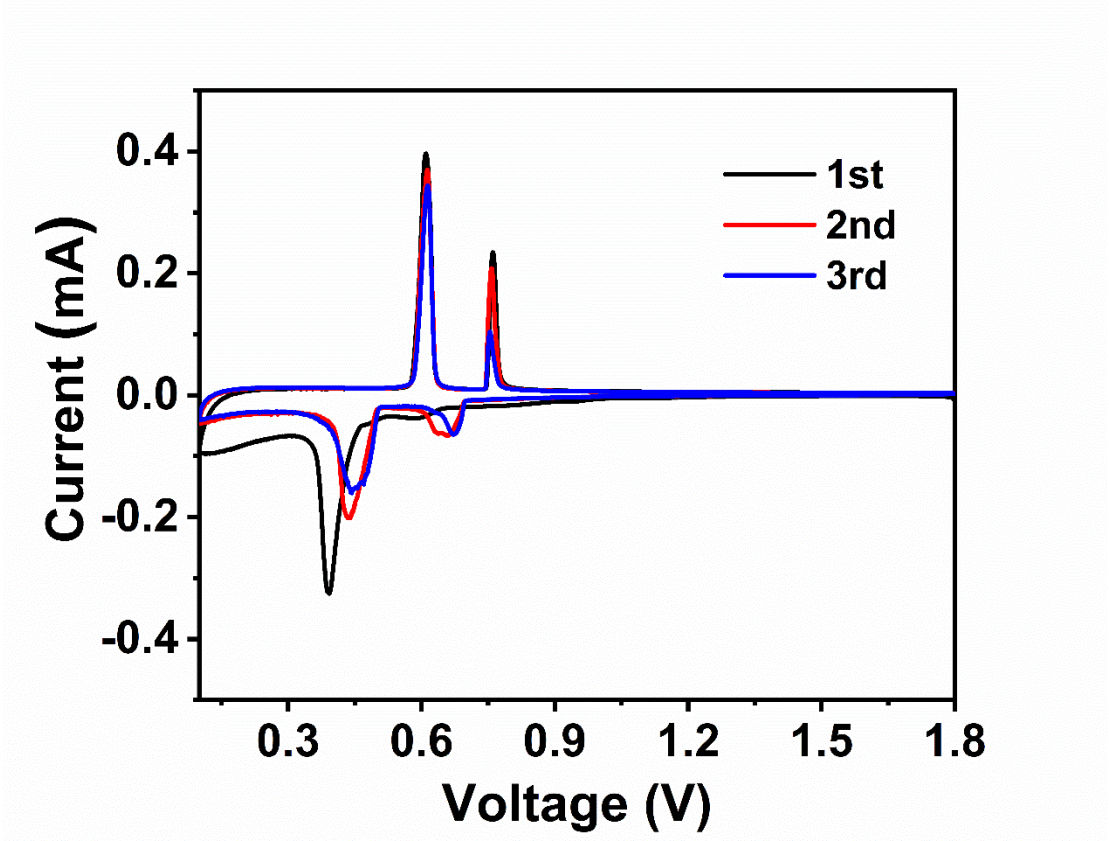

Figure S6. CV curves of Bi/C anode at 0.1 mV s^{-1} within 0.1–1.8 V.

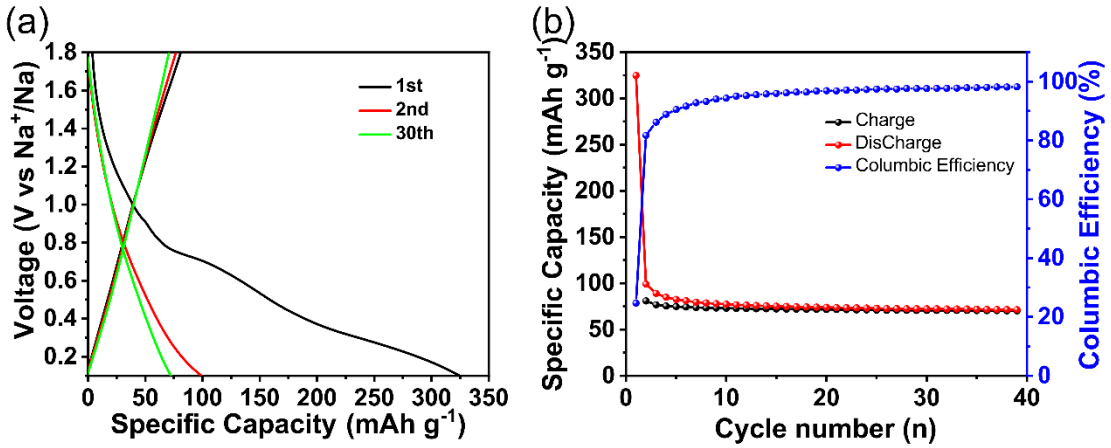

Figure S7. Galvanostatic charge–discharge profiles of 3DGFs anode at 0.1 A g^{-1} within a voltage limit of 0.1–1.8 V.

Table S1. A summary for rate performance of Bi@3DGFs anode for NIBs.

Current Density (A g^{-1})	*Capacity (mAh g^{-1})*	*Columbic Efficiency (%)*	*Capacity Retention (%)*
0.1	*230*	*99.2%*	*100*
0.2	*225*	*99.5%*	*97.8*
0.5	*220*	*99.6%*	*95.7*
1	*216*	*99.8%*	*93.9*
2	*213*	*99.9%*	*92.6*
5	*208*	*100%*	*90.4*
10	*202*	*100%*	*87.8*
20	*194*	*100%*	*84.3*
50	*180*	*100%*	*78.3*

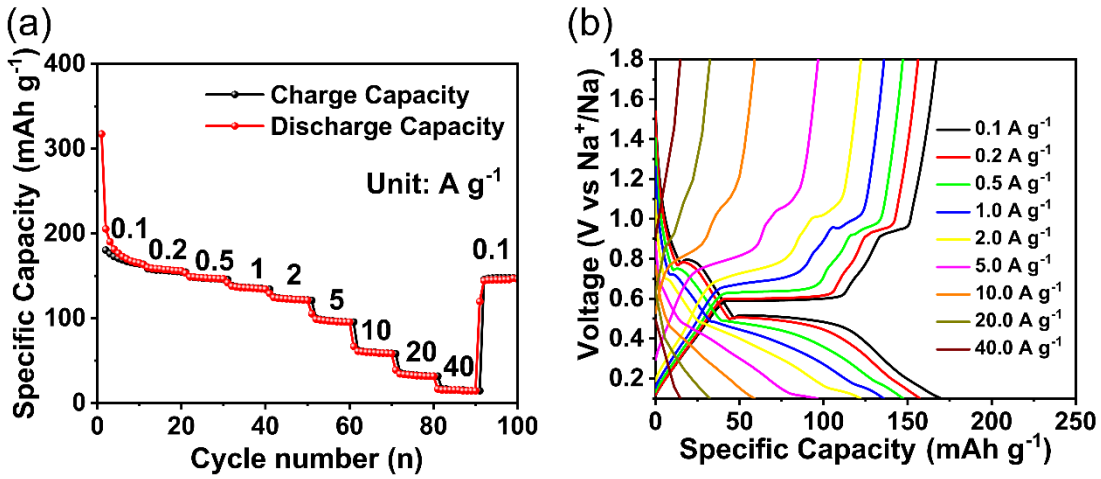

Figure S8. Rate performance of Bi/C.

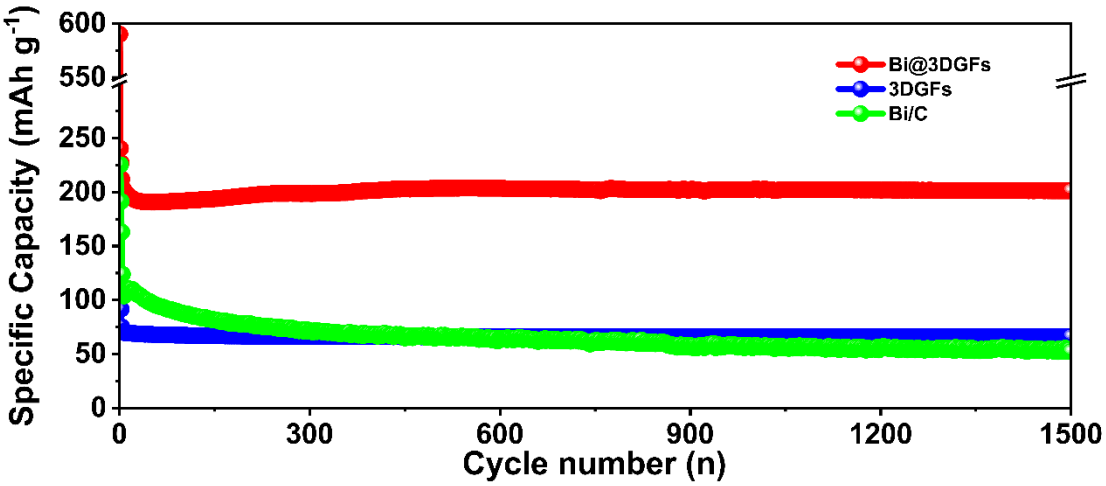

Figure S9. Cycling performance of Bi@3DGFs, 3DGFs and Bi/C at 1 A g^{-1}.

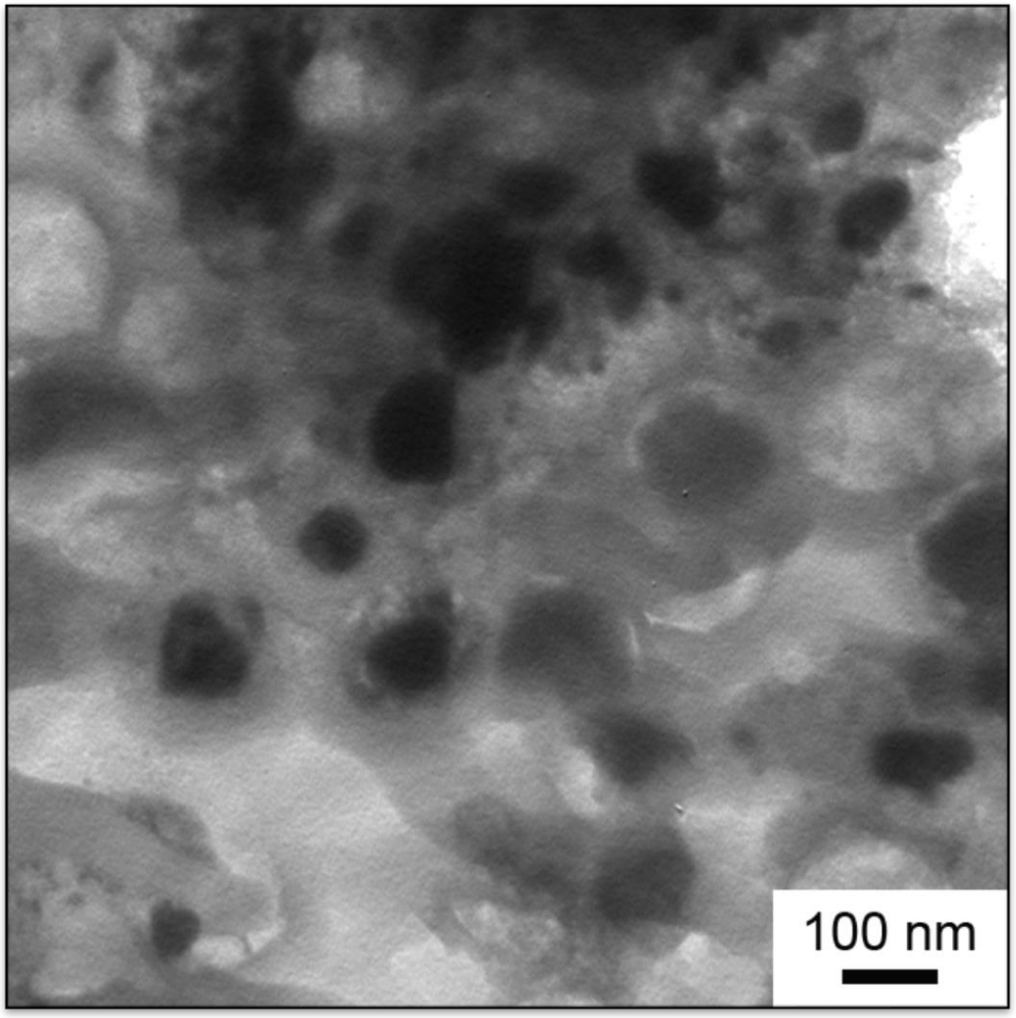

Figure S10. SEM images of Bi@3DGFs electrode after 10 cycles at 0.1 A g^{-1}.

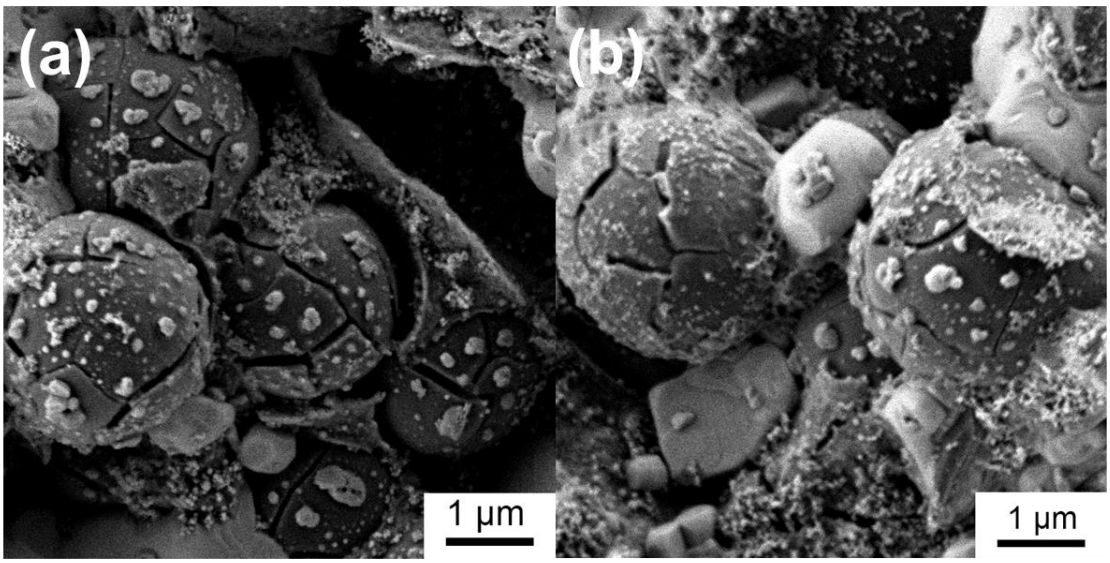

Figure S11. SEM images of Bi/C electrode after 3 cycles at 0.1 A g^{-1}.

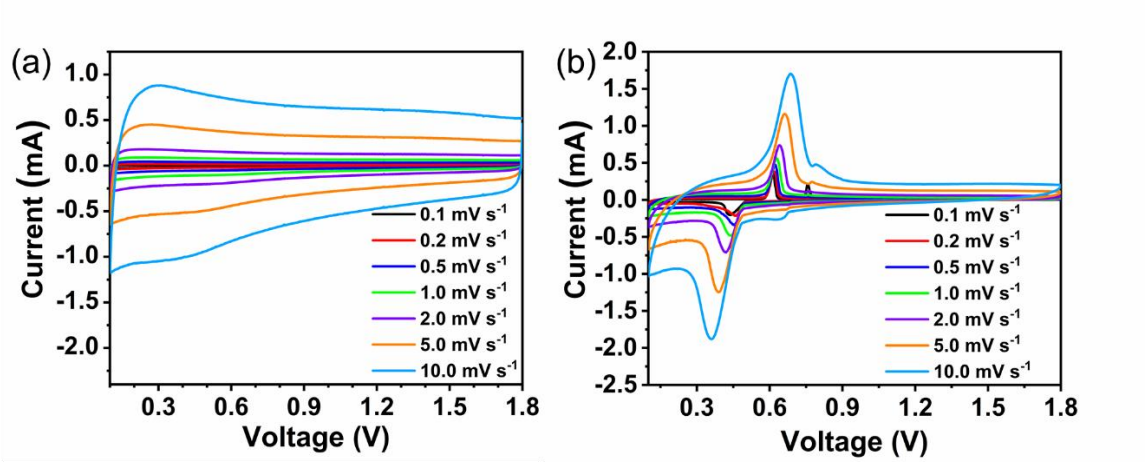

Figure S12. CV curve at different sweep rates (0.1-10 mV s^{-1}) of the 3DGFs and Bi/C anode for NIBs.

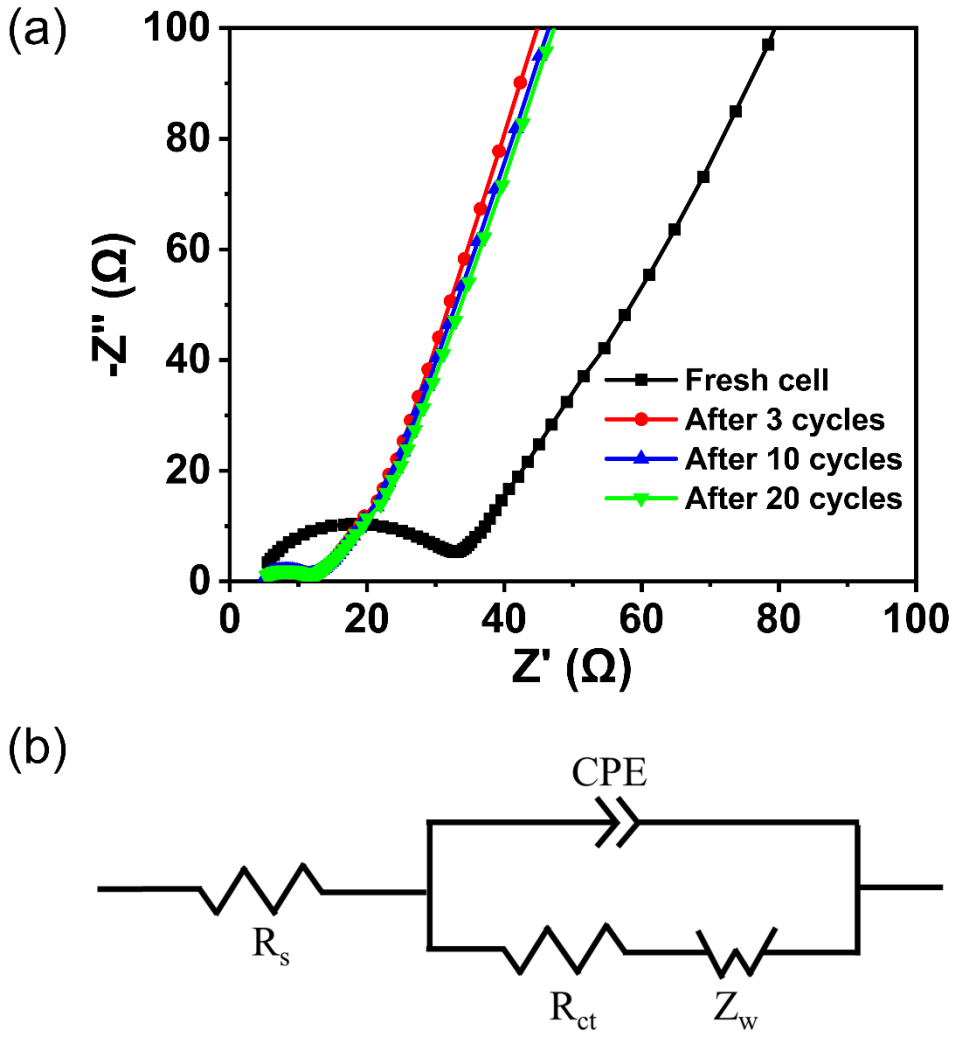

Figure S13. Nyquist plots (a) and equivalent circuit (b) of the Bi@3DGFs electrodes.

Note: R_s is the contact resistance. R_{ct} is charge-transfer resistance. ***CPE*** is constant phase element (space double-layer capacitance). Z_w is Warburg impedance.

Table S2. Impedance parameters calculated with cycling for Bi@3DGFs.

	R_s (Ω)	CPE		R_{ct} (Ω)	Z_w		
		CPE-T	CPE-P		W-R	W-T	W-P
Fresh	3.1	1.3407E-5	0.72526	31.1	3.2511E-5	1.528E-11	0.35085

3 cycles	***4.966***	***2.2317E-5***	***0.77508***	***5.599***	***14.88***	***0.1057***	***0.40111***
10 cycles	***4.833***	***2.0937E-5***	***0.78758***	***5.478***	***16.43***	***0.13166***	***0.39658***
20 cycles	*4.935*	*1.9715E-5*	*0.79071*	*5.5*	*17.58*	*0.14098*	*0.39548*