Supporting Information

Ultrahigh Capacity and Superior Stability of Three-Dimensional Porous Graphene Networks Containing In Situ Grown Carbon Nanotube Clusters as Anode Material for Lithium-Ion Batteries

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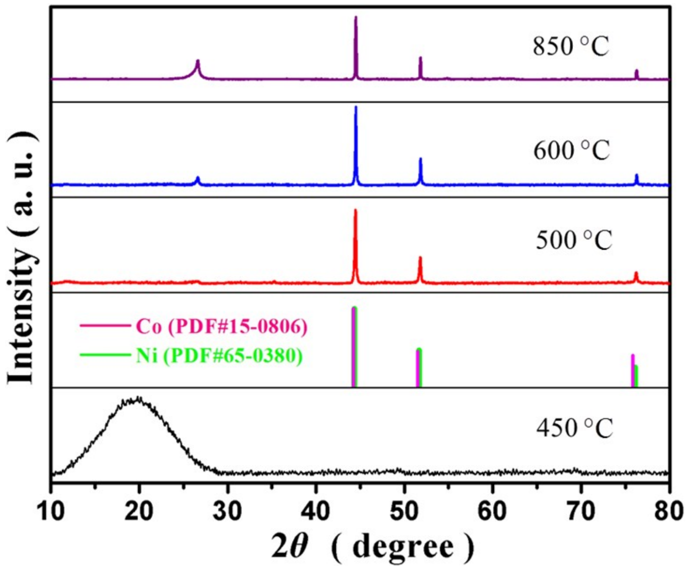


Fig. S1 XRD patterns of CNTs@3DG fabrications at different temperatures.

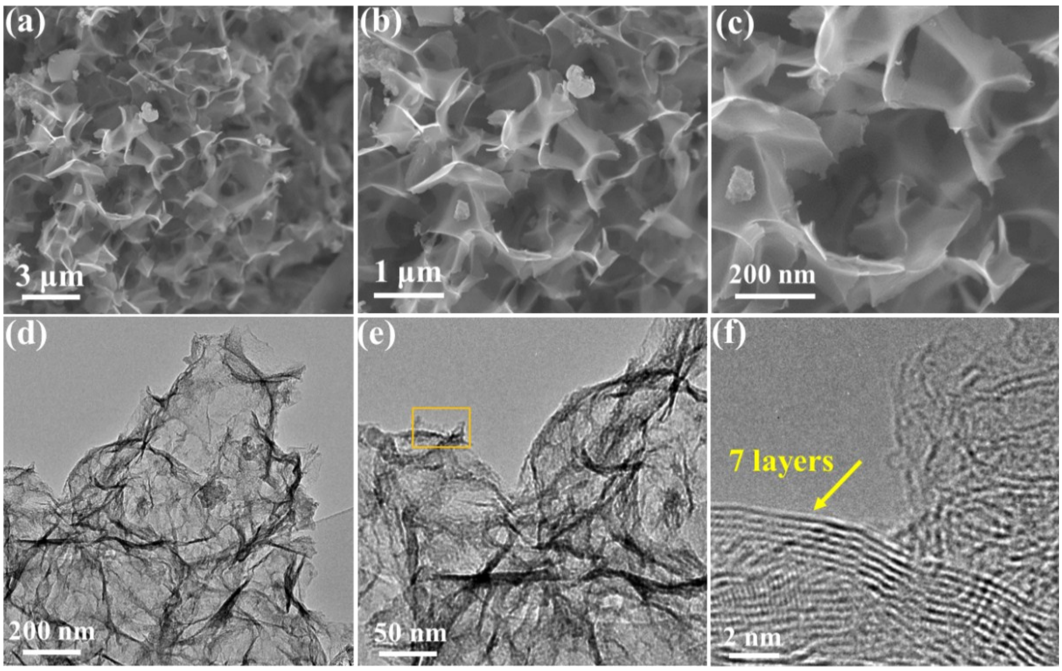


Fig. S2 (a-c) SEM and (d-f) TEM images of 3DG, marked region in e is corresponding to f.

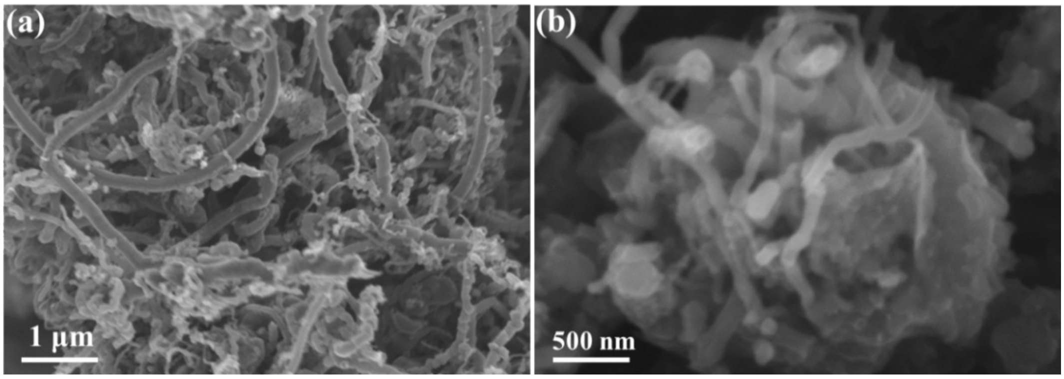


Fig. S3 SEM images of (a) CCNTs and (b) 3DG+CCNTs.

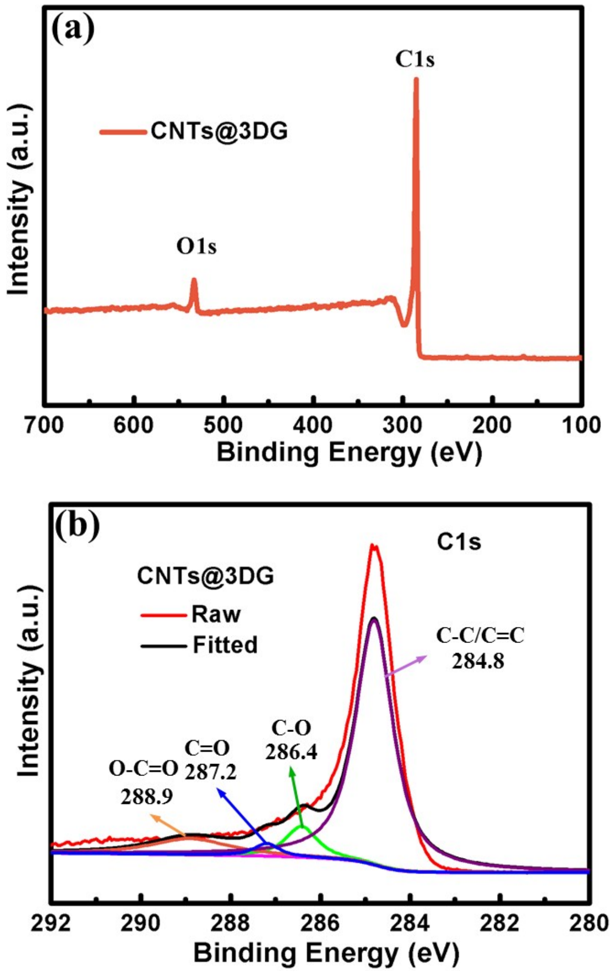


Fig. S4 XPS spectra of (a) CNTs@3DG and (b) C1s.

In this XPS analysis, the atomic percentages of C1s and O1s are 92.57 and 6.34%, respectively.

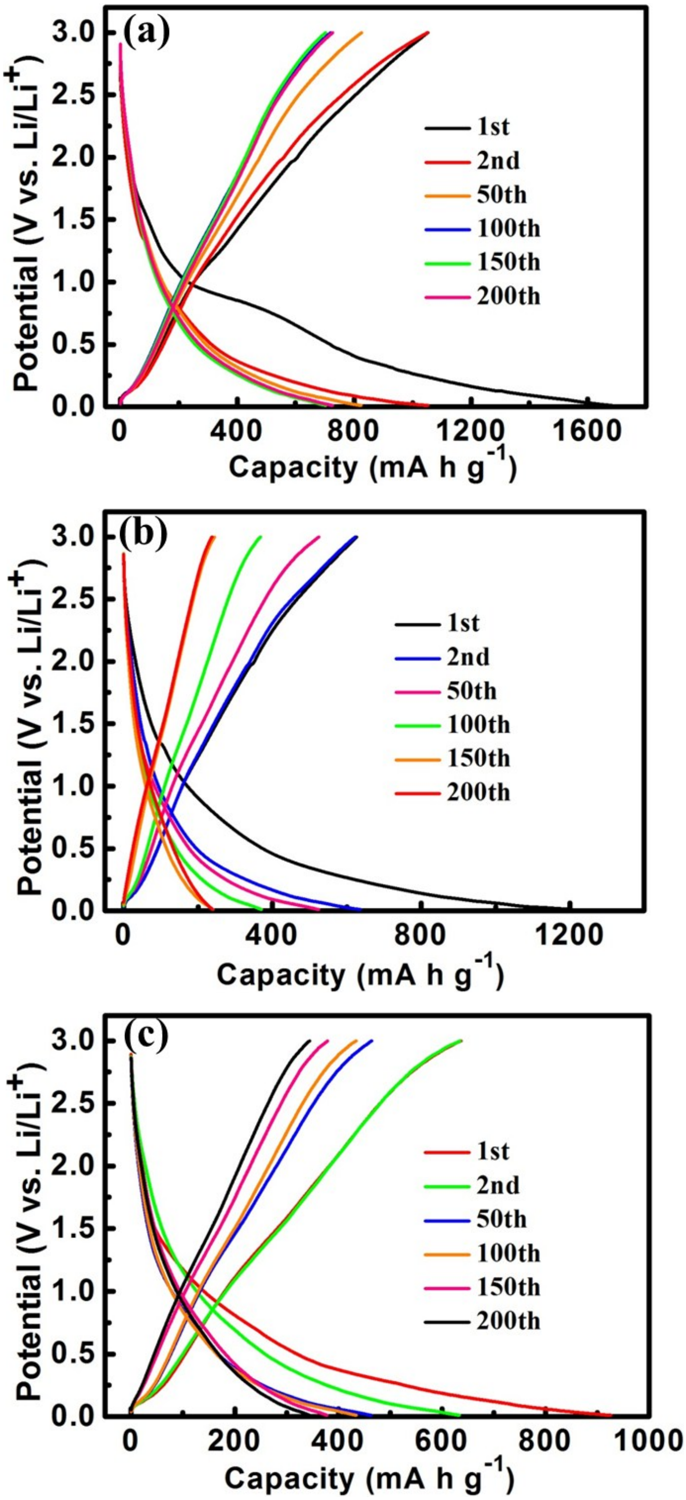


Fig. S5 Voltage profiles of (a) 3DG, (b) 3DG+CCNTs, and (c) CCNTs at a current rate of 0.1 A g^{-1} with the voltage range from 0.01 V to 3 V (*vs.* Li/Li^{+}).

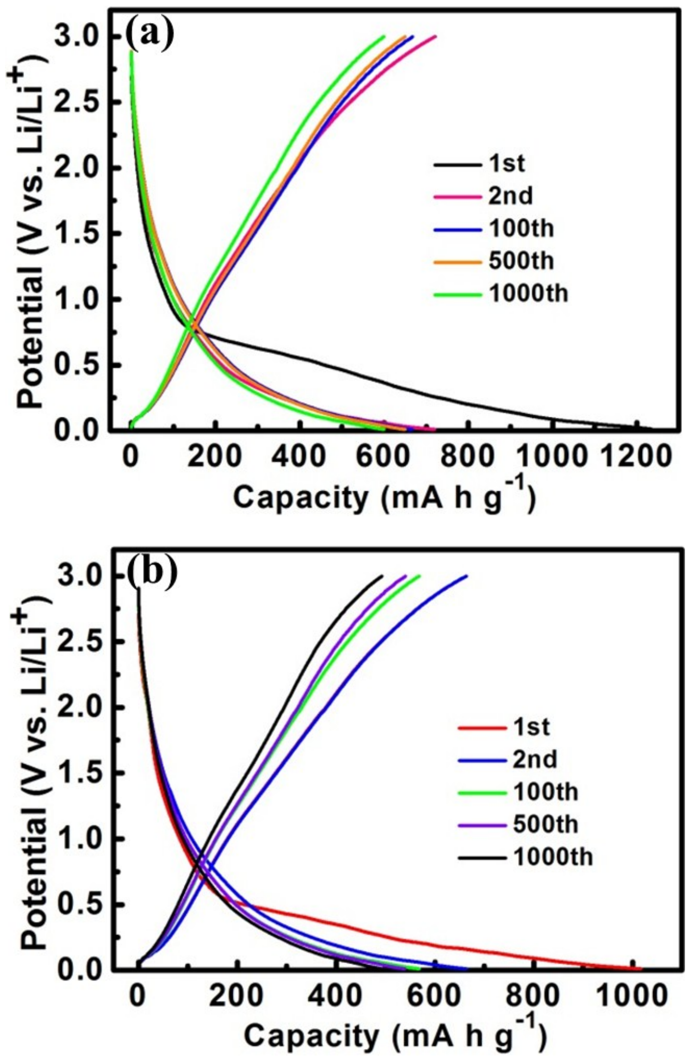


Fig. S6 Voltage profiles of CNTs@3DG at current rates of (a) 1 A g^{-1}, (b) 2 A g^{-1} with the voltage range from 0.01 V to 3 V (*vs.* Li/Li^{+}).

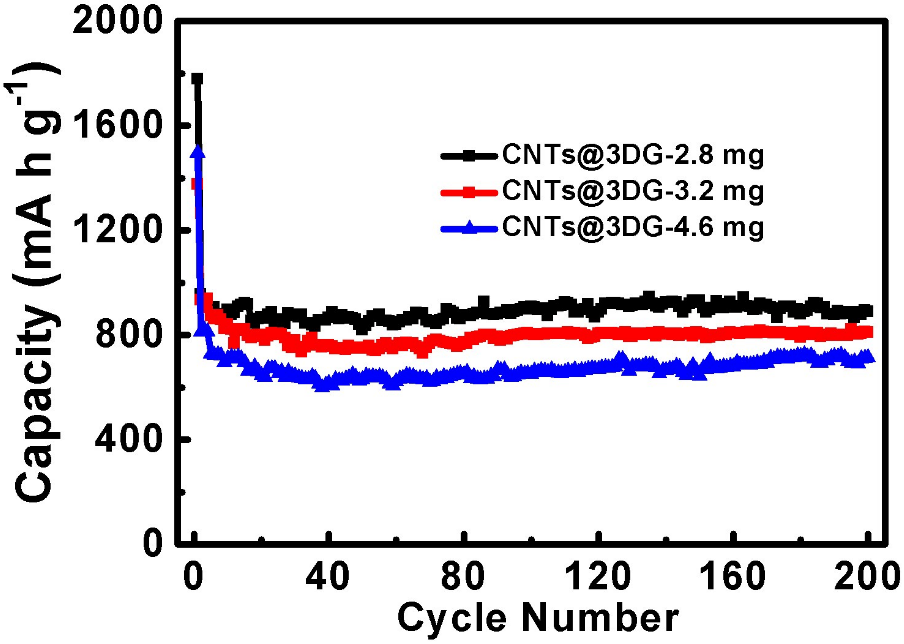
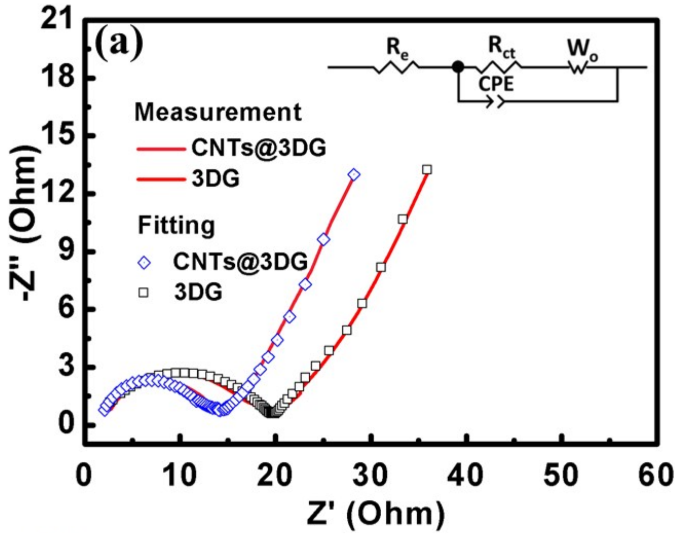


Fig. S7 Cyclic properties of highly CNTs@3DG anode masses of 2.8, 3.2 and 4.6 mg from 0.01 V to 3 V (*vs.* Li/Li^{+}) at a current of 100 mA g^{-1}.



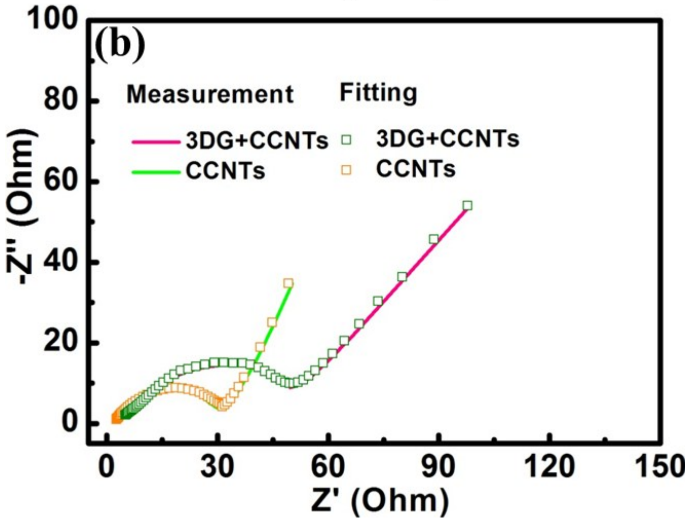


Fig. S8 Electrochemical impedance spectroscopies (EIS) of CNTs@3DG, 3DG, 3DG+CCNTs and CCNTs after 200 cycles. The insertion in (a) is corresponding to the equivalent circuit.

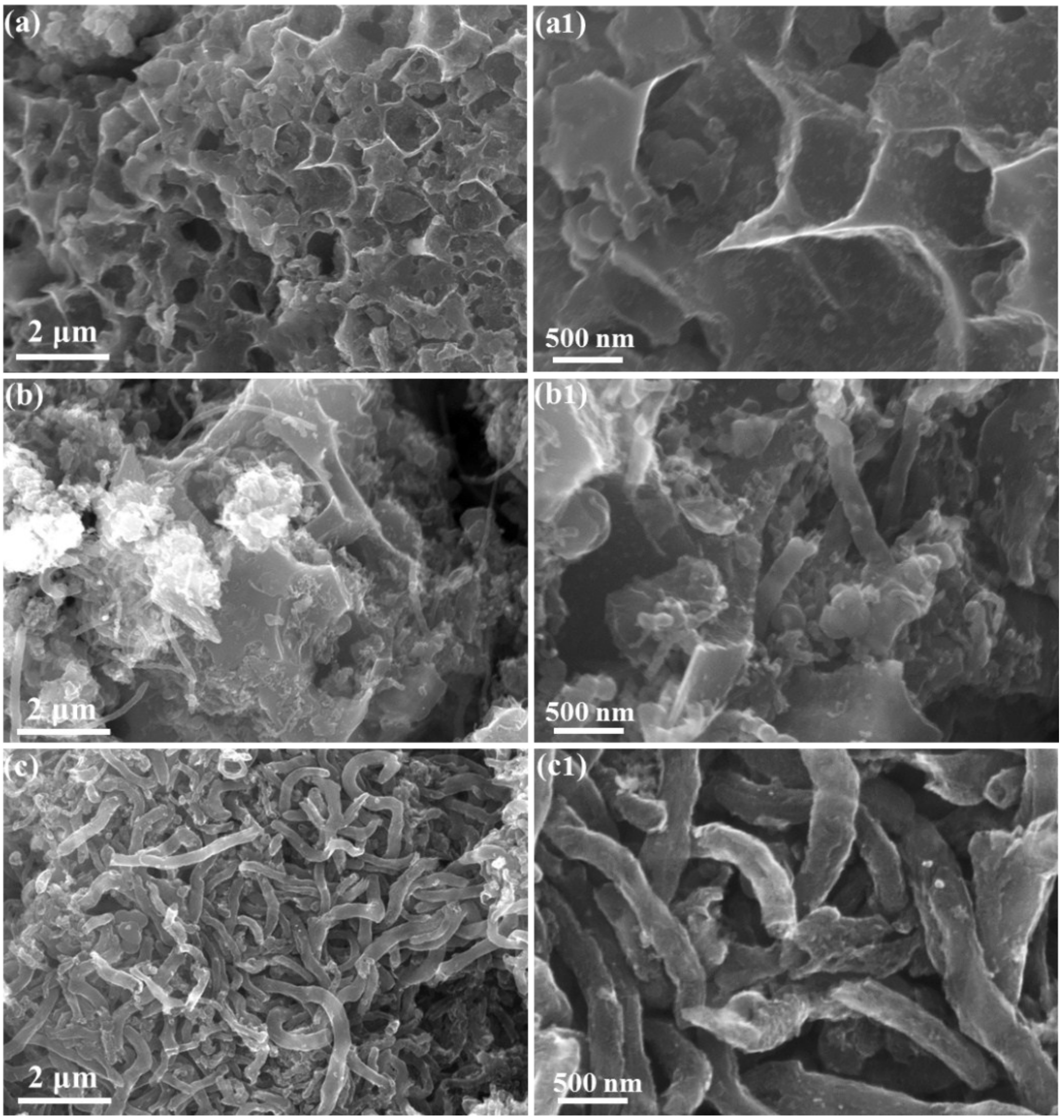


Fig. S9 SEM images of (a, a1) 3DG, (b, b1) 3DG+CCNTs, and (c, c1) CCNTs after discharge/charge 200 cycles.

Table S1. Performance comparisons of CNTs@3DG and other typical carbon-based anode materials for lithium ions batteries.

Materials	Current Densities (mA g^{-1})	Reversible Capacity (mA h g^{-1})	Decay rate of per cycle	Ref.
Nanoporous carbon nanotube	50	375	0.2%	[1]
Graphene-multiwalled carbon nanotubes hybrid	90	813	0.41%	[2]
Graphene oxide/graphite/carbon nanotube composites	100	1172.5	0.17%	[3]
Graphene-winged carbon nanotubes	100	644	0.28%	[4]
N-doped Graphene Sheets	50	1043	0.54%	[5]
Nitrogen and fluorine co-doped graphene	100	1073	0.57%	[6]
Graphite/Graphene Nanosheets	744	500	0.025%	[7]
Graphene/N-doped carbon	100	1100	0.19%	[8]
Hierarchical carbon nanocages	100	1021	0.50%	[9]
Biomass derived carbon nanoparticle	100	742	1.11%	[10]
CNTs@3DG	100	1132	0.03%	This work
	1000	720	0.017%	
	2000	663	0.025%	

References

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