Supporting Information

Determination of Precise Redox Properties of Oxygen-doped Single-Walled Carbon Nanotubes Based on In Situ Photoluminescence Electrochemistry

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Figure S1. (a, c) Vis/near IR absorption and (b,d) PL spectra of the pristine SWNTs (a and b) and (c, d) O-doped SWNTs, in which the SWNTs were solubilized in D₂O containing SDBS (blue line) and Na-CMC (red line).



Figure S₂. AFM image of the O-doped SWNTs embedded in a Na-CMC film on mica.



Figure S3. Applied potential (from 0 to 1 V vs. Ag/AgCl)-dependent PL spectra of the O-doped SWNTs excited at given wavelengths. PL spectra excited at (a) 520, (b) 570, (c) 650 and (d) 670 nm.



Figure S4. Applied potential (from o to -1 V vs. Ag/AgCl)-dependent PL spectra of the O-doped SWNTs excited at given wavelengths. PL spectra excited at (a) 520, (b) 570, (c) 650 and (d) 670 nm.



Figure S5. PL spectra of the film of the O-doped SWNTs on the ITO electrode under potential ((a) o mV, (b) and (c) 700 mV). A convolution of three O-doped (6,5)SWNTs peaks: $E_{\rm n}$ peak (blue), $E_{\rm n}{}^*{}_{\rm a}$ peak (red) and $E_{\rm n}{}^*{}_{\rm b}$ (green). The solid black lines are fitted peaks and the dotted gray lines are the original data. (c) is added a trion peak to eliminate fitting mismatch (b).



Figure S6. Normalized PL intensity plots as a function of applied potentials in the oxidation process. The colored lines represent $E_{\rm n}$ (blue) of the non-doped SWNTs and $E_{\rm n}*_{\rm a}$ (red), and $E_{\rm n}*_{\rm b}$ (green) of the O-doped SWNTs.



Figure S7. Normalized PL intensity plots as a function of applied potentials in the reduction process. The colored lines represent E_n (blue) of the non-doped SWNTs and $E_n_a^*$ (red), and $E_n_b^*$ (green) of the O-doped SWNTs.

Table S1. Electronic properties of the pristine SWNTs determined by the prepared												
modified electrode.												
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Chirality	Diameter	Eox	$E_{ m red}$	Fermi level	$\Delta E_{ m opt}$	$\Delta E_{ m electro}$						

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(n,m)	(nm)	(V vs. Ag/AgCl)	(V vs. Ag/AgCl)	(V vs. Ag/AgCl)	(eV)	(eV)
(7,3)	0.706	0.582	-0.42	0.081	1.234	1.002
(6,5)	0.757	0.588	-0.423	0.083	1.240	1.011
(7,5)	0.829	0.524	-0.454	0.033	1.188	0.978
(8,3)	0.782	0.556	-0.490	0.035	1.273	1.046