# Supplementary Information

## Surface area measurements

The method of methylene blue (MB) adsorption was employed to measure the specific surface area of as-synthesized RGO-based materials.[1] For this experiment, 0.2 g of adsorbents were dispersed in deionized water (15 ml) by sonication for 1 h, and MB solution (5 g $L^{-1}$) was added to the suspension. The resulting mixture was stirred continuously for 24 h to reach the adsorption-desorption equilibrium of MB. Suspended materials were then removed by centrifuging the mixture, and the remnant concentration of MB in the supernatant was measured using a Hach DR-2000 spectrophotometer (Hach Company, USA) at 665 nm wavelength. Then, the amount of MB added versus the amount of absorbed MB was plotted to identify the point of complete cation replacement (CPR) (Fig. S1). The specific surface is computed from the amount of absorbed MB at CRP point with the following equation:

$$S_s = \frac{m_{MB}}{319.87} A_v A_{MB} \frac{1}{m_s} \quad \text{(S1)}$$

Where $m_{MB}$ is the mass of the absorbed MB at the point of complete cation replacement, $m_s$ is the mass of RGO-based materials, $A_v$ is Avogadro's number ($6.02 \times 10^{23}$/ mol), and $A_{MB}$ is the area covered by one MB molecule (130 $A^{\circ 2}$).

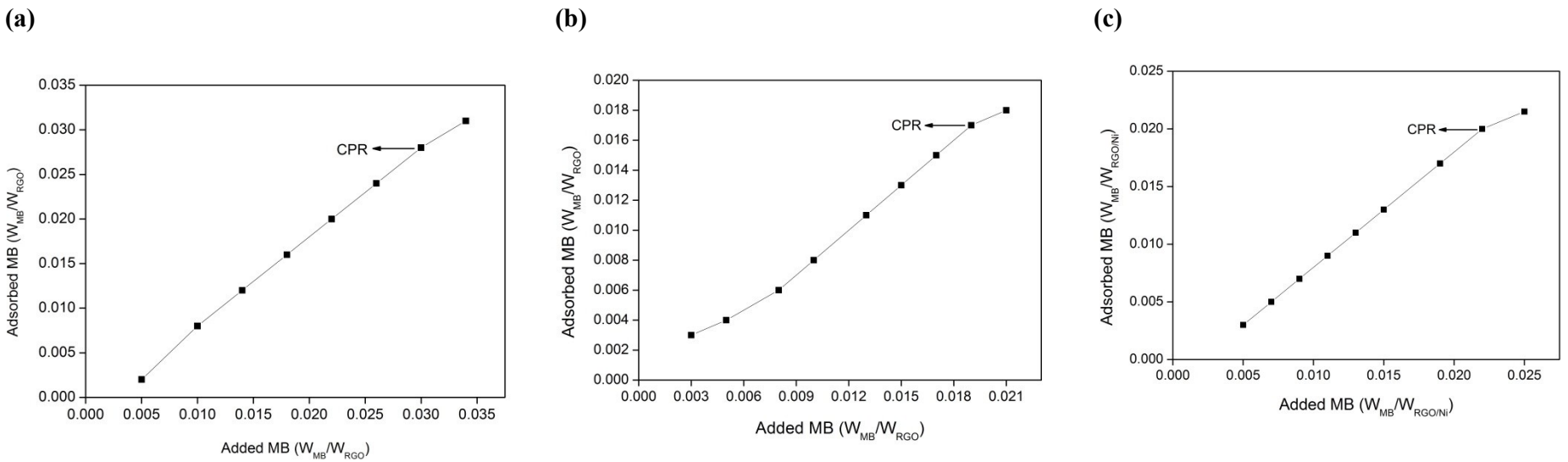
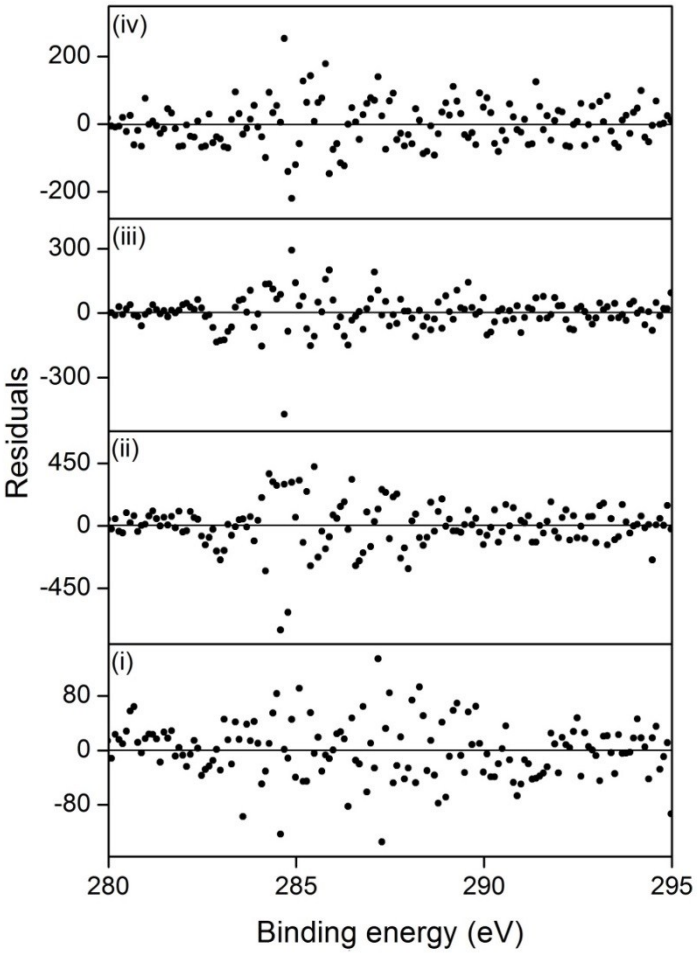



**Fig. S1** Determination of the point of complete cation replacement from the titration curve: (a) $RGO_{HI\text{-}AcOH}$, (b) $RGO_{hydrazine}$, (c) G1N1 composite.

**(a)**




**(b)**

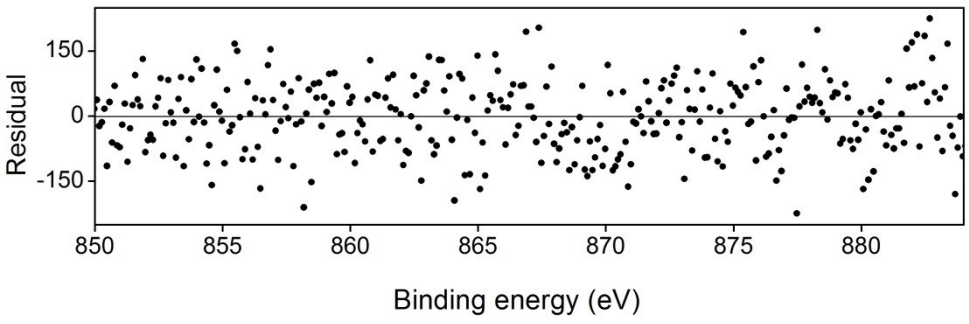



**Fig. S2** Residual plots from XPS of (a) C1s, and (b) Ni2p of the (i) GO, (ii) $RGO_{HI\text{-}AcOH}$, (iii) $RGO_{hydrazine}$, and (iv) G1N1composite samples.

**Table S1** Comparison of electrochemical (charge/discharge) performance of single RGO based electrode materials in supercapacitor applications.

| Material | Substrate | Electrolyte | Cs, F $g^{-1}$ | References |
|---|---|---|---|---|
| $RGO_{HI\text{-}AcOH}$ | Carbon cloth | PBS | 70 (0.2) | This study |
| $RGO_{TBAOH\text{-}hydrazine}$ | Glassy carbon | $H_2SO_4$ | 194 (1) | 2 |
| $RGO_{thermal}$ | Copper mesh | KOH | 261 (0.4) | 3 |
| $RGO_{HPA/I2}$ | Nickel foam | KOH | 212 (0.2) | 4 |
| $RGO_{HPA/I2}$ | Titanium mesh | $H_2SO_4$ | 279 (0.2) | 4 |
| Paper $RGO_{flame}$ | Nickel foam | KOH | 212 (1) | 5 |
| $RGO_{electrochemical}$ | Glassy carbon | $H_2SO_4$ | 246 (0.0002) | 6 |
| $RGO_{KOH\text{-}hydrazine}$ | Glassy carbon | $H_2SO_4$ | 253 (0.2) | 7 |
| $RGO_{thermal}$ | Stainless steel | $LiPF_6$ in mixture of organic carbonates | 132 (0.2) | 8 |

* In all cases, the electrodes were fabricated by means of drop-drying.
( ): current density, A $g^{-1}$

## References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