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# Supplementary Information

## Effects of concentration and temperature of $EMIMBF_4$/acetonitrile electrolyte on the supercapacitive behavior of graphene nanosheets

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**NMR data:**

**EMIMBF$_4$**: $^1$H NMR (400 MHz, Acetone-$d_6$): δ = 8.98 (s, 1 H), 7.76 (s, 1 H), 7.66 (s, 1 H), 4.38 (t, J = 7.3 Hz, 2 H), 4.03 (s, 3 H), 1.55 (t, J = 7.4 Hz, 3 H) ppm; $^{13}$C NMR (Acetone-$d_6$): δ = 137.27, 124.64, 122.96, 45.57, 36.41, 15.54 ppm.

## $^1$H and $^{13}$C NMR spectra:

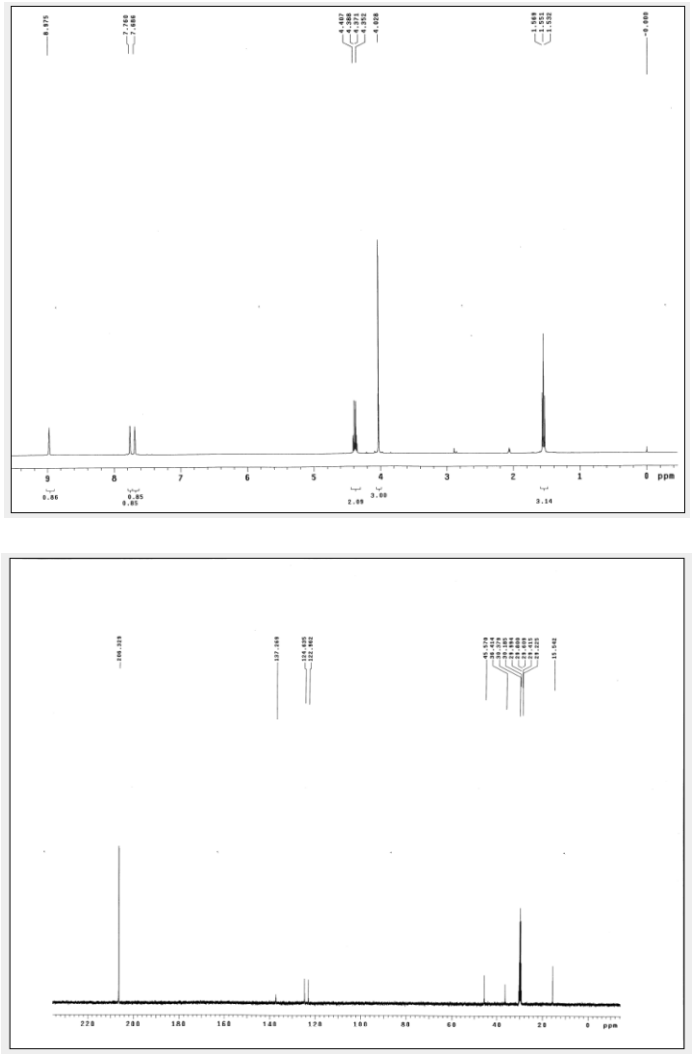

**Fig. S 1 The $^1$H (top) and $^{13}$C (bottom) NMR spectra of the EMIMBF$_4$ ionic liquids**

**Table. S1 The time for the EMIMBF$_4$/acetonitrile electrolytes with different molar concentrations at different operating temperatures flowing through the capillary.**

| | T (°C) | Time (s) | | | Average time (s) |
|---|---|---|---|---|---|
| | | $t_1$ | $t_2$ | $t_3$ | |
| 1 | -20 | 169 | 168 | 168 | 168 |
| 2 | -10 | 144 | 144 | 143 | 144 |
| 3 | 0 | 124 | 124 | 124 | 124 |
| 4 | 10 | 109 | 109 | 109 | 109 |
| 5 | 20 | 97 | 97 | 97 | 97 |
| 6 | 30 | 88 | 88 | 89 | 88 |
| 7 | 40 | 80 | 80 | 80 | 80 |
| 8 | 50 | 74 | 74 | 74 | 74 |
| 9 | 60 | 68 | 69 | 68 | 68 |

**Table. S2 The density of 2.0 M EMIMBF$_4$/acetonitrile electrolytes with different molar concentrations at different operating temperatures**

| | T (°C) | Volume (mL) | The mass of empty volumetlric flask (mg) | The mass of volumetlric flask containing IL (mg) | Density (g/mL) |
|---|---|---|---|---|---|
| 1 | -20 | 25 | 21065.34 | 44567.84 | 0.942 |
| 2 | 0 | 25 | 21469.21 | 44468.50 | 0.921 |
| 3 | 20 | 25 | 21469.21 | 44000.30 | 0.903 |
| 4 | 40 | 25 | 20548.41 | 42559.40 | 0.881 |
| 5 | 60 | 25 | 21065.34 | 42880.80 | 0.867 |

**Table. S3 The density of $EMIMBF_4$/acetonitrile electrolytes with different molar concentrations**

| Molar concentration | 0 M | 0.5 M | 1.0 M | 1.5 M | 2.0 M | 2.5 M | 3.0 M | 3.5 M | 4.0 M |
|---|---|---|---|---|---|---|---|---|---|
| Density (g/mL) | 0.764 | 0.822 | 0.861 | 0.903 | 0.946 | 0.981 | 1.017 | 1.062 | 1.091 |

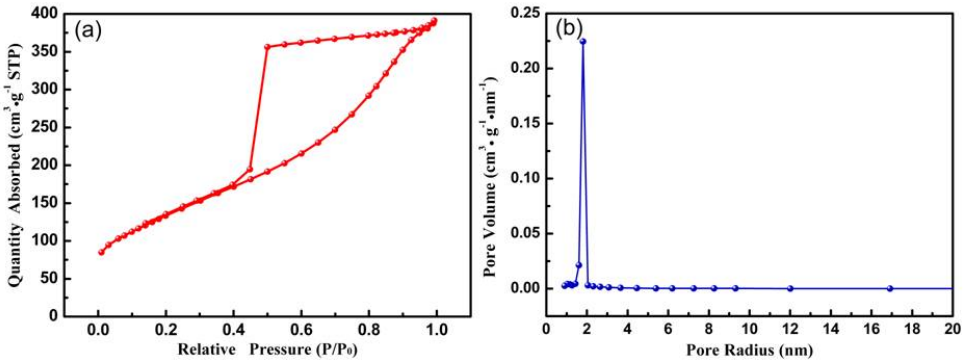


**Fig. S2**. (a) Nitrogen adsorption/desorption isotherms of GNSs, (b) pore distribution of GNSs.

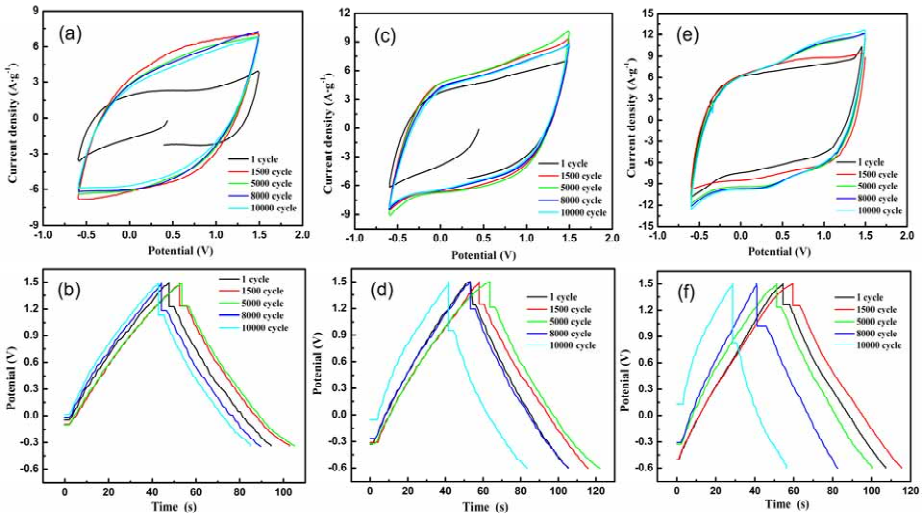


**Fig. S3** CV curves of the GNSs electrode in 2.0 M $EMIMBF_4$/acetonitrile electrolyte with the scan rates of 100 $mV \cdot s^{-1}$ at different operating temperatures: (a) -20 °C, (c) 20 °C and (e) 60 °C. Galvanostatic charge/discharge curves of the GNSs electrode in 2.0 M $EMIMBF_4$/acetonitrile electrolyte with the current density of 4 $A \cdot g^{-1}$ at different operating temperatures: (b) -20 °C, (d) 20 °C and (f) 60 °C.


**Fig. S4** The color changes of $EMIMBF_4$/acetonitrile electrolyte before and after cycling at different operating temperatures: (a) -20 °C, (b) 20 °C and (c) 60 °C.

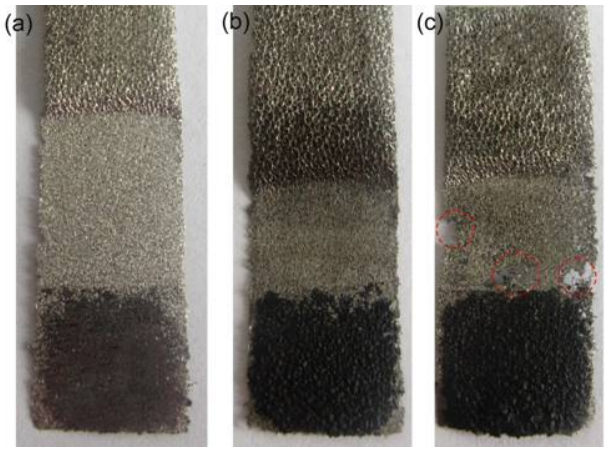


**Fig. S5** Digital photograph of the working electrode with the different cycle number at 60 °C: (a) 0 cycle, (b) 1500 cycles and (c) 10000 cycles.