

## Electronic Supplementary Information (ESI)

### Synthesis of functionalized 3D porous graphene using both ionic liquid and SiO<sub>2</sub> spheres as “spacers” for high-performance supercapacitors application

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#### **Preparation of graphene oxide (GO)**

Natural graphite powder (3.0 g), K<sub>2</sub>S<sub>2</sub>O<sub>8</sub> (2.5 g) and P<sub>2</sub>O<sub>5</sub> (2.5 g) were mixed with H<sub>2</sub>SO<sub>4</sub> (12 mL) at 80 °C for 4.5 h. After that, the mixture was cooled down to room temperature and diluted with 500 mL distilled water along with stand overnight, and then filtered using microporous membrane (0.22 μm) to wash several times with distilled water. After being dried, KMnO<sub>4</sub> (15 g) was slowly added to the graphite powder solution with 120 mL of H<sub>2</sub>SO<sub>4</sub> at 0 °C and then the mixture was stirred for 2 h below 35 °C. Subsequently, 250 mL of distilled water was added and stirred at 35 °C for additional 2 h. Later the mixture was further diluted with 700 mL distilled water, 20 mL 30% H<sub>2</sub>O<sub>2</sub> was added slowly and the solution changed into brilliant yellow. The mixture was washed and filtrated with 1000 mL of HCl (10%) followed by distilled water to remove the acid. After dialyzed for one week, the resulting solid was filtered and freeze-dried to obtain pure graphite oxide powders. GO were obtained by ultrasonic exfoliation the graphite oxide powders with distilled water.

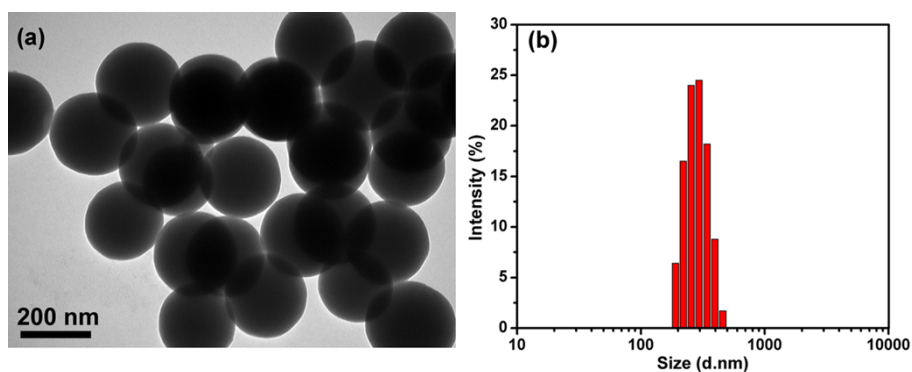


Fig. S1 (a) TEM image and (b) DLS plot of the prepared SiO<sub>2</sub> spheres.

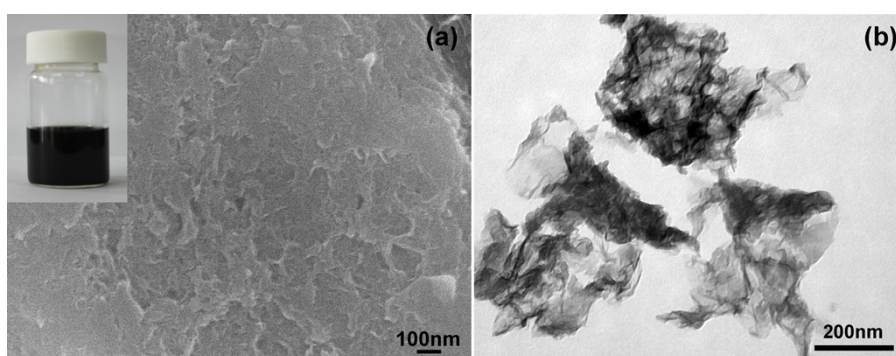


Fig. S2 SEM (a) and TEM (b) images of rGO (inset: the digital photo of rGO).

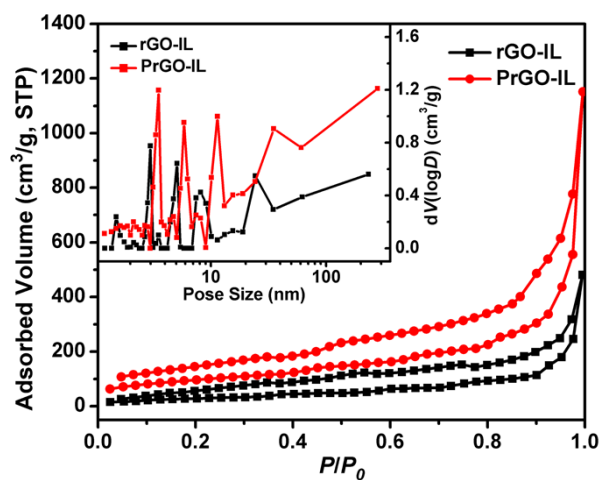


Fig. S3 Nitrogen adsorption–desorption isotherms of rGO-IL and PrGO-IL. The inset is the corresponding pore size distribution curves.

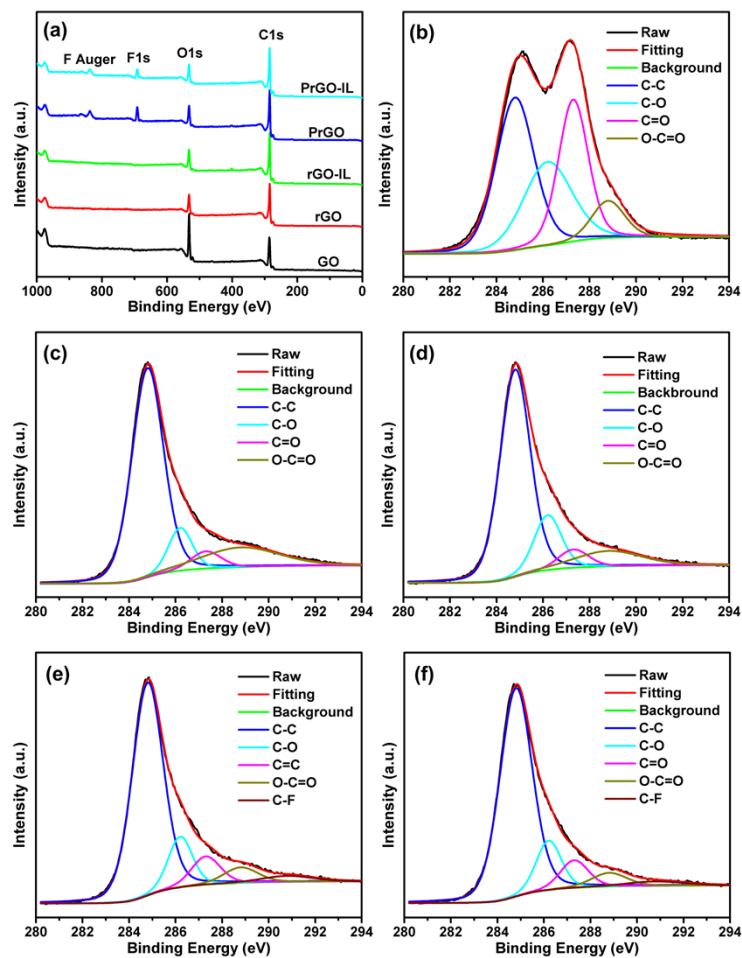


Fig. S4 (a) XPS spectra of GO, rGO, rGO-IL, PrGO and PrGO-IL, and the corresponding high resolution C 1s peaks of (b) GO, (c) rGO, (d) rGO-IL, (e) PrGO and (f) PrGO-IL.

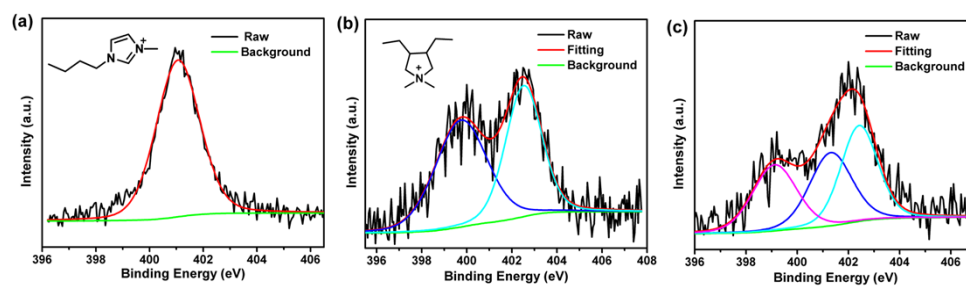


Fig. S5 The high resolution of N 1s XPS spectra of (a) rGO-IL, (b) PrGO and (c) PrGO-IL.

Table S1 Composition of all samples from elementary analysis.

| sample  | Chemical composition (wt%) |       |      |                  |
|---------|----------------------------|-------|------|------------------|
|         | C                          | O     | N    | C/O <sup>a</sup> |
| GO      | 46.81                      | 50.24 | 0.04 | 1.24             |
| rGO     | 70.46                      | 27.38 | 0.25 | 3.43             |
| rGO-IL  | 74.59                      | 20.43 | 2.50 | 4.87             |
| PrGO    | 58.15                      | 24.74 | 0.72 | 3.13             |
| PrGO-IL | 60.57                      | 25.70 | 0.94 | 3.14             |

<sup>a</sup> molar ratio.

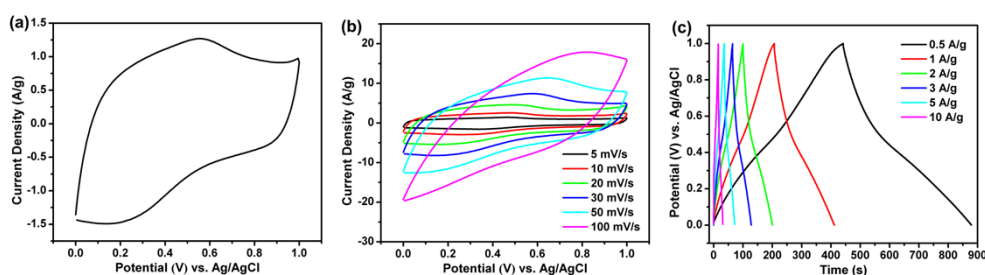


Fig. S6 (a) CV curve of rGO electrode at a scan rate of  $5 \text{ mV s}^{-1}$ . CV (b) and GCD curves (c) of rGO-IL electrode at different scan rates or current densities. Data obtained from three-electrode cell with  $1 \text{ M H}_2\text{SO}_4$  as aqueous electrolyte.

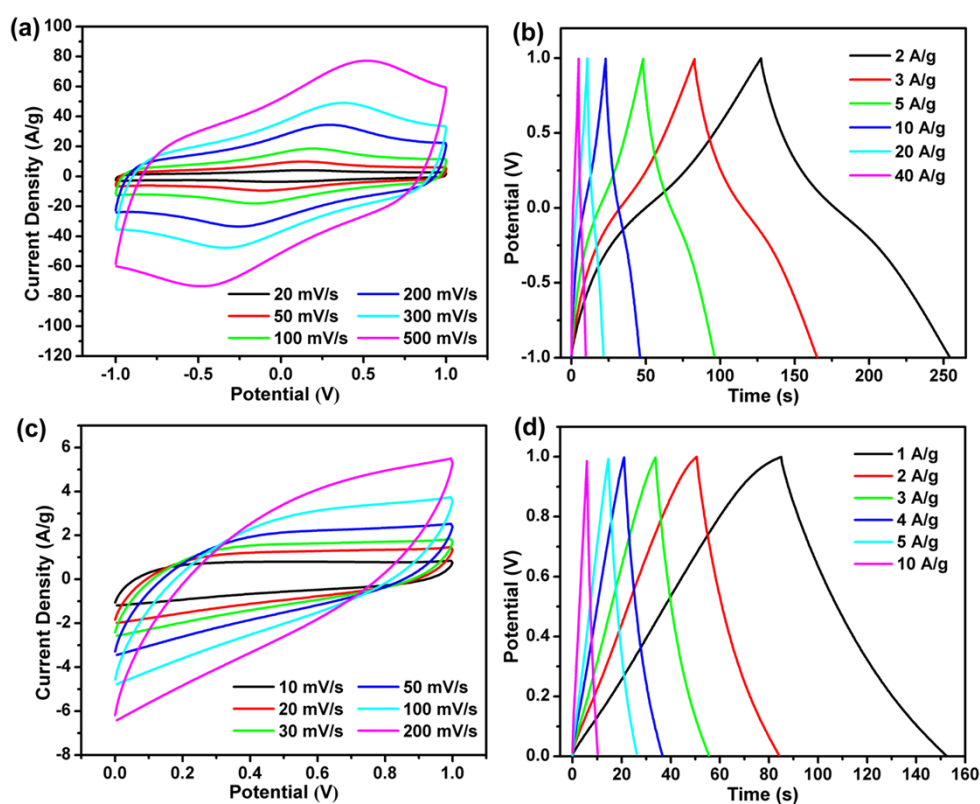


Fig. S7 CV curves (a) and GCD curves (b) of PrGO-IL supercapacitor at different scan rates or current densities within the potential range of  $-1.0$  to  $1.0 \text{ V}$ . CV curves (c) and GCD curves (d) of rGO-IL supercapacitor between  $0$  and  $1.0 \text{ V}$  at different scan rates or current densities.

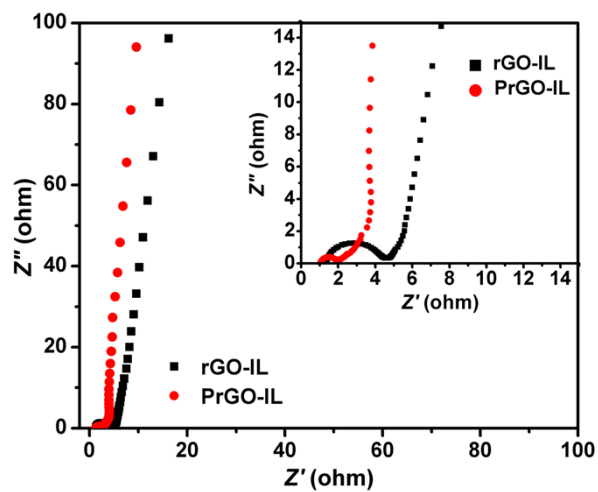


Fig. S8 EIS of rGO-IL and PrGO-IL with sweep frequency of 10 mHz to 100 kHz. The inset shows the magnified high-frequency regions.