Supplementary Material

Opening the Structure for Transport of Ions: Improvement of the Structural and Chemical Properties of Single-walled Carbon Nanohorns for Supercapacitor Electrodes

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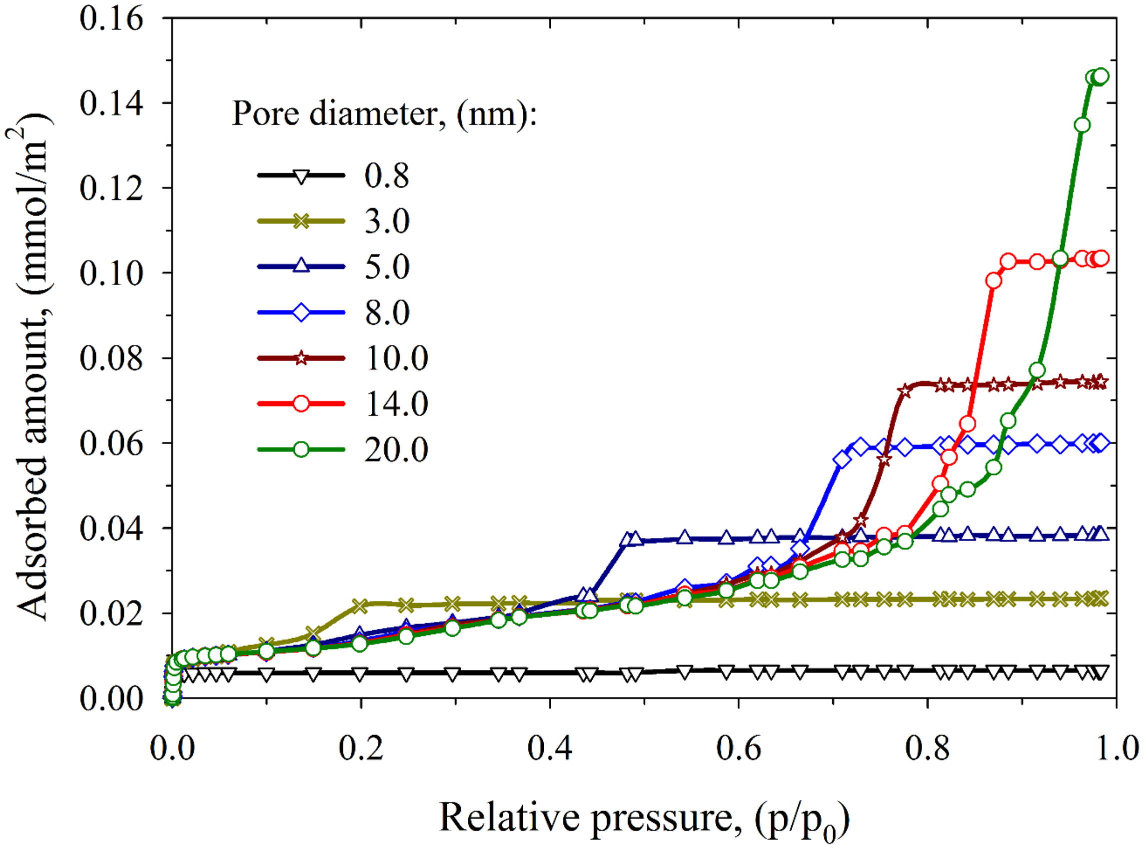

Figure S1. N_2 (77 K) adsorption isotherms in graphene cylinders simulated from GCMC method. Values of pore diameters are displayed on the plot.

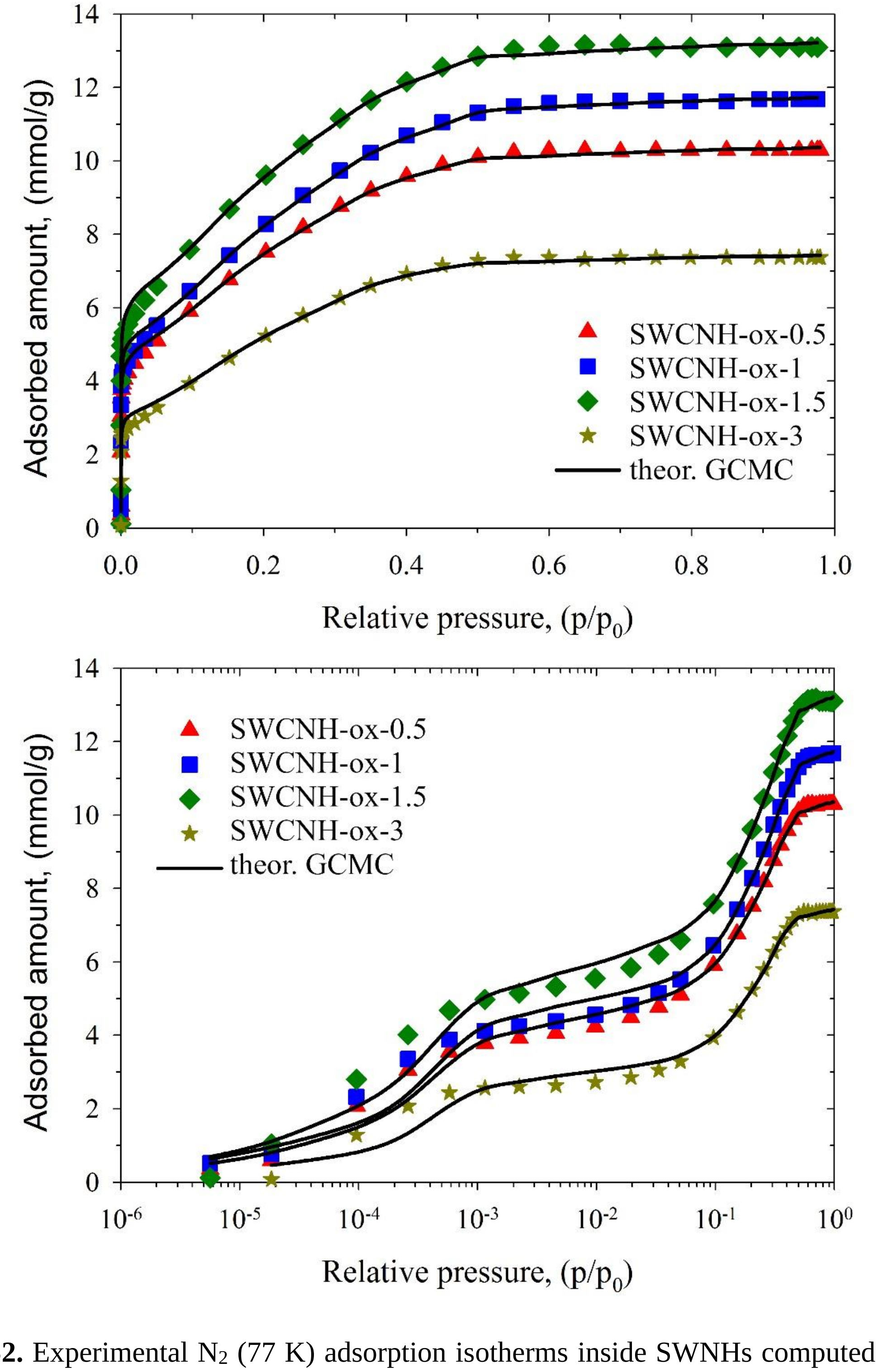

Figure S2. Experimental N_2 (77 K) adsorption isotherms inside SWNHs computed from Eq. (5) (in manuscript). The theoretical N_2 (77 K) adsorption isotherms inside SWNHs obtained from the fitting of the experimental ones by GCMC kernel are given by solid lines (Eq. (6) in manuscript).

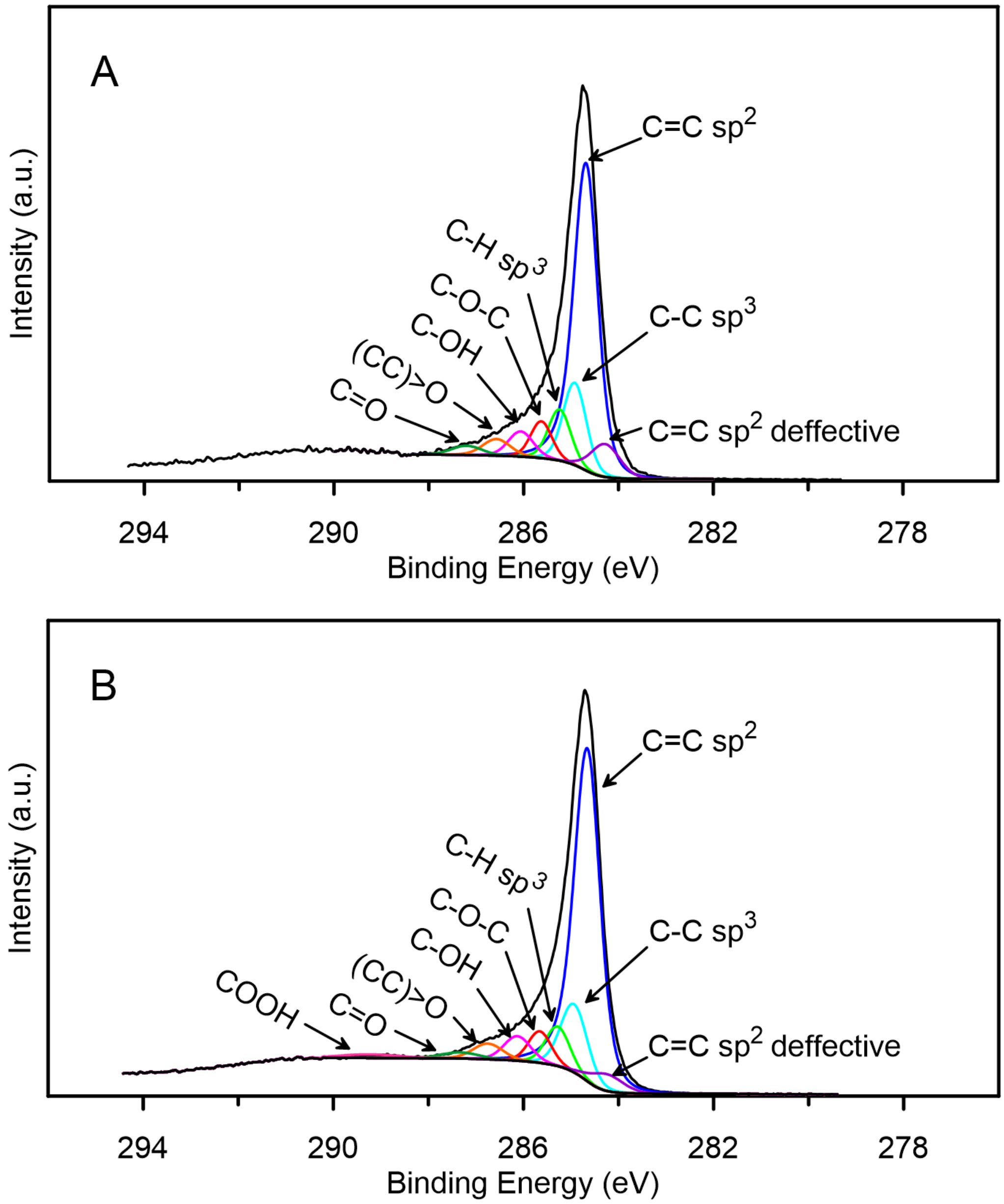

Figure S3. High-resolution C 1s XPS spectra for (A) SWCNH and (B) SWCNH-ox-1.5.

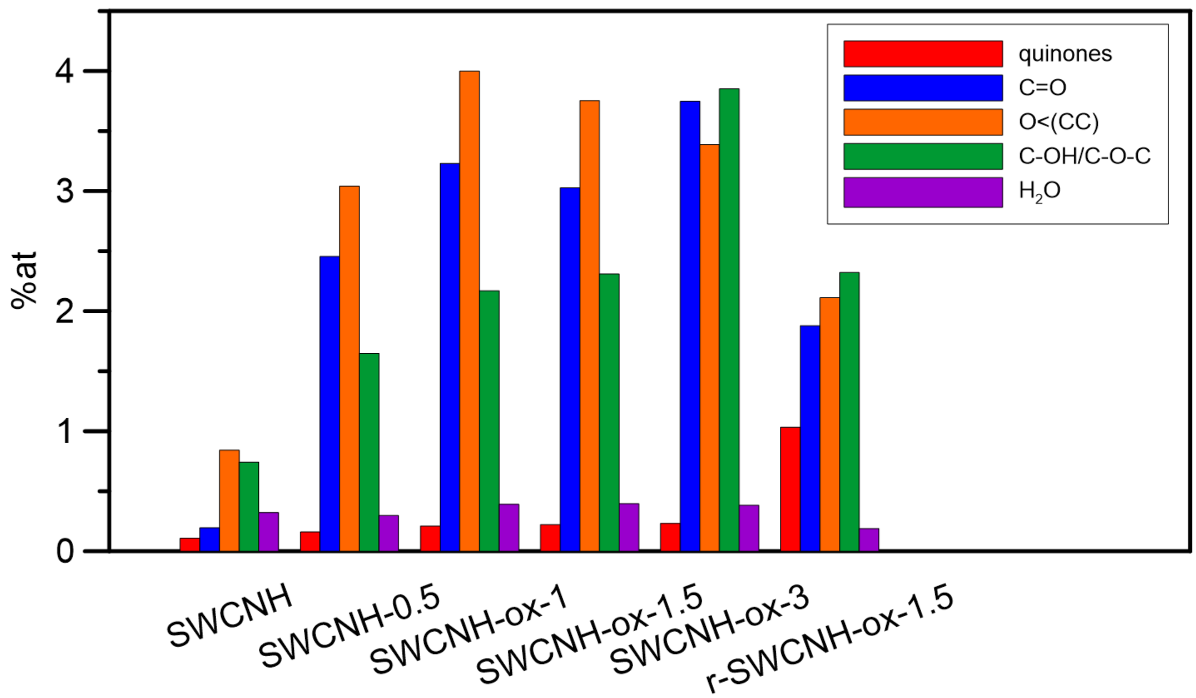

Figure S4. XPS atomic % of different forms of surface oxygen after wet HNO_3 modification based on O 1s XPS spectra.

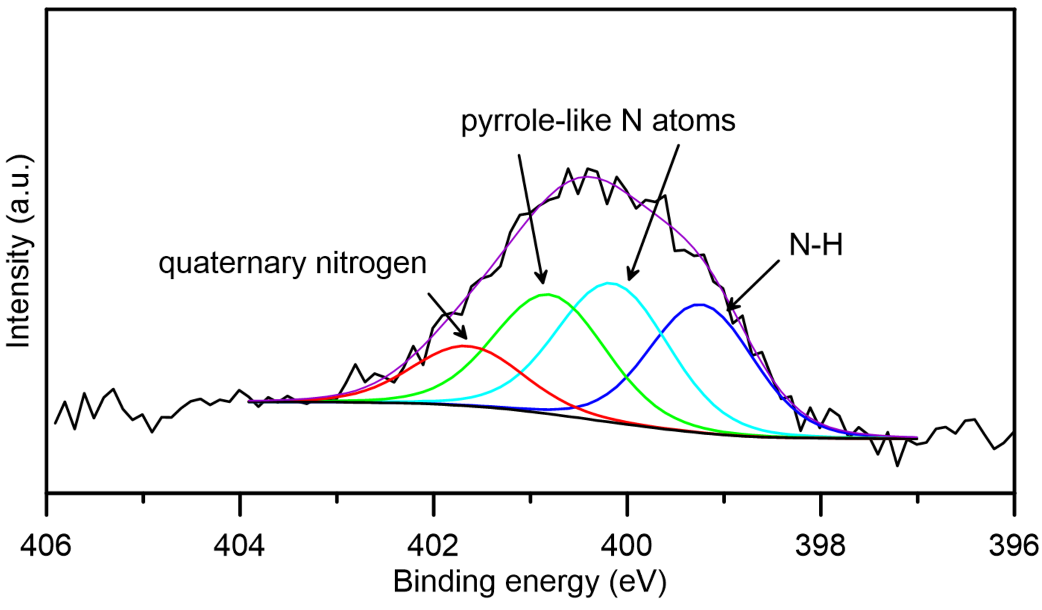

Figure S5. High-resolution N 1s XPS spectra for the r-SWCNH-ox-1.5.

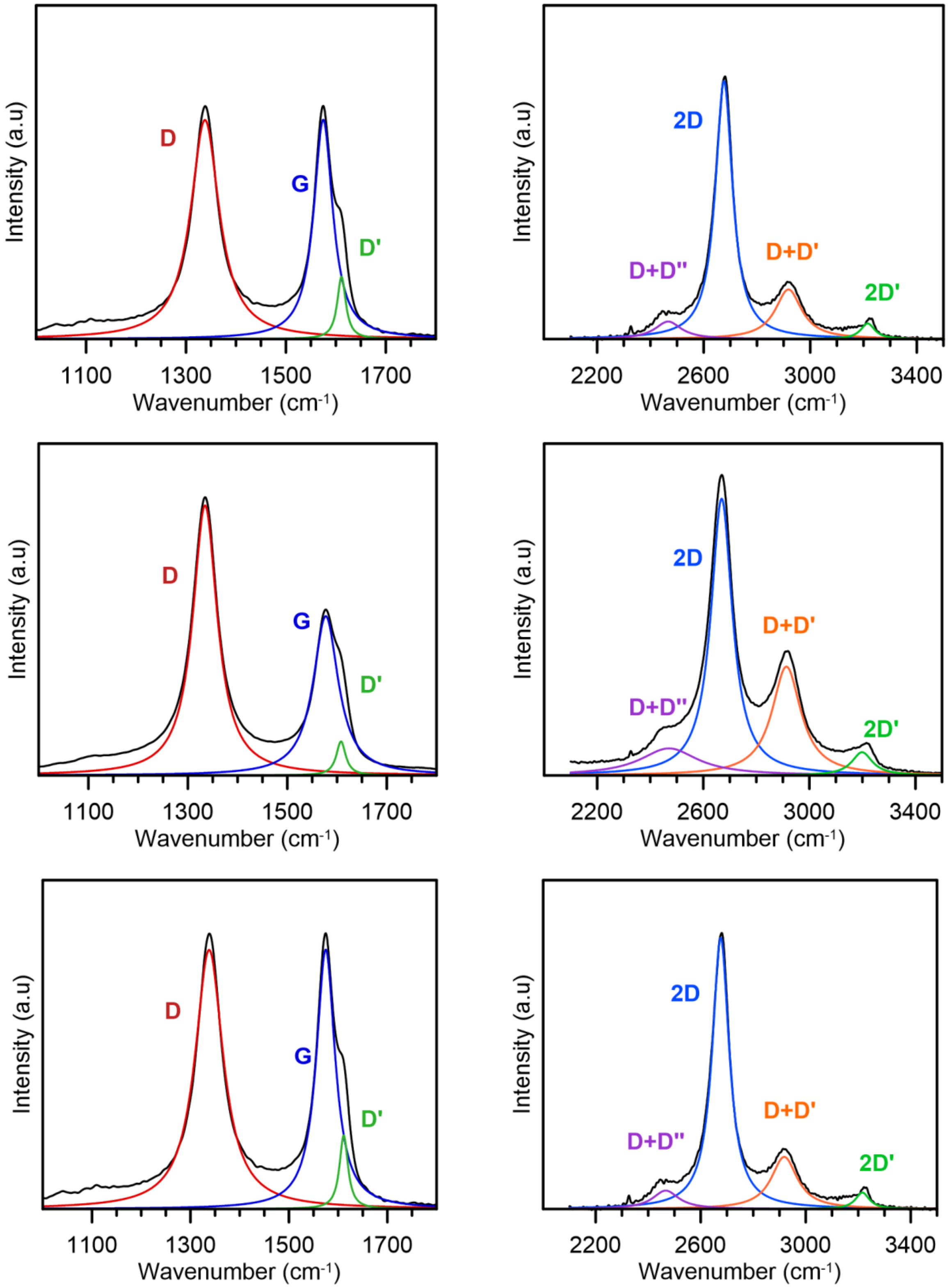

Figure S6. Deconvolution of Raman spectra for SWCNH (first row), SWCNH-ox-1.5 (second row) and r-SWCNH-ox-1.5 (bottom row).

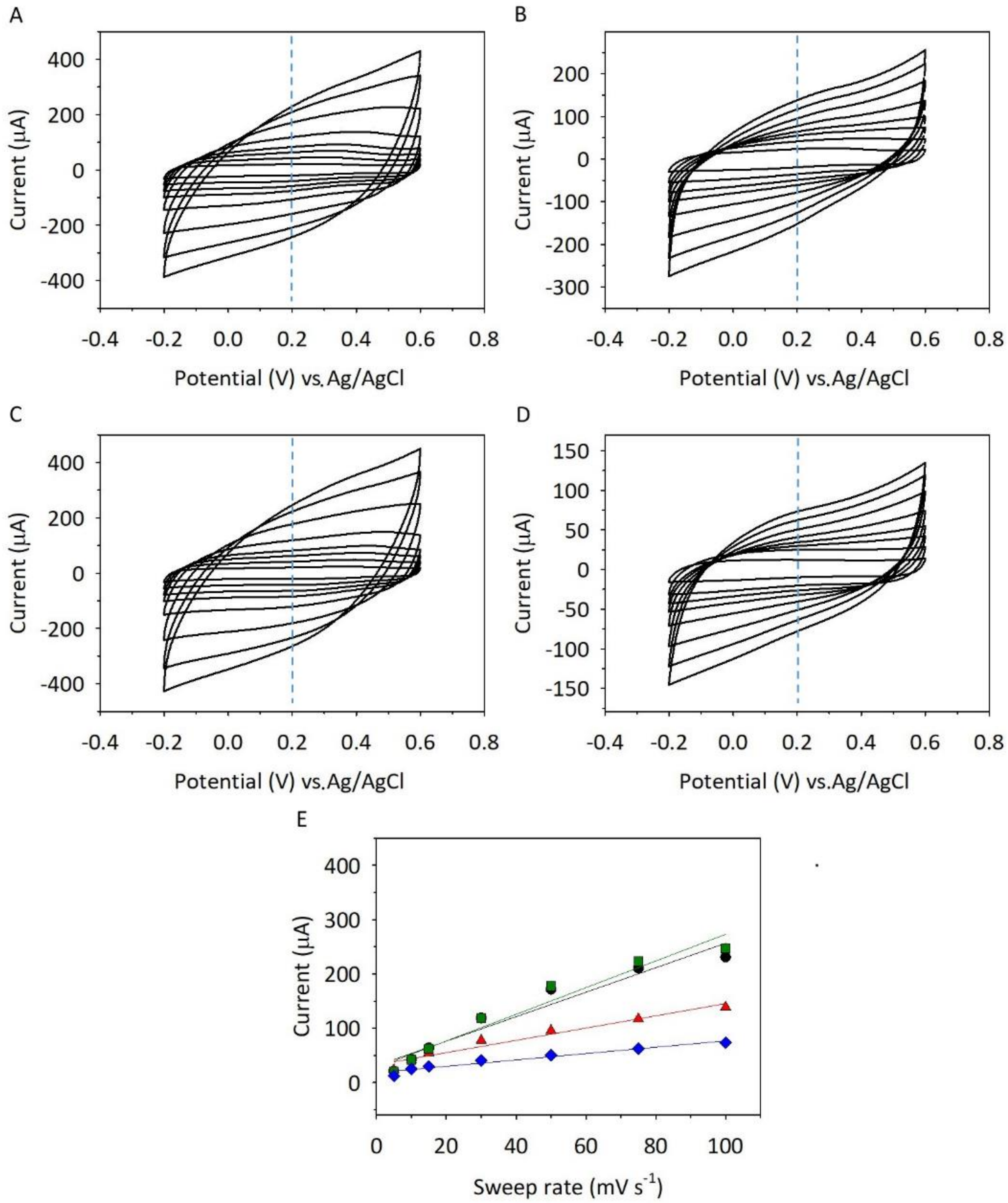

Figure S7. Cyclic voltammograms of SWCNH-ox-1.5 in 0.1 M different supporting electrolytes (A) NaCl, (B) Na_2SO_4, (C) H_2SO_4, and (D) $(Et)_4NCl$ at the different sweep rate: 5, 10, 15, 30, 50, 75, and 100 mV s^{-1}. (E) Dependence of the current of SWCNH at 0.2 V (vs. Ag/AgCl) for (●) NaCl, (▼) Na_2SO_4, (▪) H_2SO_4, and (♦) $(Et)_4NCl$.

Table S1. The specific element content based on the XPS results.

Element	SWCNH	SWCNH-ox-0.5	SWCNH-ox-1	SWCNH-ox-1.5	SWCNH-ox-3	r-SWCNH-ox-1.5
	%Atomic concentration					
C	97.79	92.4	90.0	90.3	88.4	89.6
O	2.21	7.6	10.0	9.7	11.6	7.5
N	0	0	0	0	0	2.9

Table S2. Studied ionic species: Stokes radius, hydrated radius and standard molar enthalpy of hydration.

Ions	r_s **(nm)**	r_h **(nm)**	$\Delta_{hyd}H°$ **(kJ mol^{-1})**
Na^+	0.184	0.358	-240.6
$(Et)_4N^+$	0.282	0.400	-154.9
SO_4^{2-}	0.230	0.379	-903.7
Cl^-	0.121	0.332	-363.0

Stokes radius (r_s), hydrated radius (r_h) and standard molar enthalpy of hydration ($\Delta_{hyd}H°$). The reported Stokes and hydrated radii are from Ref. [1]. Standard molar enthalpy of hydration $\Delta_{hyd}H°$ values are from Ref. [2].

Table S3. Specific capacitance of SWCNH, SWCNH-ox and r-SWCNH-ox in aqueous solution of different supporting electrolyte.

Materials	**Specific capacitance (F g^{-1})**			
	Integration ΔE_1 (0.0 – 0.3 V vs. Ag/AgCl)[a]		$I - v$ (slope) E_1 (0.2 V vs. Ag/AgCl)	
	NaCl	H_2SO_4	NaCl	H_2SO_4
SWCNH	32	65	29	62
SWCNH-ox-0.5	127	175	118	165
SWCNH-ox-1.0	169	177	159	168
SWCNH-ox-1.5	230	233	212	228
SWCNH-ox-3.0	227	184	218	176
r-SWCNH-ox-1.5	95	134	88	130

[a] at v = 20 mV s^{-1}

1 A. K. Covington and T. Dickinson, *Physical Chemistry of Organic Solvent Systems*, Springer US, Boston, MA, 1973.
2 D. Dobos, *Electrochemical data: a handbook for electrochemists in industry and universities*, Elsevier Scientific Pub. Co, Amsterdam ; New York, 1975.