Electronic Supplementary Information (ESI)

Multimodal Porous Carbon Derived from Ionic Liquids: Correlation between Pore Sizes and Ionic Clusters

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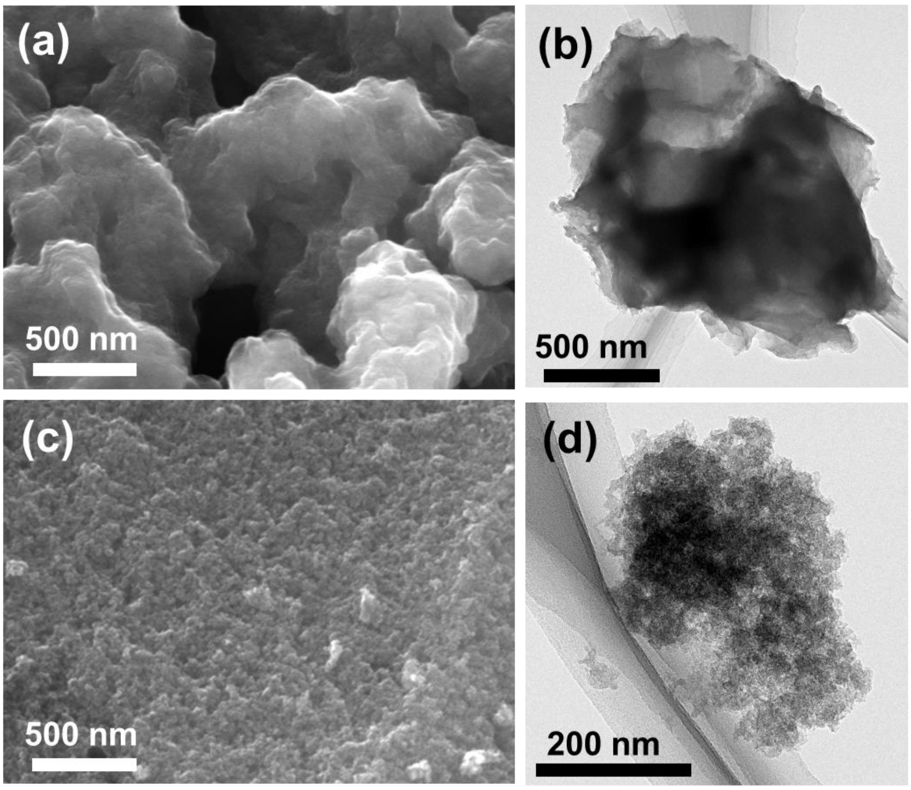

Fig. S1 SEM and TEM images of (a), (b) *co*-IL-1, and (c), (d) *co*-IL-2.

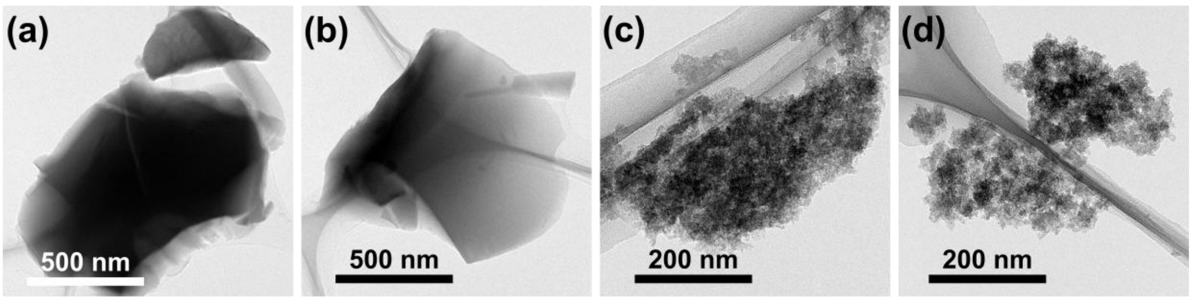

Fig. S2 TEM images of (a) IL-0, (b) *co*-IL-1, (c) *co*-IL-2, (d) *co*-IL-5.

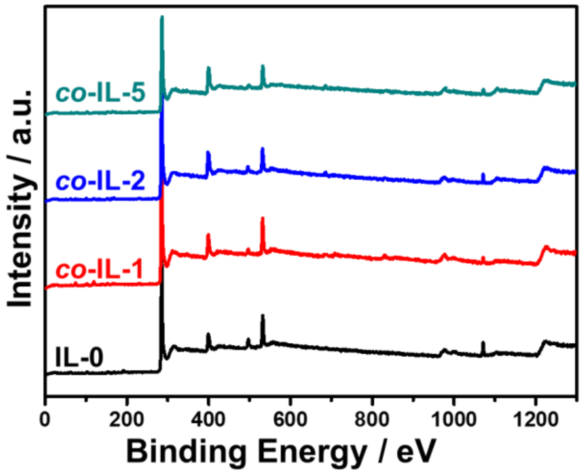

Fig. S3 XPS survey scan spectra of IL-0 and *co*-IL-derived porous carbons.

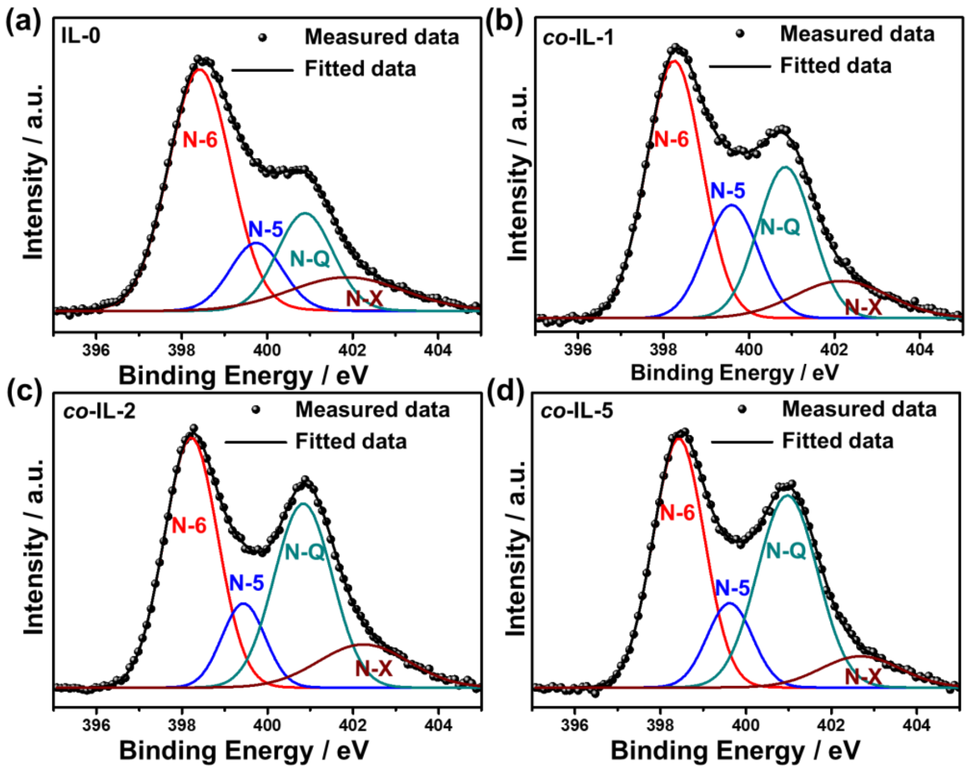

Fig. S4 XPS N 1*s* spectra of (a) IL-0, (b) *co*-IL-1, (c) *co*-IL-2, and (d) *co*-IL-5.

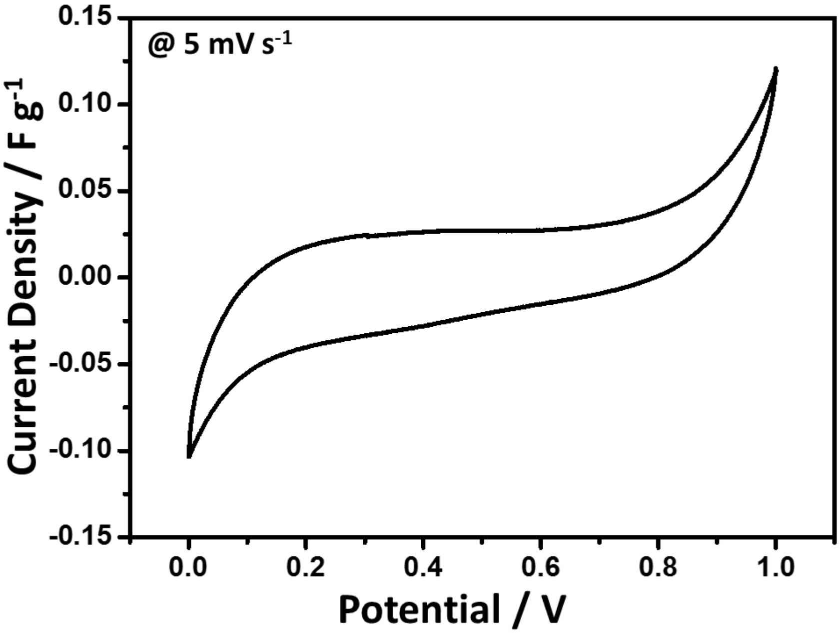

Fig. S5 Magnified CV profile of IL-0 at scan rate of 5 mV s^{-1}.

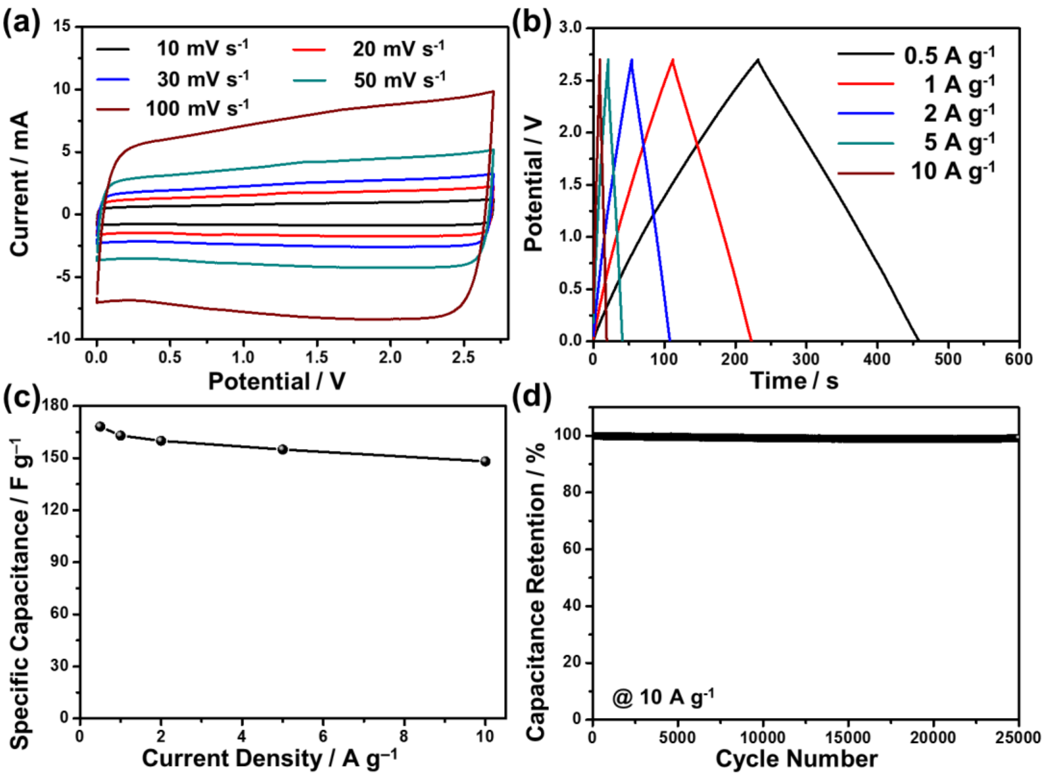

Fig. S6 Electrochemical properties of *co*-IL-5 in 1 M $TEABF_4$/ACN organic electrolyte within a potential window of 0–2.7 V. (a) CV profiles at scan rate of 10–100 mV s^{-1}, (b) GCD profiles at a current density of 0.5–10 A g^{-1}, (c) rate capabilities at various current densities between 0.5–10 A g^{-1}, at which the specific capacitance is calculated from the associated galvanostatic discharge results, and (d) capacitance retention study at 10 A g^{-1} up to 25000 cycles.

Based on the remarkable electrochemical properties of co-IL-derived porous carbons in 1 M H_2SO_4 electrolyte, electrochemical properties of the co-IL-5 were investigated in an organic electrolyte of 1 M tetraethyl ammonium tetra-fluoroborate dissolved in acetonitrile ($TEABF_4$/ACN) using the symmetrical two-electrode coin cell (2032 coin cell) at room temperature between 0-2.7 V. The *co*-IL-5 electrode was prepared using a slurry composed of 90 wt.% *co*-IL-derived porous carbon as the active material and 10 wt.% polyvinylidene fluoride (PVDF; Sigma-Aldrich) as a binder dissolved in *N*-methylpyrrolidone (NMP; Sigma-

Aldrich). The slurry was uniformly cast on an etched Al foil. The mass loading of electrodes are controlled at approximately 1 mg cm^{-2}. The 2032 coin cells, symmetrical two-electrode units, were assembled with *co*-IL-5 electrodes in Ar filled glove box. Galvanostatic charging-discharging (GCD) tests and cyclic voltammetry (CV) were performed using a potentiostat/galvanostat (VMP3, Princeton Applied Research).

Fig. S6a shows the CV profiles obtained from the *co*-IL-5 at scan rates of 10–100 mV s^{-1}, in the potential window ranging from 0 to 2.7 V. The CV profiles of *co*-IL-5 exhibit typical rectangular shapes that are maintained even at the high scan rate of 100 mV s^{-1}, indicating that the current response primarily results from electrical double-layer (EDL) formation at the interface between the *co*-IL-5 and electrolyte. As shown in Fig. S6b, the *co*-IL-5 shows linear GCD profiles at various current densities between 0.5 and 10 A g^{-1}, indicating typical EDL capacitive behaviour. The specific capacitance of a single electrode was obtained from the discharge profiles. The specific capacitance of the *co*-IL-5 was 168, 163, and 160 F g^{-1} at current densities of 0.5, 1, and 2 A g^{-1}, respectively. The specific capacitance remains 149 F g^{-1} even at a high current density of 10 A g^{-1}, indicating 89% retention of the specific capacitance measured at 0.5 A g^{-1}. Fig. S6d shows the cycling stability of the *co*-IL-5 over 25000 cycles, it can be seen that the *co*-IL-5 were highly chemically stable in a 1 M $TEABF_4$/ACN electrolyte.

Table S1 Brunauer–Emmett–Teller (BET) specific surface areas and pore characteristics IL-0 and *co*-IL-derived porous carbons.

	SSA [m^2 g^{-1}]	S_{micro} [m^2 g^{-1}]	Pore volume [cm^3 g^{-1}]	V_{micro} [cm^3 g^{-1}]
IL-0	2.1	-	-	-
co-IL-1	66.3	6.4	0.07	0.002
co-IL-2	363.8	181.1	0.21	0.078
co-IL-5	625.3	222.2	0.54	0.099

Table S2 Elemental compositions of IL-0 and *co*-IL-derived porous carbons characterized by EA and XPS.

Sample	Atomic contents (At.%)								
	EA				XPS				
	C	N	S	H	C	N	O	S	F
IL-0	79.0	11.3	0.2	1.3	79.5	9.9	10.2	0.3	0.1
co-IL-1	77.6	13.4	1.2	1.2	79.7	11.0	8.5	0.5	0.3
co-IL-2	75.5	16.7	1.1	1.4	78.5	13.7	6.6	1.0	0.2
co-IL-5	73.2	17.8	1.9	1.7	76.1	16.1	6.9	0.6	0.3