

Supplementary Information

Dendrite-free Lithium Deposition on Conventional Graphite Anode by Growth of Defective Carbon-nanotube for Lithium-metal/ion Hybrid Batteries

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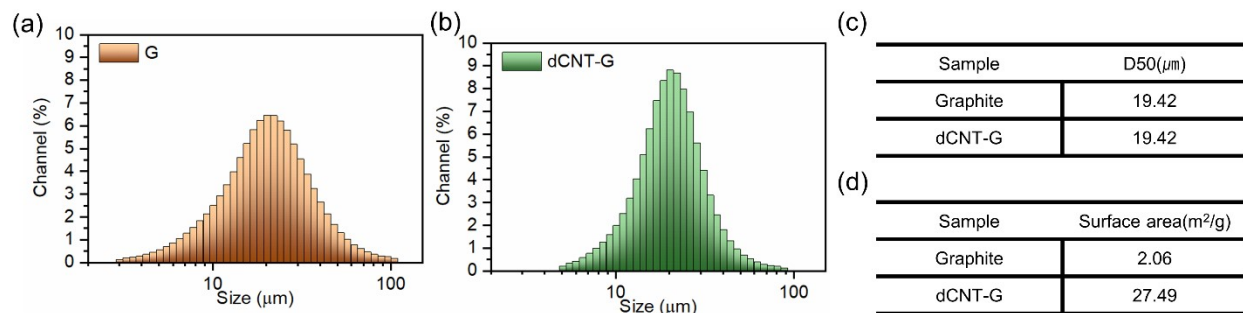


Figure S1. PSA result graph of (a) G and (b) dCNT-G. (c) Table of measured D50 by PSA and surface area by BET.

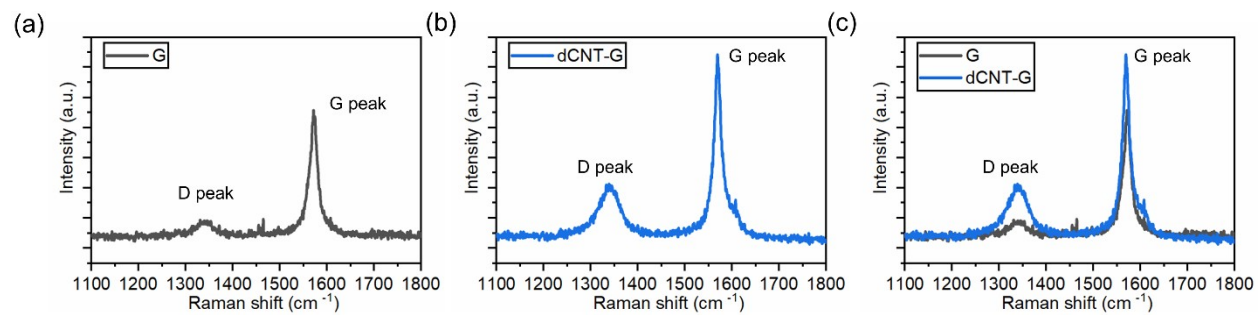


Figure S2. Raman spectrum of (a) G, (b) dCNT-G and (c) overlapped graph of G and dCNT-G.

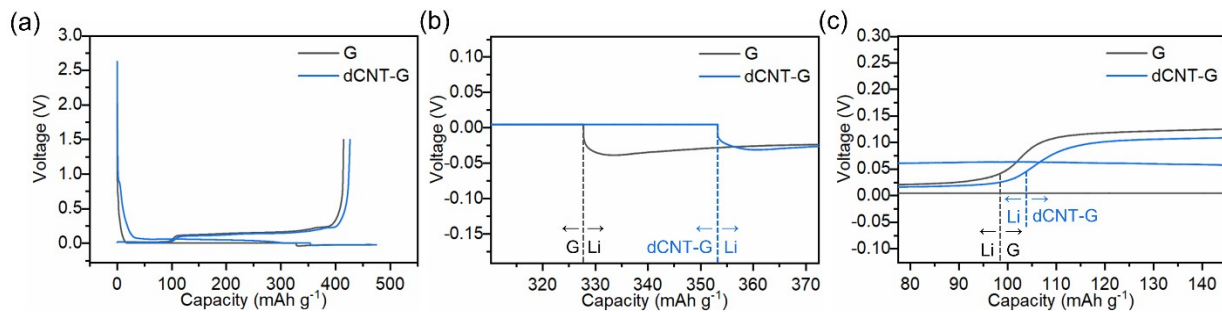


Figure S3. (a) Voltage profile of G and CNT-G at first cycle. Enlarged voltage profile at the end point of (b) graphite lithiation and (c) lithium stripping.

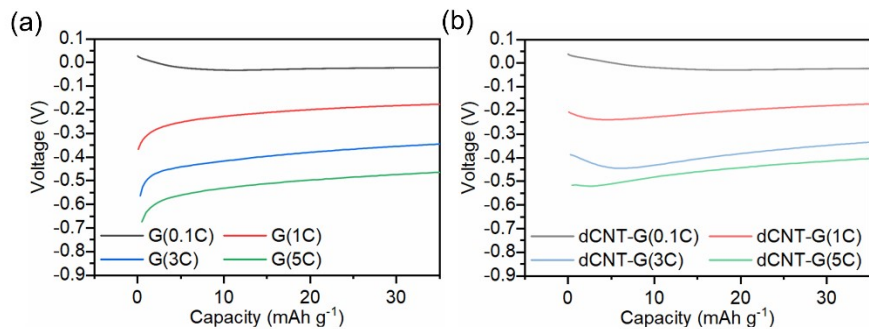


Figure S4. Enlarged voltage profile at diverse C-rates for lithium plating process.

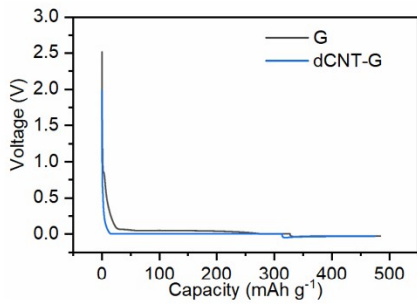


Figure S5. Voltage profile of additional lithium plating process of 140mAh g⁻¹ for lithium half-cell cycling test electrodes.

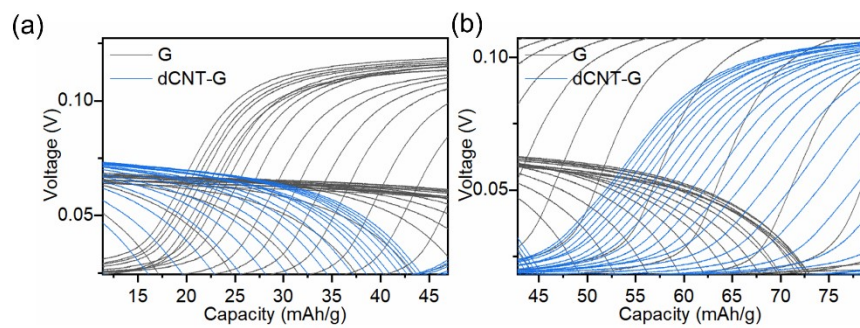


Figure S6. Enlarged voltage profile of Figure 3(d) at 50th discharge cycle of (a) G and (b) dCNT-G.

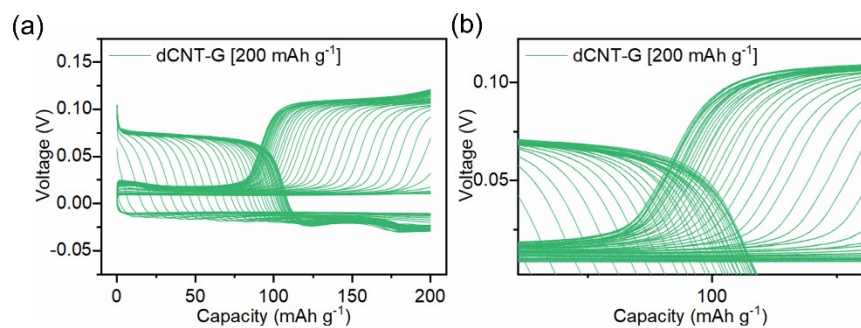


Figure S7. (a) Voltage profile for 50 cycles of plated lithium with 200mAh g^{-1} at dCNT-G electrode. (b) Enlarged voltage profile at 50th delitiation.

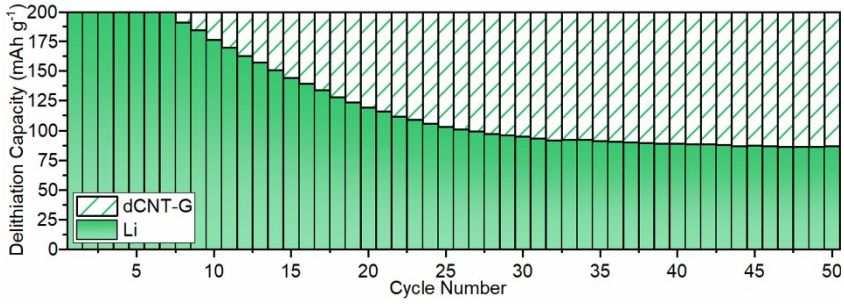


Figure S8. Delithiation capacity between lithium and dCNT-G cycle within 200mAh g⁻¹ of capacity.

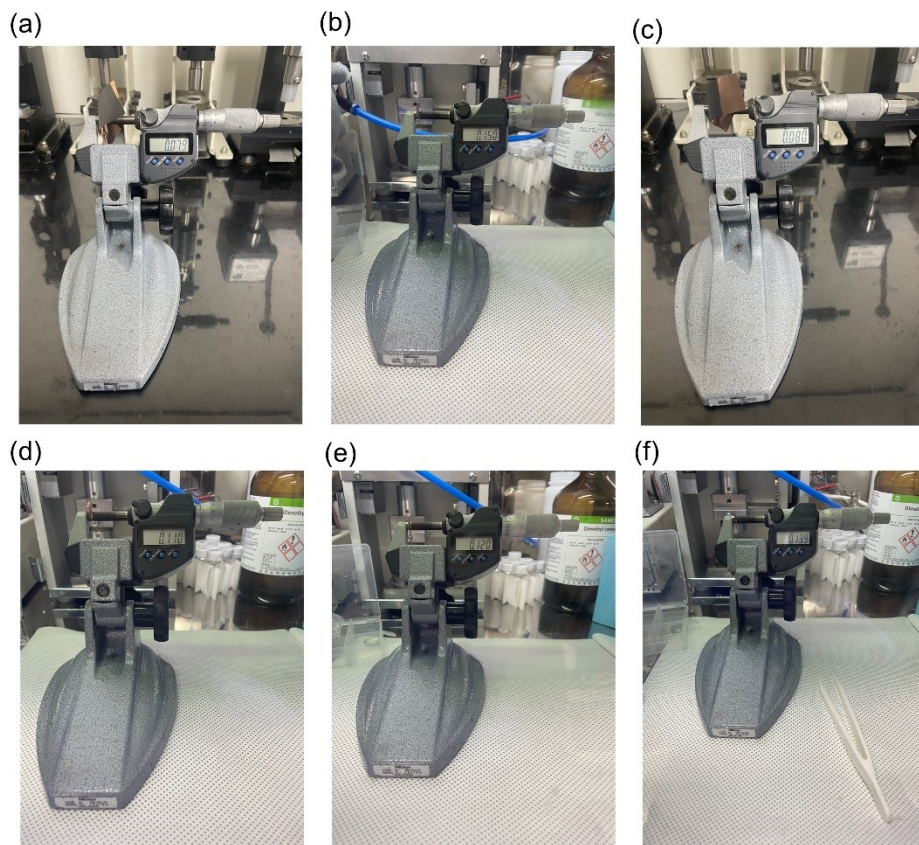


Figure S9. Digital photos of (a) initial G electrode, (b) after charging and plating 140mAh g⁻¹ of lithium, (c) initial dCNT-G electrode, after charging and plating (d) 140mAh g⁻¹, (e) 280mAh g⁻¹, (f) 470mAh g⁻¹ of lithium. Overall thickness changes of electrode are displayed at Table S2.

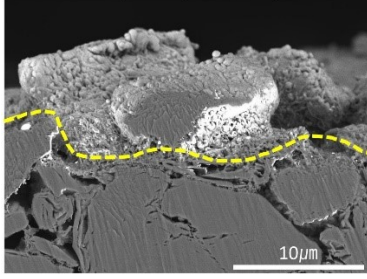


Figure S10. High magnification SEM image of dCNT-G/G electrode. Scale bar, 10 μ m.

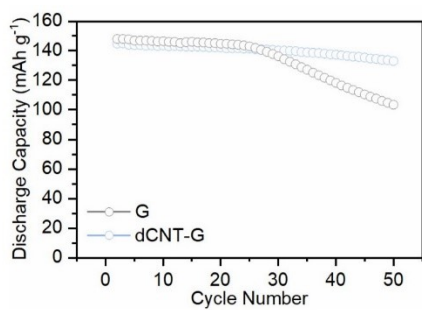


Figure S11. Cycling graphs of full-cell with excessive lithium plate anode (cathode: 2.06 mAh cm⁻², anode: 1.64 mAh cm⁻²). Extra lithium plated electrodes were fabricated by using additional lithium plated electrode at half-cell (0.4 mAh cm⁻²). After lithiation of graphite and lithium plated, coin cells were disassembled to collect electrode and collected electrodes were used as working electrode for full-cell test with 622 NCM at argon-filled glove box.

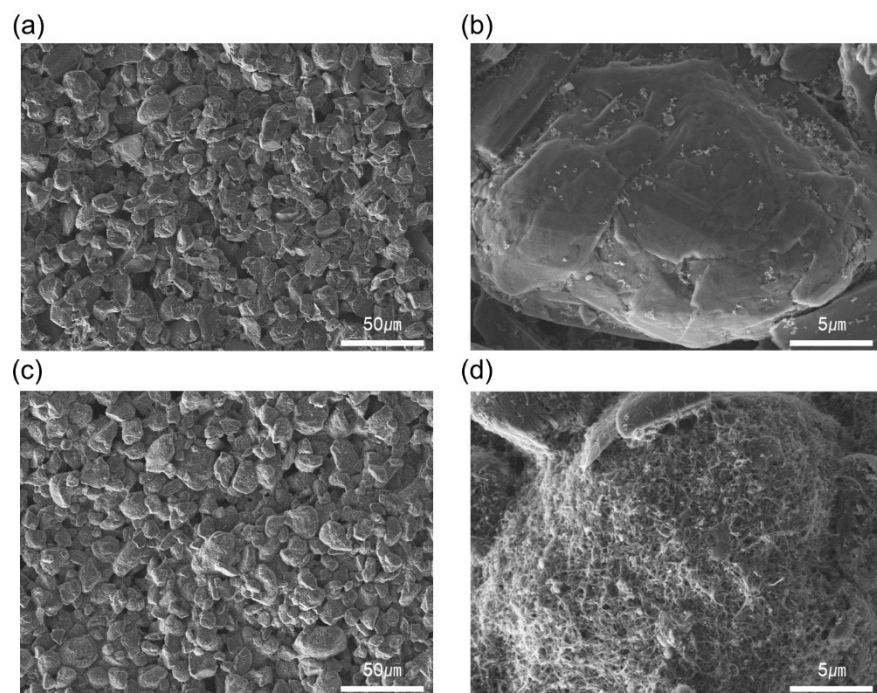


Figure S12. SEM image (a) low magnification and (b) high magnification of G electrode and (c) low magnification and (d) high magnification of dCNT-G electrode.

Sample	Graphite			Lithium		
	Lithiation Capacity (mAh g ⁻¹ , Graphite)	Delithiation Capacity (mAh g ⁻¹ , Graphite)	ICE (%, Graphite)	Lithiation Capacity (mAh g ⁻¹ , Lithium)	Delithiation Capacity (mAh g ⁻¹ , Lithium)	ICE (%, Lithium)
Graphite	327.75	316.93	96.6	137.74	97.74	70.9
dCNT-G	353.26	324.59	91.8	121.73	101.77	83.6

Table S1. Independent capacity and initial CE of graphite and lithium based on Fig. S2.

Sample	Plated amount of Lithium (mAh g ⁻¹)	Electrode thickness change (μ m)
G	140	71
dCNT-G	140	30
dCNT-G	280	40
dCNT-G	470	59

Table S2. Electrode thickness change of G with 140mAh g⁻¹ of deposited lithium and dCNT-G electrode with diverse amount of deposited lithium. Electrode thickness was measured by micrometer after disassembly of cell at argon-filled glove box.