

Electronic Supplementary Information (ESI) for RSC Advances

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Electronic Supplementary Information

Simultaneous Regulation of morphology, crystallization, thermal stability and adsorbability of electrospun polyamide 6 nanofibers *via* graphene oxide and chemically reduced graphene oxide

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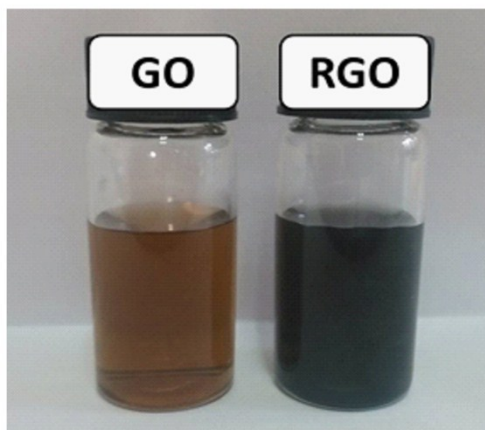


Fig. S1 Photographs of GO and RGO suspensions dispersed in formic acid, after placed statically for 2 weeks. GO can be easily exfoliated and dispersed in formic acid due to strong interaction between abundant polar groups (e.g. hydroxyl, carboxylic acid and epoxy groups) of GO and carboxyl groups of formic acid. After reduction, , the π - π stacking tendency of RGO is restrained due to the stabilization effect of oxidized products of *L*-AA, endow RGO with good dispersibility.

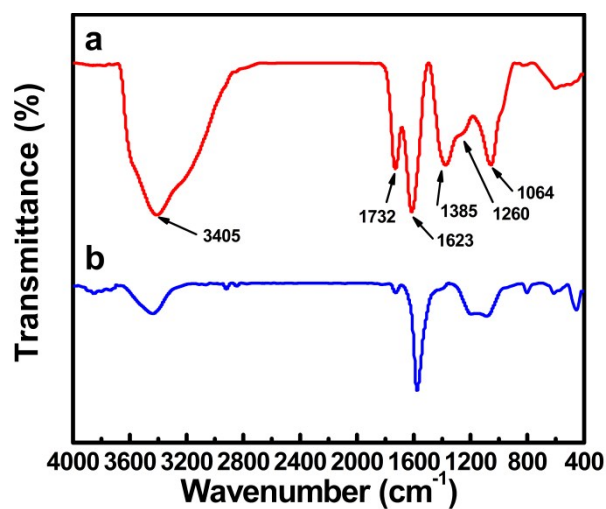


Fig. S2 FT-IR transmittance spectra of GO (a) and RGO (b). After reduction, the absorption peaks such as C=O (carbonyl) at 1732 cm^{-1} , O-H at 3405 cm^{-1} and 1385 cm^{-1} , C-O (epoxy) at 1260 cm^{-1} , and C-O (alkoxy) at 1064 cm^{-1} in GO ^{2,3} decrease dramatically, suggesting that most oxygen functionalities are removed.

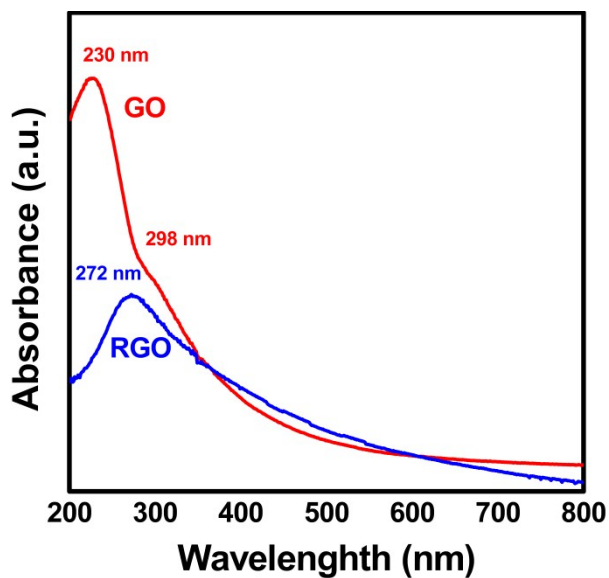


Fig. S3 UV-Vis spectra of GO and RGO aqueous dispersions. The UV-Vis curve of GO dispersion exhibits a peak at 230 nm and a shoulder at 298 nm, attributed to $\pi \rightarrow \pi^*$ transition of phenyl and $n \rightarrow \pi^*$ transition of C=O bonds, respectively. For the RGO, the shoulder at 298 nm disappears and the peak at 230 nm red-shifts to 272 nm due to the restored electronic conjugation.⁴

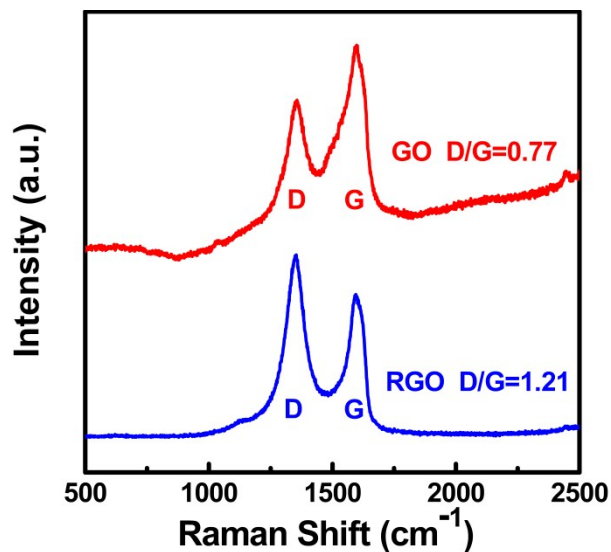


Fig. S4 Raman spectra of GO and RGO. GO displays a D band at 1351 cm⁻¹ and a G band at 1595 cm⁻¹, attributed to the first order scattering of the E_{2g} mode⁵ and the reduction in size of the in-plane *sp*² domains,⁴ respectively. RGO also contains both D band (at 1349 cm⁻¹) and G band (at 1593 cm⁻¹) but has increased D/G ratio than GO, suggesting that more *sp*² domains are formed.^{4,6}

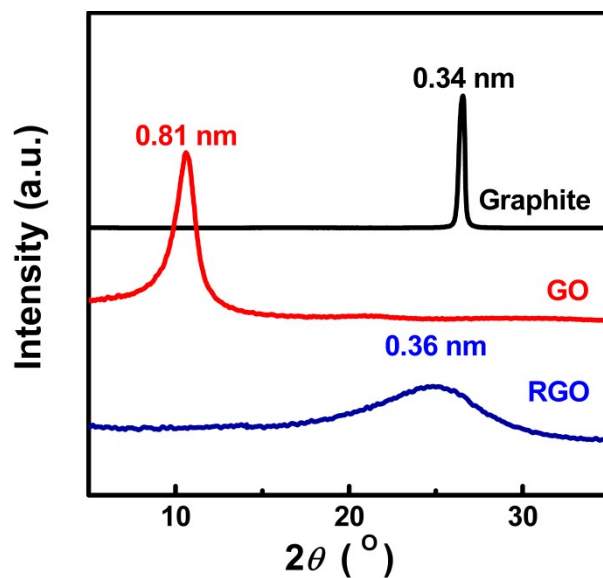


Fig. S5 XRD patterns of pristine graphite, GO and RGO. Pristine graphite exhibits a sharp diffraction peak at $2\theta = 27.3^\circ$ corresponding to a d -spacing of 0.34 nm. After oxidation, the diffraction peak of GO shifts to $2\theta = 11.1^\circ$ or d -spacing of 0.81 nm due to the intercalation by oxygen-containing groups. RGO shows a weak diffraction at $2\theta = 25.8^\circ$ or d -spacing 0.36 nm being very close to the pristine graphite, indicating the functional groups of GO have been efficiently removed.⁷

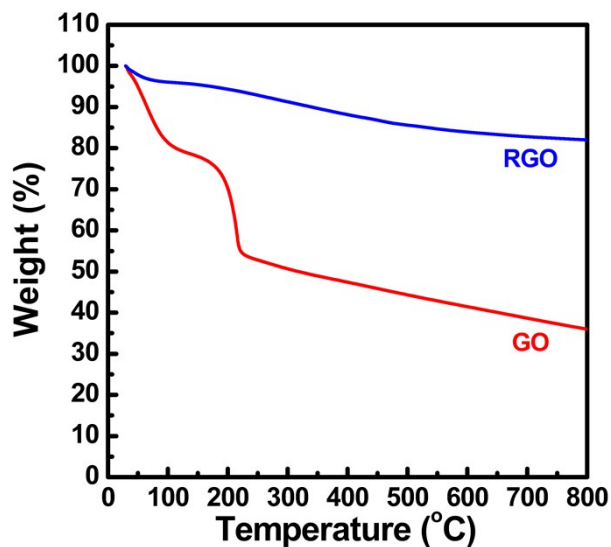


Fig. S6 TGA curves of GO and RGO. The GO powder exhibits about 20 % weight loss below 100 °C and more than 40 % loss at 200 °C, resulting from the removal of the labile oxygen-containing functional groups, yielding CO, CO₂ and H₂O vapors.^{4,8} The slow, steady mass loss (~ 20 %) observed in the whole temperature range above 200 °C can be ascribed to desorption of more stable oxygen functional groups.⁹ On the other hand, apart from a slight mass loss below 200 °C attributed to the loss of adsorbed water, no significant mass loss is detected for RGO up to 800 °C, suggesting the efficient removal of oxygen functional groups.

Table S1 Langmuir and Freundlich isotherm parameters for Cu (II) adsorption on nanofibers.

| Samples | Langmuir | | | Freundlich | | |
|----------|--------------|------|-------|-------------------------------|-------|-------|
| | Q_m (mg/g) | b | R^2 | K ((L/mg) ^{1/n}) | $1/n$ | R^2 |
| PA 6 | 4.77 | 1.79 | 0.997 | 4.27 | 0.02 | 0.845 |
| GO/PA 6 | 5.33 | 0.89 | 0.997 | 4.54 | 0.03 | 0.920 |
| RGO/PA 6 | 4.96 | 1.65 | 0.993 | 4.41 | 0.02 | 0.852 |

The Langmuir adsorption equation can be expressed as

$$Q_e = \frac{Q_m b C_e}{1 + b C_e} \quad (1)$$

where C_e and Q_e are the equilibrium Cu²⁺ concentration (mg L⁻¹) and equilibrium absorption capacity (mg g⁻¹), respectively. Q_m is the maximum adsorption capacity (mg g⁻¹) and b is the Langmuir constant (L mg⁻¹) associated with the binding energy.

The Freundlich equation can be expressed as

$$Q_e = K C_e^{1/n} \quad (2)$$

where K ((L/mg)^{1/n}) and n are the empirical Freundlich constants, representing the adsorption capacity and adsorption intensity, respectively.

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