Supporting information for

Self-template/activation nitrogen-doped porous carbon materials derived from lignosulfonate for high performance supercapacitors

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1. Electrochemical measurements

The gravimetric capacitance (C_g, F g^{-1}) of a single electrode is calculated from the discharge curves according to the following equation (1) [1-4]:

$$C_g = \frac{2I \Delta t}{m \Delta V} \quad (1)$$

where I (A) is the constant discharge current, Δt (s) the discharge time, m (g) the mass of the active material in a single electrode, and ΔV (V) the voltage change in discharge.

The gravimetric energy density (W_g, Wh kg^{-1}) and power density (P_g, W kg^{-1}) of the two-electrode symmetric supercapacitors are also calculated according to equation (2 & 3):

$$W_g = \frac{C_g \Delta V^2}{8x3.6} \quad (2)$$

$$P_g = \frac{3600 x W g}{\Delta t} \quad (3)$$

where C_g (F g^{-1}) represents the gravimetric specific capacitance of a single electrode obtained from equation (1), ΔV (V) the voltage change in discharge, and Δt (s) the discharge time.

2. Figures

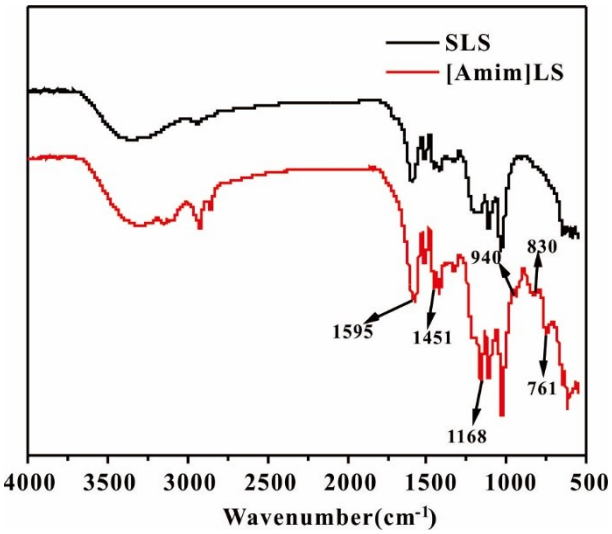

Figure S1. FTIR spectra of SLS and [Amim]LS precursor

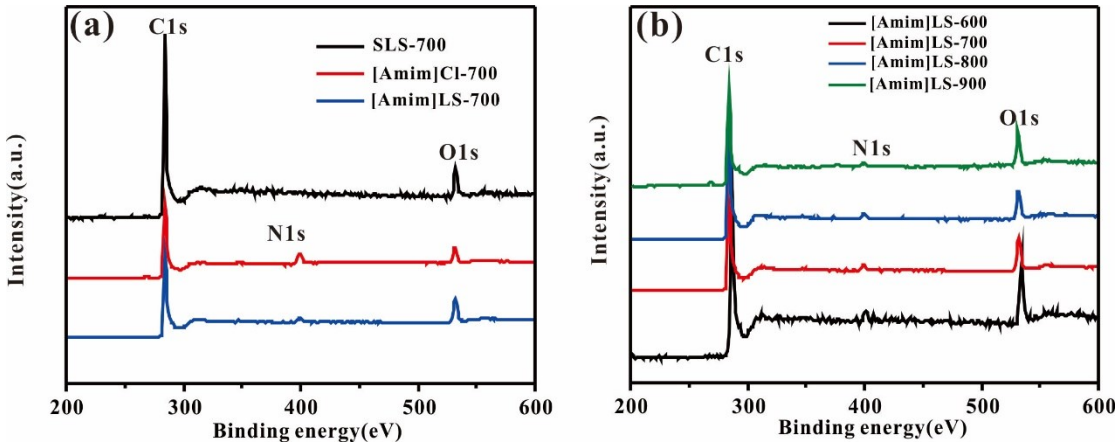

Figure S2. Wide-scan XPS spectra of (a) SLS-700, [Amim]Cl-700 and [Amim]LS-700 carbon samples, (b) carbon samples at different preparation temperatures (600 ℃ - 900 ℃) ([Amim]LS-600, [Amim]LS-700, [Amim]LS-800 and [Amim]LS-900)

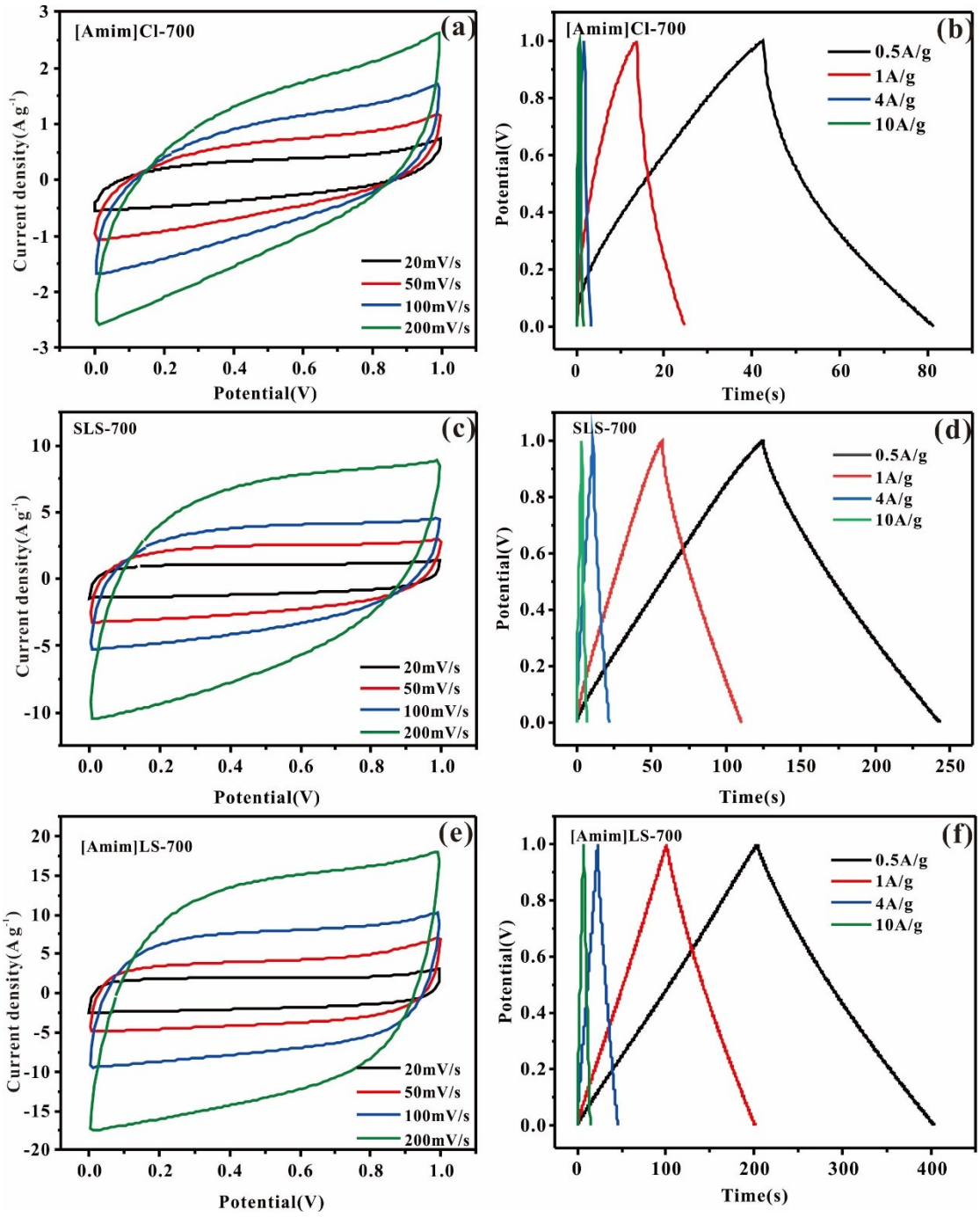

Figure S3. (a) (c) (e) CV curves at 20 mV s^{-1} - 200 mV s^{-1} and (b) (d) (f) GCD curves at 0.5 A g^{-1} ~ 10 A g^{-1} of SLS-700, [Amim]Cl-700 and [Amim]LS-700 carbon samples in 6 mol L^{-1} KOH

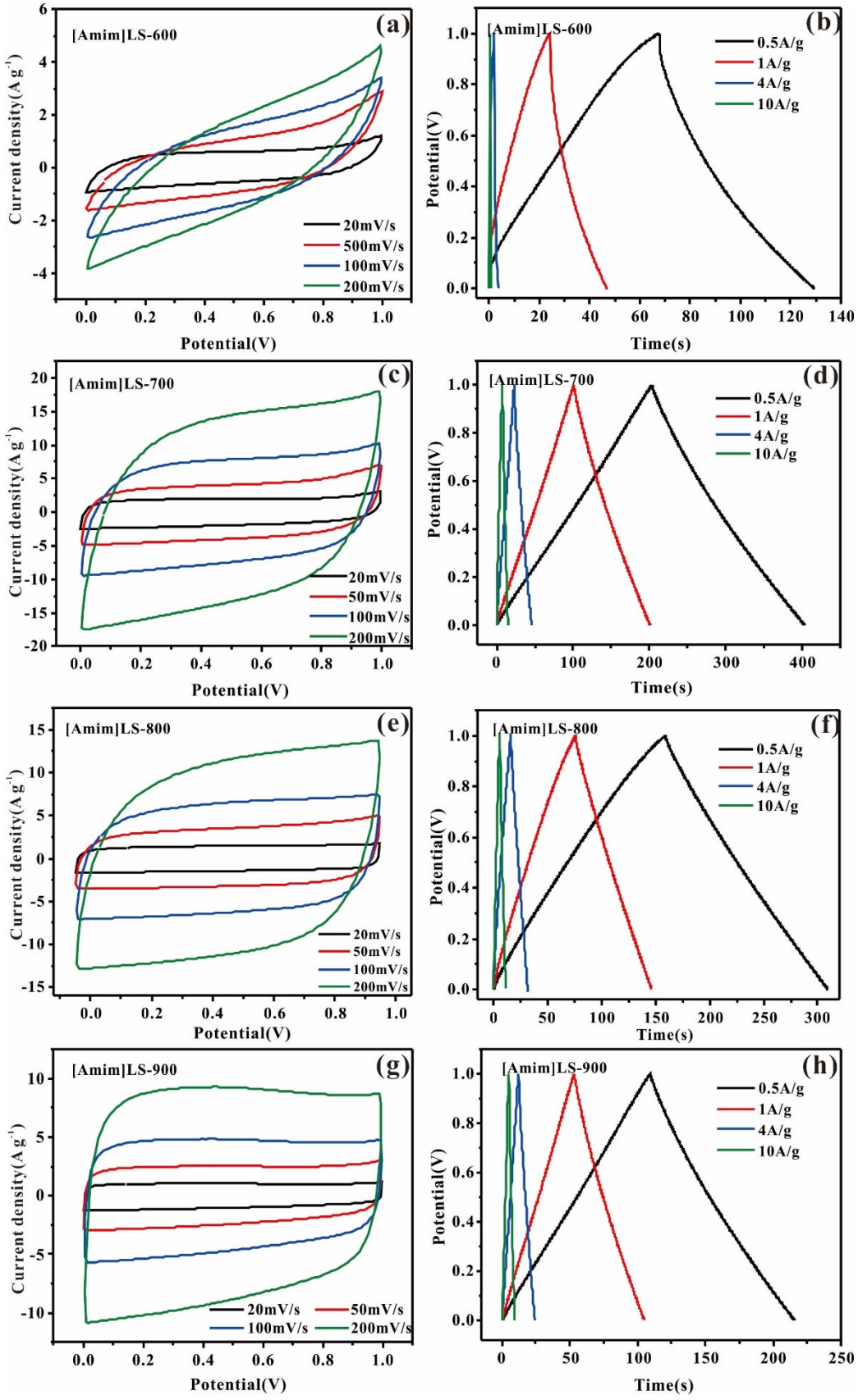

Figure S4. (a) (c) (e) (g) CV curves at 20 mV s^{-1} ~ 200 mV s^{-1} and (b) (d) (f) (h) GCD curves at 0.5 A g^{-1} ~ 10 A g^{-1} of [Amim]LS-X carbon samples in 6 mol L^{-1} KOH

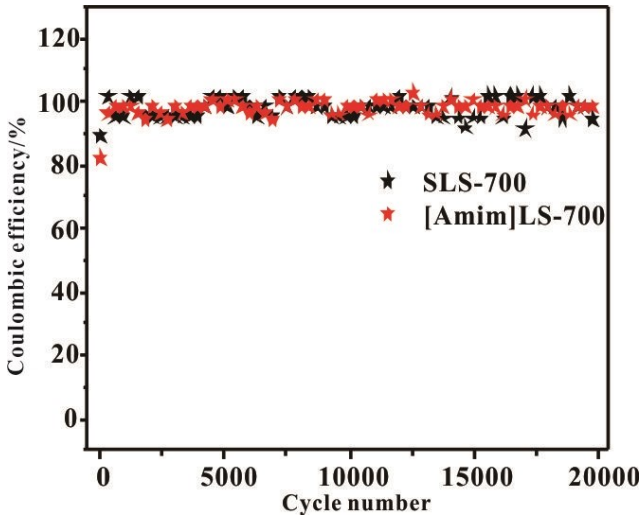

Figure S5. Coulombic efficiency of SLS-700 and [Amim]LS-700 carbon samples

Table S1 The calculated parameters of the equivalent circuit for the obtained carbon samples

	[Amim]LS-600	[Amim]LS-700	[Amim]LS-800	[Amim]LS-900	SLS-700	[Amim]Cl-700
Rs (Ω)	0.489	0.293	0.473	0.373	0.334	0.472
Rct(Ω)	15.661	0.713	0.25	0.499	1.171	1.234

Table S2 Comparison of the supercapacitance performance in this work and other literatures

Electrode	**Electrolyte**	**Frequency range**	**Potential window (V)**	**Current density ($A\ g^{-1}$)**	**Specific capacitance ($F\ g^{-1}$)**	**Energy density ($Wh\ kg^{-1}$)**	**Power density ($W\ kg^{-1}$)**	**Refs**
Lignosulfonate derived hierarchical porous carbons	7 M KOH	0.01Hz~100kHz	0 – 1	0.05	247	3.4	6.18	5
Molten salt synthesis of nitrogen-doped carbon	1 M KOH	0.01Hz~100kHz	-1 – 0	0.5	252	8.75	125	6
Nitrogen-doped ordered mesoporous carbons	6 M KOH	0.01Hz~100kHz	-0.9 - 0.1	0.5	230	5.11	100	7
Sustainable nitrogen-		0.01Hz~100k						

containing hierarchical porous carbon		Hz						
Biomass derived interconnected hierarchical micro-meso-macro- porous carbon	1 M H_2SO_4	0.01Hz~100k Hz	-0.1 - 0.9	0.2	550	19.09	50	9
Fishbone-derived N-doped hierarchical porous carbon	1 M H_2SO_4	0.01Hz~100k Hz	0 – 1.0	0.1	476	21.2	39	10
Nitrogen-Doped Porous Carbon	6 M KOH	0.01Hz~100k Hz	0 - 1.0	1	202	7.01	250	11
[Amim]LS-700	**6 M KOH**	**0.01Hz~100k Hz**	**0 - 1.0**	**0.1**	**230**	**7.99**	**25**	**This work**

Ref:

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