Supporting information

Robust, flexible, freestanding and high surface area activated carbon and multi-walled carbon nanotubes composite material with outstanding electrode properties for aqueous-based supercapacitors

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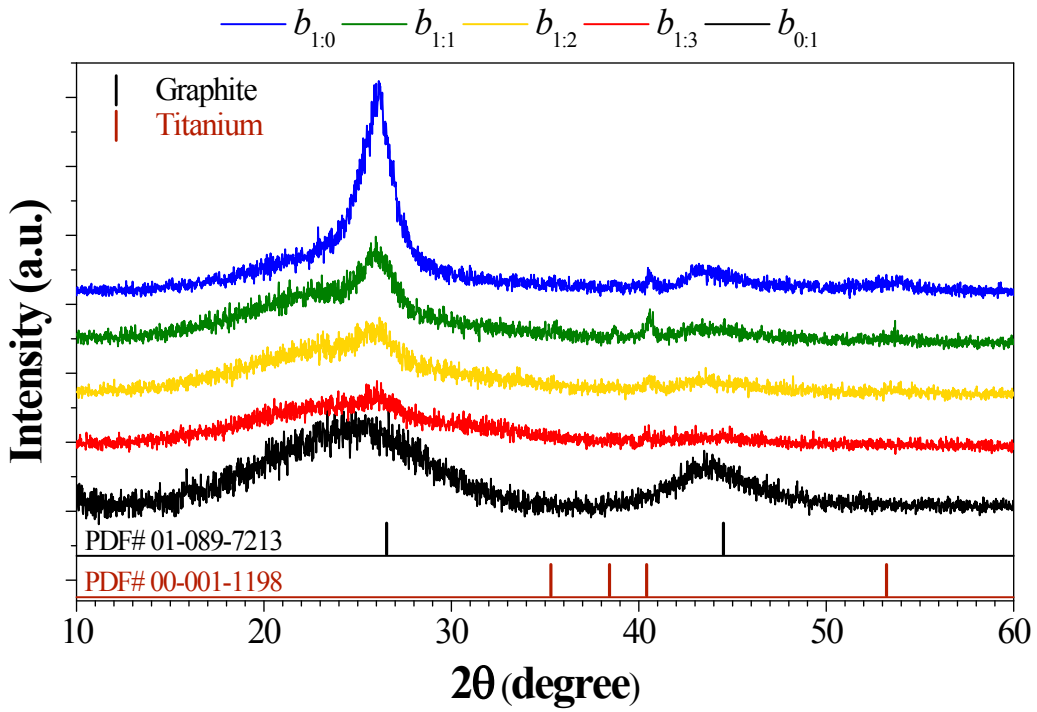

Figure S1: XRD of the carbon materials MWCNT ($b_{1:0}$) in blue; MWCNT:AC ($b_{1:1}$, $b_{1:2}$, and $b_{1:3}$) in green, yellow and red; and AC in black. The Titanium corresponds to the hexagonal phase of spatial group *P63/mmc* (PDF# 00-001-1198) (1), which was the catalyst for MWCNT preparation.

Table S1. Influence of the MWCNT:AC ratio on the specific (gravimetric) capacitance (SC) and the equivalent series resistance (ESR) as a function of the applied voltage.

Electrode	SC ($F\ g^{-1}$)								
	1.0 V	1.1 V	1.2 V	1.3 V	1.4 V	1.5 V	1.6 V	1.7 V	1.8 V
$b_{1:0}$	7.59	7.71	7.79	7.86	7.95	8.07	8.18	8.26	8.34
$b_{1:1}$	45.87	46.23	46.25	46.02	45.82	45.64	45.59	45.58	45.54
$b_{1:2}$	49.47	49.45	49.34	49.19	49.03	48.95	48.99	49.35	49.81
$b_{1:3}$	52.75	52.08	53.86	54.14	54.30	54.33	54.36	54.41	54.36

Note: Data extracted from the GCD data at 0.15 A g^{-1}.

	ESR* (mΩ g)								
$b_{1:0}$	245.5	242.5	239.6	235.9	231.8	228.0	222.0	214.5	204.7
$b_{1:1}$	116.8	118.3	118.8	120.9	123.4	123.9	124.2	127.9	133.9
$b_{1:2}$	133.1	132.9	132.1	130.8	129.7	128.9	130.8	134.2	143.5
$b_{1:3}$	155.2	203.9	155.6	155.4	154.9	154.9	157.9	160.7	160.8

* ESR values were calculated from GCD data using the relation ESR (mΩ g) = $\Delta U/2I$, where ΔU (V) is the voltage drop, I (A g^{-1}) is the modulus of the applied specific current, and 2 is the rational normalizing factor proposed by Vicentini *et al*. (2).

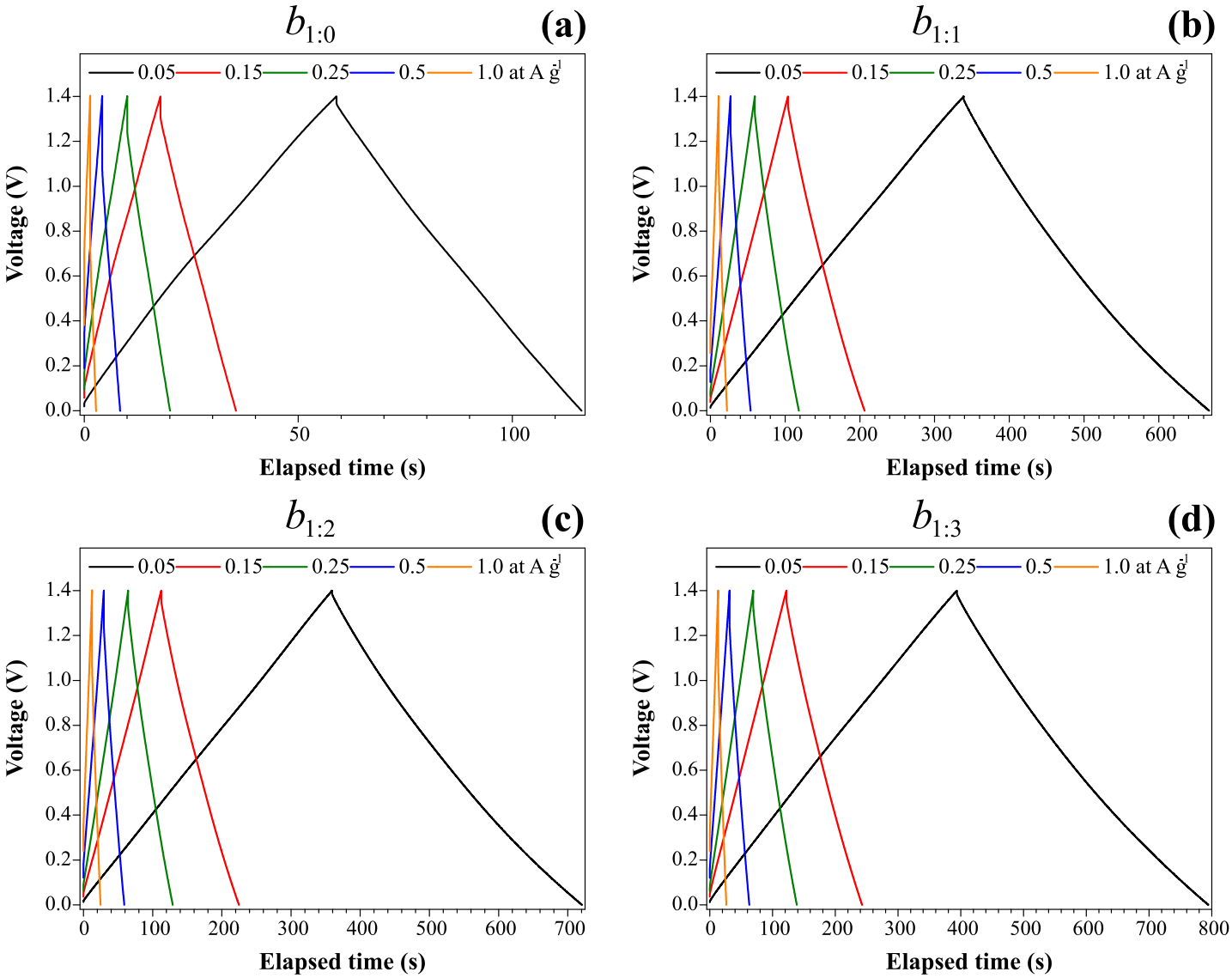

Fig. S2. GCD data at different applied gravimetric currents. (a) $b_{1:0}$, (b) $b_{1:1}$, (c) $b_{1:2}$, and (d) $b_{1:3}$.

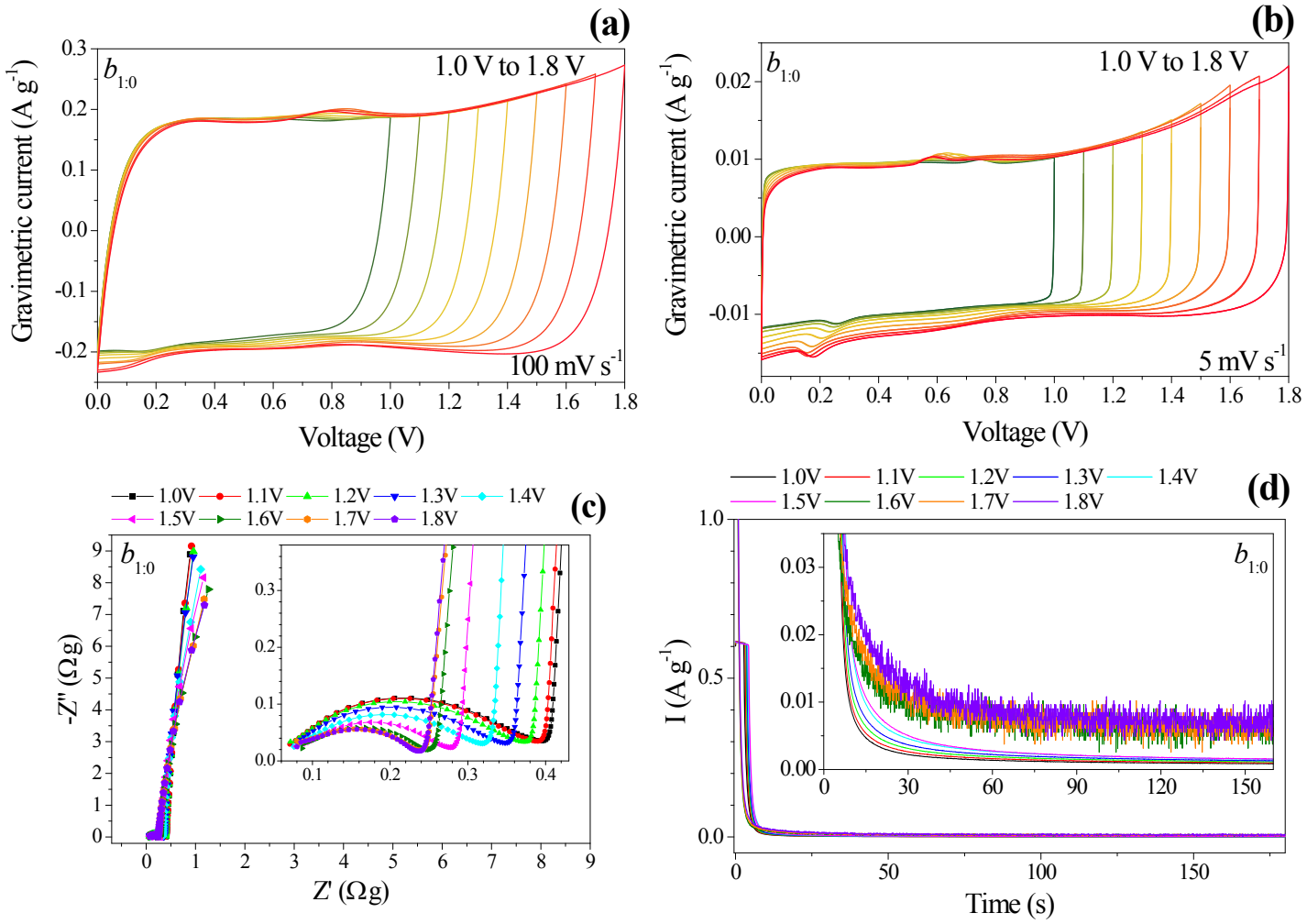

Fig. S3. Defining the working voltage window (WVW) of the symmetric coin cell (CR 2032). Electrodes: $b_{1:0}$ sample. Electrolyte: 1.0 mol dm^{-3} Li_2SO_4 aqueous solution. We performed (a & b) CV, (c) EIS, and (d) SSC experiments at different cell voltages.

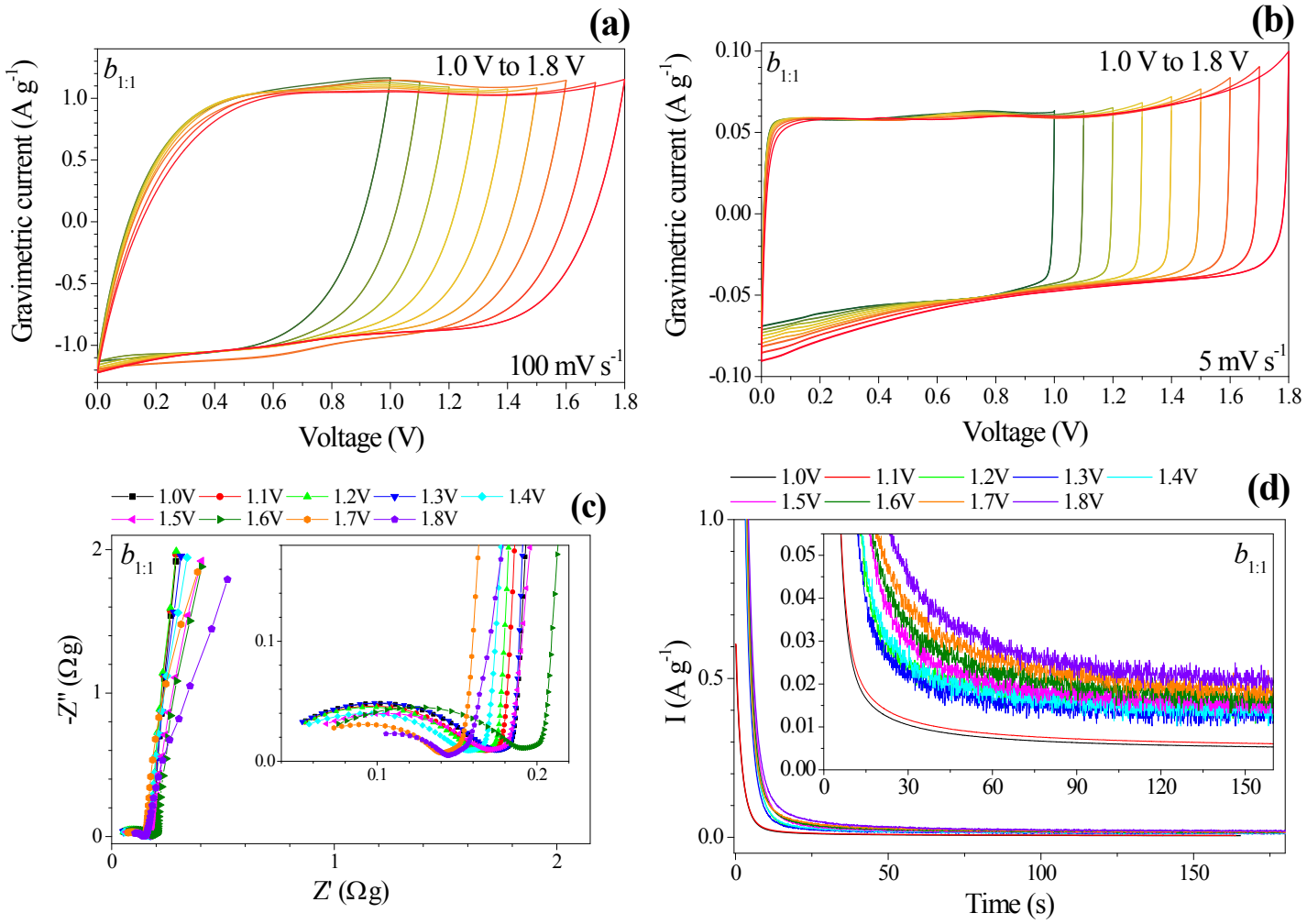

Fig. S4. Defining the working voltage window (WVW) of the symmetric coin cell (CR 2032). Electrodes: $b_{1:1}$ sample. Electrolyte: 1.0 mol dm^{-3} Li_2SO_4 aqueous solution. We performed (a & b) CV, (c) EIS, and (d) SSC experiments at different cell voltages.

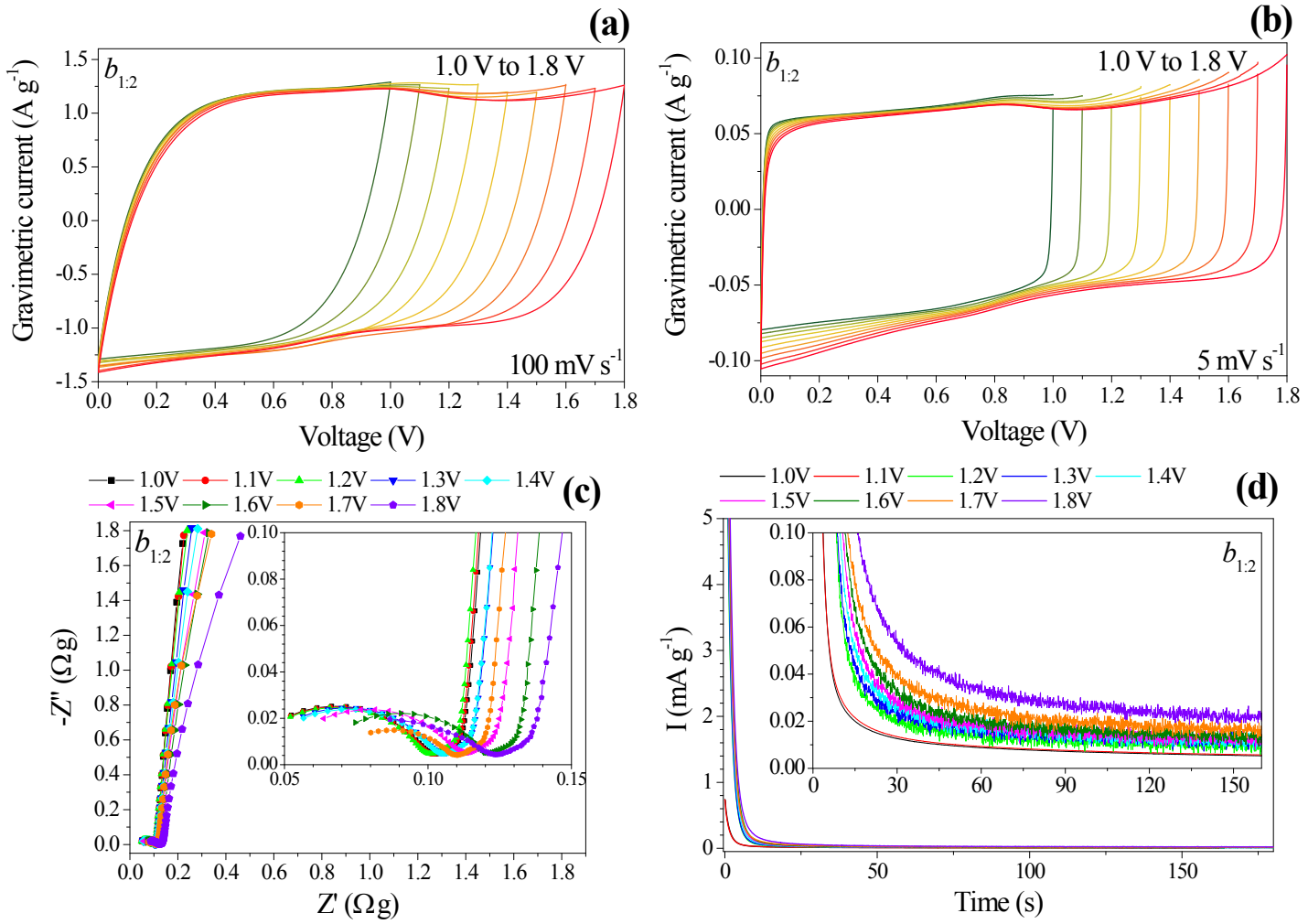

Fig. S5. Defining the working voltage window (WVW) of the symmetric coin cell (CR 2032). Electrodes: $b_{1:2}$ sample. Electrolyte: 1.0 mol dm^{-3} Li_2SO_4 aqueous solution. We performed (a & b) CV, (c) EIS, and (d) SSC experiments at different cell voltages.

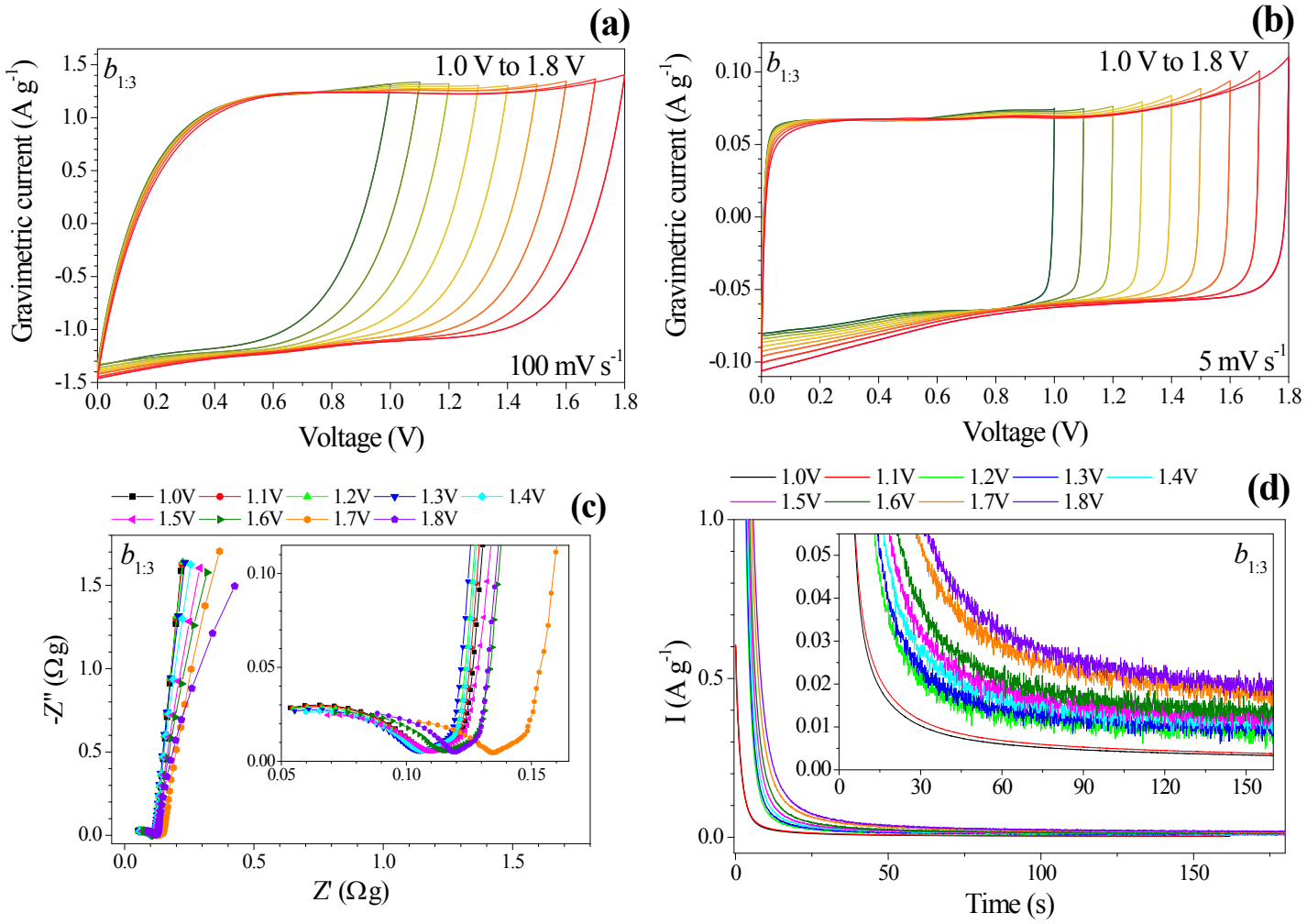

Fig. S6. Defining the working voltage window (WVW) of the symmetric coin cell (CR 2032). Electrodes: $b_{1:3}$ sample. Electrolyte: 1.0 mol dm^{-3} Li_2SO_4 aqueous solution. We performed (a & b) CV, (c) EIS, and (d) SSC experiments at different cell voltages.

References

1. N. Wright, "Application of Infrared Spectroscopy to Industrial Research," *Ind. Eng. Chem. - Anal. Ed.*, vol. 13, no. 1, pp. 1–8, 1941, doi: 10.1021/i560089a001.

2. R. Vicentini, L. M. Da Silva, E. P. Cecilio Junior, T. A. Alves, W. G. Nunes, and H. Zanin, "How to Measure and Calculate Equivalent Series Resistance of Electric Double-Layer Capacitors," *Molecules*, vol. 24, no. 8, p. 1452, Apr. 2019, doi: 10.3390/molecules24081452.