

Electronic supporting information

**Enhanced power factor within graphene hybridized carbon aerogels**

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**Preparation of graphene oxide**

Graphene oxide was prepared through a modified Hummers method.<sup>1, 2</sup> In a typical experiment, graphite (10 g) and sodium nitrate (5 g) were put into a 1 L flask at 0 °C, and then concentrated H<sub>2</sub>SO<sub>4</sub> (230 mL) was slowly added into the flask under stirring for 0.5 hours. In this process the temperature of mixture was kept under 10 °C. Subsequently 30 g of KMnO<sub>4</sub> was added little by little in 1.5 hours to prevent the rapid temperature rise and the temperature was kept at ~10 °C. The mixture was continuously stirred for 2 hours. Then, the temperature was lifted to 35±3 °C and maintained for another 2 hours under agitation. After the reaction was completed, 460 mL of deionized water was poured slowly into the solution under vigorous stirring with the temperature around 98 °C, and a dark brown suspension was obtained. This

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suspension was further treated by adding 150 mL of H<sub>2</sub>O<sub>2</sub> (5 %) to convert the residual permanganate and MnO<sub>2</sub> into soluble MnSO<sub>4</sub>, and then diluted to approximately 1.4 L. Upon treatment, the resulting suspension becomes bright yellow. After washing for several times with diluted HCl (3 %) and deionized water, the GO aqueous suspension was concentrated to different concentrations, which were then subjected to vigorous mechanical stirring for 24 hours and ultra sonication for 0.5 hours.

#### **TGA result of GO aerogel and RF aerogel**

TGA results of the GO aerogel and the RF aerogel are used to calculate the graphene content (wt %) in the graphene hybridized carbon aerogels. After pyrolysis at high temperature, the mass remaining of GO ( $mr(GO)$ ) and that of RF ( $mr(RF)$ ) were recorded as shown in Fig. S2. The graphene content (wt %) in the carbon aerogels was calculated by the formula as follows.

$$\text{Graphene \%} = \frac{m(GO) \times mr(GO)\%}{m(GO) \times mr(GO)\% + m(RF) \times mr(RF)\%}$$

$$mr(GO) = 21.74 \%, mr(RF) = 12.55 \%$$

Therefore, 9 wt %, 15 wt %, 20 wt % and 27 wt % of the doped concentrations of GO in the GO-RF hydrogels correspond to 15 wt %, 23 wt %, 31 wt % and 39 wt %, respectively, for the graphene contents in the graphene hybridized carbon aerogels.

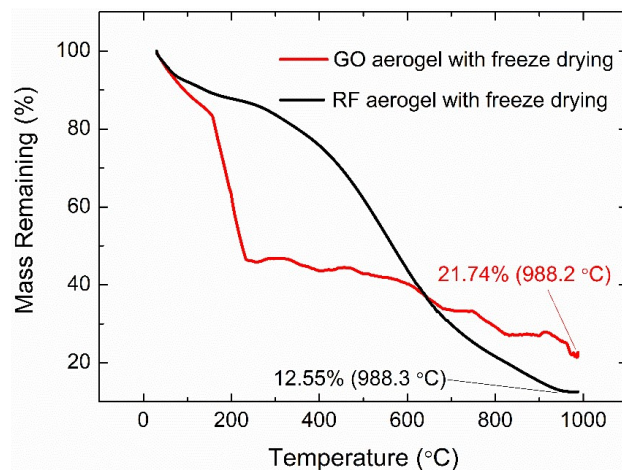


Fig. S1 TG curves of the GO aerogel and the RF aerogel.

### AFM image of graphene oxide

The AFM image indicates the size and thickness of GO. The plane size of GO ( $\sim 3.4 \mu\text{m}$ ) is much smaller than that of natural graphite flakes ( $40 \mu\text{m}$ ) due to the oxidation process shearing the graphite layers. The thickness of GO is around 0.8 nm.

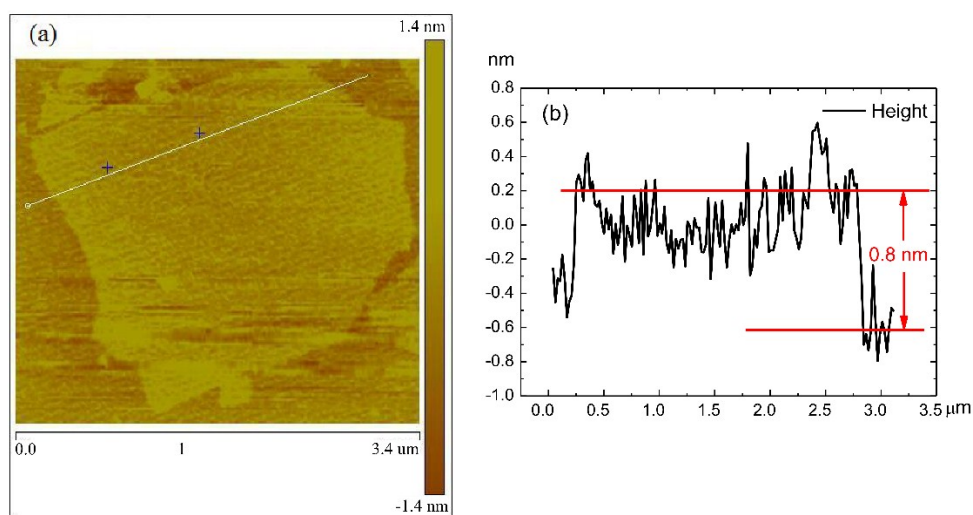


Fig. S2 (a) AFM image of the graphene oxide and (b) the height profile for the graphene oxide

## References

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