Electronic Supplementary Information

Dimensional Tailoring of Nitrogen-doped Graphene for High-performing Supercapacitors

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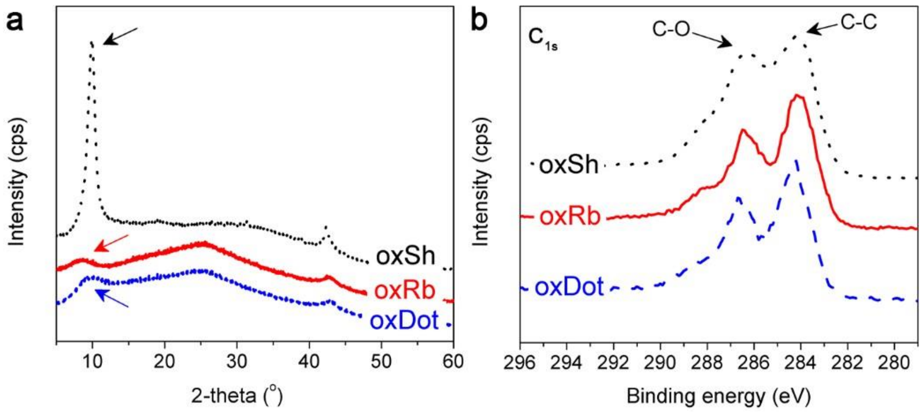

Figure S1. Physical characterizations of the chemically oxidized graphene materials. (a) XRD results. The peaks near 10 ° in the XRD result (indicated by arrows) refer to a graphene oxide. (b) XPS-C_{1s} results. The C-C and C-O bonding peaks were assigned in the figure.

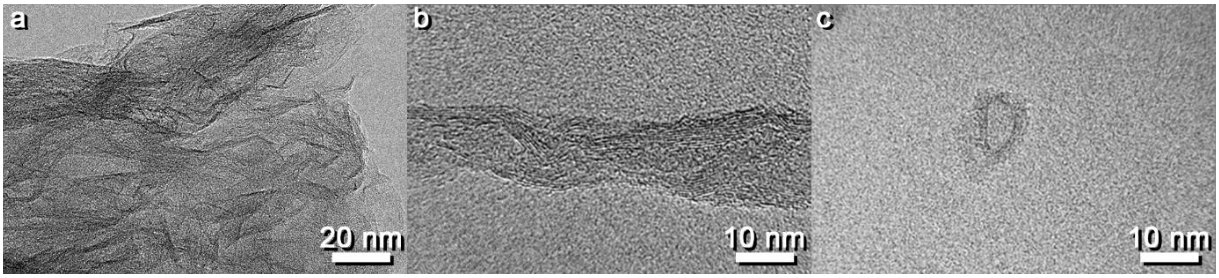

Figure S2. The high-magnification TEM images of the prepared graphene oxides. : (a) oxSh, (b) oxRb and (c) oxDot.

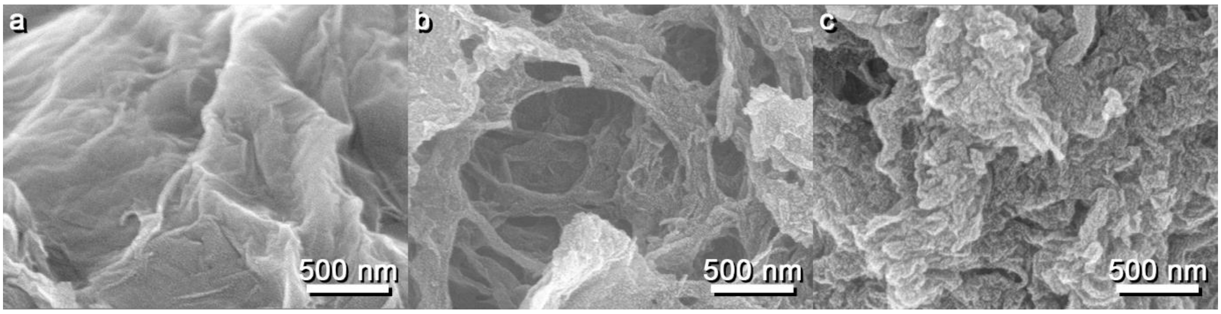

Figure S3. Morphology of the prepared graphene derivatives. (a) rSh, (b) rRb and (c) rDot obtained at a 5 kV electron acceleration voltage.

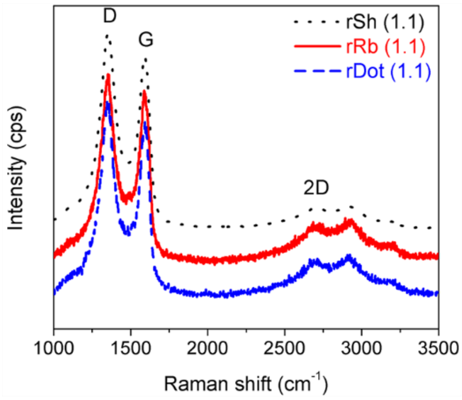

Figure S4. Raman spectra of the prepared graphene materials. The I_D/I_G values were noted in parenthesis of the figure.

Table S1. The compositions (at. %) of the graphene derivatives examined from elemental analysis.

	oxSh	oxRb	oxDot	rSh	rRb	rDot
C	46.2	35.6	35.3	76.2	70.1	66.7
O	49.0	36.2	34.7	6.8	9.6	11.5
H	2.0	25.4	27.4	11.5	14.4	15.5
N	-	-	-	5.5	5.9	6.3
S	2.8	2.8	2.6	-	-	-

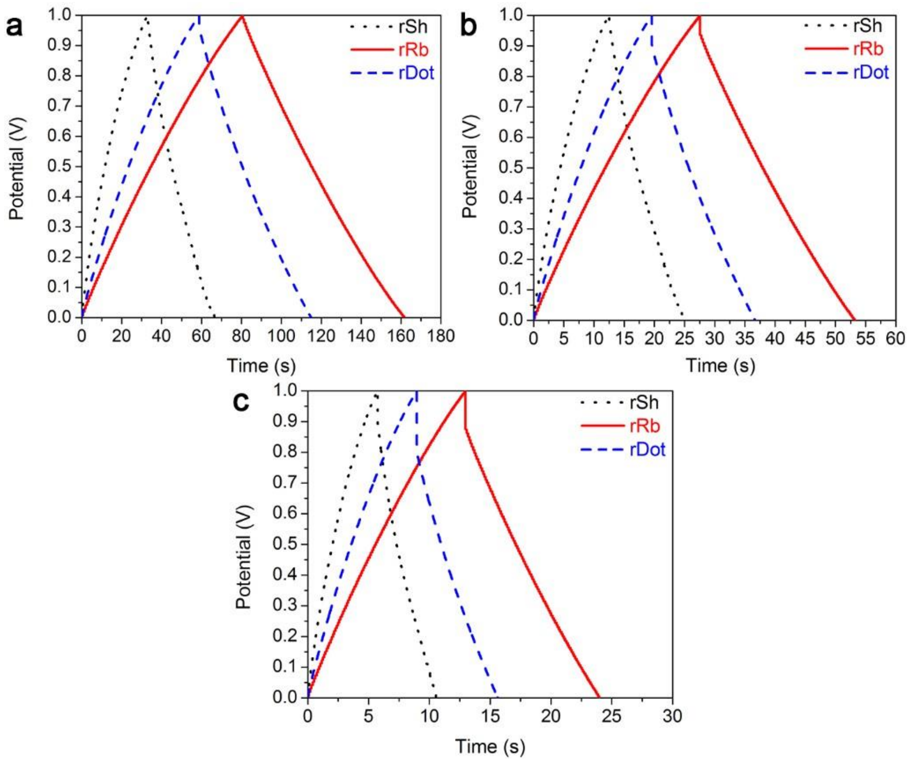

Figure S5. Galvanostatic charge-discharge results of the fabricated supercapacitors. The testes were performed at (a) 2 A g^{-1}, (b) 5 A g^{-1}, and (c) 10 A g^{-1} current densities with 6 M KOH electrolyte and a symmetric cell.

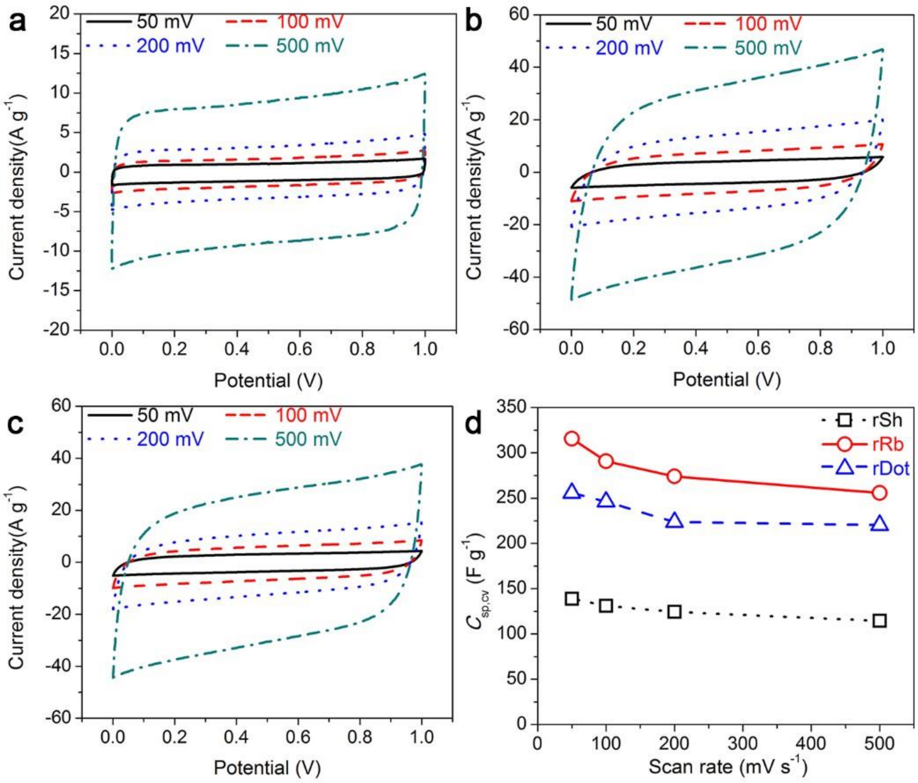

Figure S6. CV curves of the fabricated graphene materials at various scan rates with 6 M KOH electrolyte and a symmetric cell; (a) rSh, (b) rRb, and (c) rDot. (d) The specific capacitances obtained from the CV results were plotted along with the scan rates.

Table S2. Comparison with the other graphene derivatives reported previously for supercapacitors with the two electrode system

Material and preparation	Electrolyte	Condition	Capacitance ($F\ g^{-1}$)	References
rRb (This study)	6 M KOH	1 A g^{-1}	378	
Structural modified carbons				
Activated CNTs	1 M H_2SO_4	1 A g^{-1}	319	S1
Activated hierarchical porous carbons	6 M KOH	0.05 A g^{-1}	339	S2
Vertical MWCNT carpet	6 M KOH	5.7 A g^{-1}	106	S3
Crumpled graphene	5 M KOH	0.1 A g^{-1}	150	S4
Honeycomb-like hierarchical carbon	6 M KOH	0.5 A g^{-1}	294	S5
Porous CNT-networks decorated crumpled graphene	6 M KOH	10 mV s^{-1}	162	S6
Bread leavening inspired porous carbon	6 M KOH	0.5 A g^{-1}	253	S7
Heteroatom doped carbons				
N-doped graphene hydrogels	5 M KOH	10 A g^{-1}	190	S8
3D N-doped graphene-CNT networks	6 M KOH	0.5 A g^{-1}	180	S9
N-doped graphene with *o*-phenylenediamine	6 M KOH	0.1 A g^{-1}	301	S10
N-doped graphene	6 M KOH	1 A g^{-1}	282	S11

N-doped hollow carbon spheres	6 M KOH	0.5 A g^{-1}	213	S12
3D micro porous conducting carbon	1 M H_2SO_4	0.5 A g^{-1}	258	S13
Sandwich-like PANi/B-doped graphene	1 M H_2SO_4 6 M KOH	0.5 A g^{-1}	241 189	S14
Gelatin-derived N-doped carbon	6 M KOH	1 A g^{-1}	284	S15
N self-doped porous carbon aerogels	6 M KOH	2 mV s^{-1}	292	S16
N-enriched activated carbons	7 M KOH	0.05 A g^{-1}	263	S17
N-doped multi-walled CNTs	6 M KOH	1 mA g^{-1}	44	S18

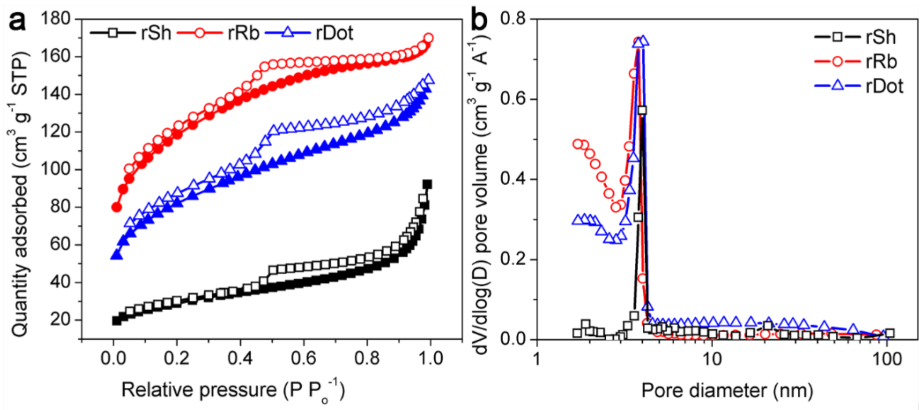

Figure S7. (a) N_2-adsorptions and (b) pore size distributions of the prepared graphene materials.

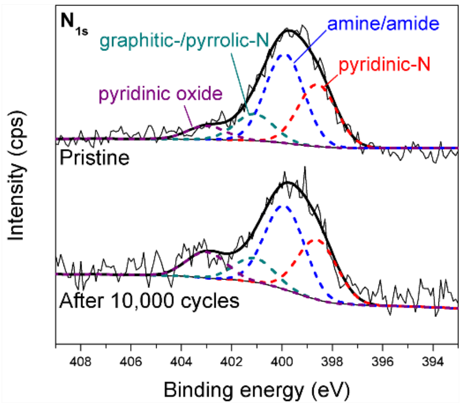

Figure S8. XPS-N_{1s} results of the rRb electrode before and after 10,000 cycles of stability tests performed at 5 A g^{-1} current density.

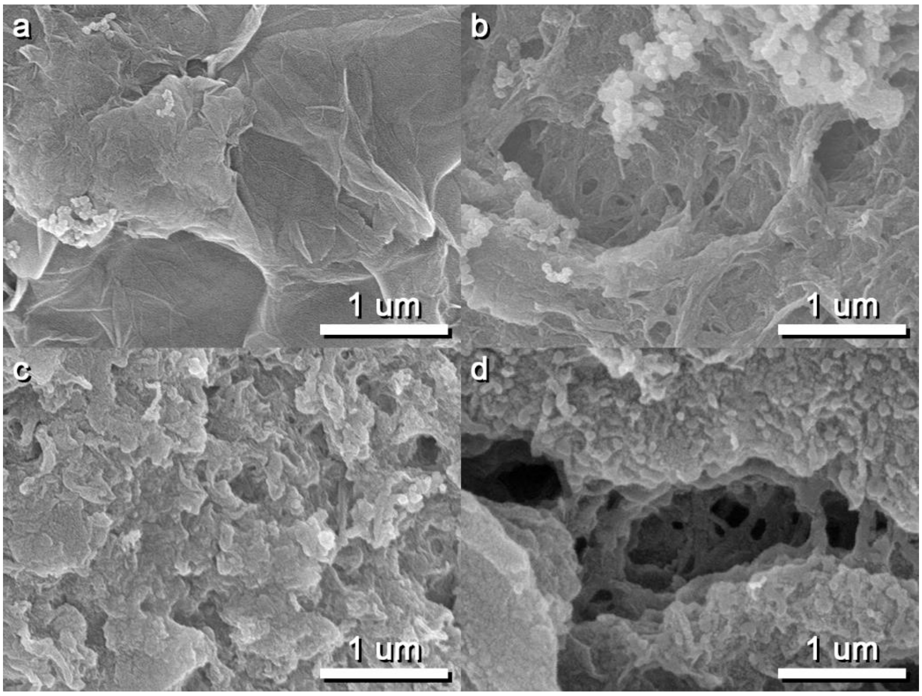

Figure S9. Morphology of the fabricated graphene electrodes after cycling operations. (a) rSh, (b) rRb, (c) rDot after 1,000 cycles of operations and (d) rRb after 10,000 cycles of operation obtained at a 5 kV electron acceleration voltage. The small particles in the SEM images indicates salts from the electrolytes.

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