

## Supplementary information

### **Superior conductive polystyrene – chemically converted graphene nanocomposite**

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Descriptions of chemicals, GO synthesis, Morphology of the fresh fractured surface of PS-CCG pellets and Tg determined by DSC.

#### **1. Chemicals**

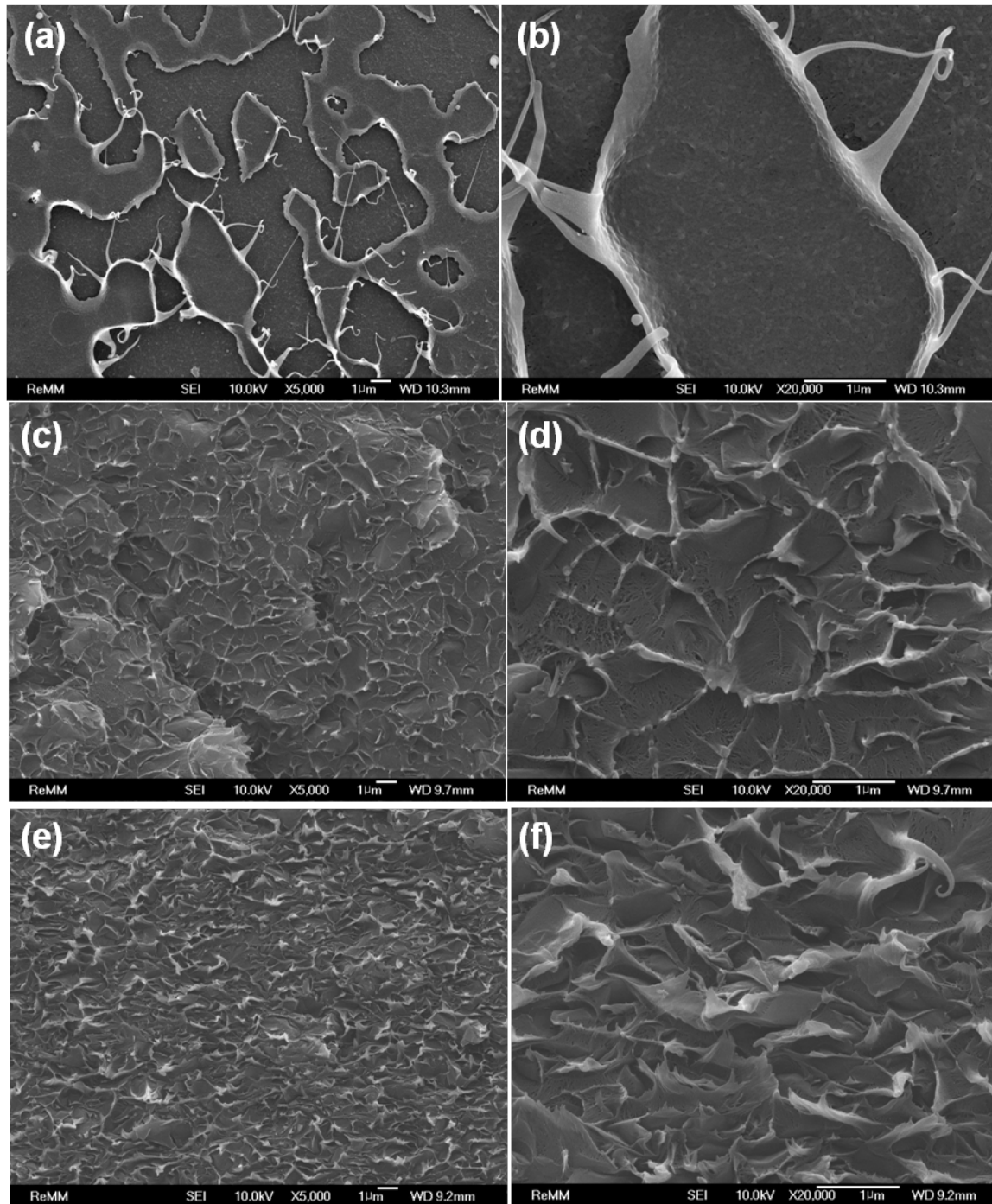
Expandable graphite (Grade 1721) was supplied by Asbury Carbon. Concentrated sulfuric acid (H<sub>2</sub>SO<sub>4</sub>), potassium permanganate (KMnO<sub>4</sub>), hydrochloric acid (HCl), hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) was purchased from Samchun Chemical (Korea). Hydrazine hydrate (N<sub>2</sub>H<sub>4</sub>), 1-methyl-2-pyrrolidinone (NMP) and polystyrene (Mw~ 192.000) were purchased from Sigma-Aldrich. All chemicals were used as received without further purification.

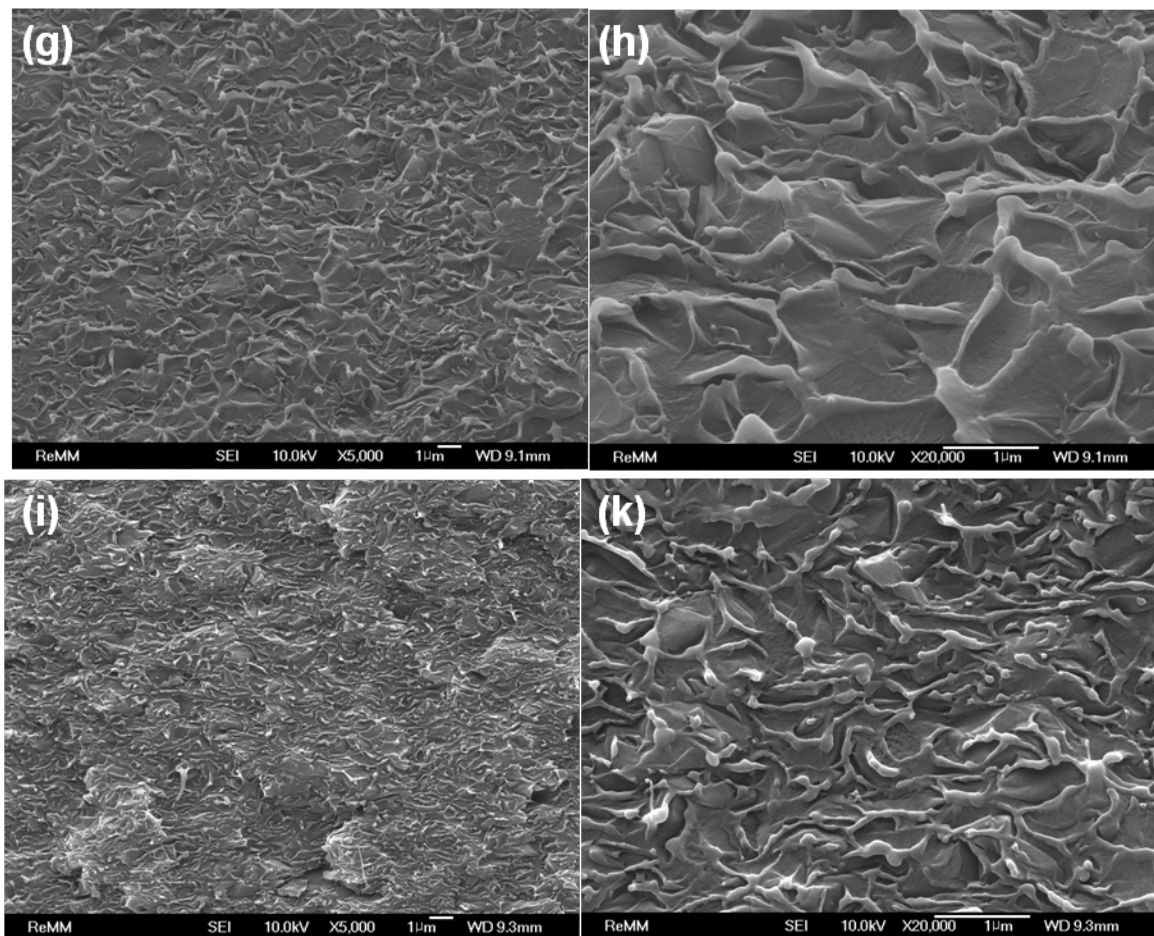
## 2. Synthesis of GO

A small amount of expandable graphite was charged into a 1-L beaker and heated for 10 s in a microwave oven (Panasonic, NN-5653A). The graphite expanded to about 150 times its original volume. Graphene oxide (GO) was synthesized from expanded graphite according to a modified Hummers method [1]. Typically, 500 mL of concentrated H<sub>2</sub>SO<sub>4</sub> was charged into a 3-L, three-necked flask equipped with a mechanical stirrer (Teflon impeller). The flask was put into an ice bath to chill to 0°C. Five grams of expanded graphite were gradually added under stirring to make a suspension. Then, 30 g of KMnO<sub>4</sub> was slowly added so that the temperature did not exceed 20°C. The temperature was then elevated to 35°C, and the suspension was stirred for 2 h. The flask was then chilled again in the ice bath, and 1 L of deionized water was slowly added to maintain a temperature below 70°C. The mixture was stirred for 1 h and subsequently diluted with 5 L of deionized water. Fifty milliliters of H<sub>2</sub>O<sub>2</sub> (30 wt%) was slowly added, and vigorous bubbles appeared as the color of the suspension changed from dark brown to yellow. The suspension was centrifuged and washed with 3.6 wt% HCl solution four times, followed by centrifuging at 10,000 rpm and washings with deionized water to completely remove the acid until the pH of the GO dispersion reached 6. The as-synthesized GO dispersion was in a paste form. The concentration of GO was around 1.0 wt%, which was determined after drying the GO dispersion at 80 °C under vacuum for 24 h.

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### 3. Morphology of fresh fractured surface of PS-CCG pellets





**Fig. S1** Morphology of the fresh fractured surface of PS-CCG pellets as function of CCG volume fraction. (a, b) pristine PS, (c, d) 0.24 vol.%, (e, f) 0.48 vol.%, (g, h) 0.96 vol.% and (i, h) 1.94 vol.%

The Fig. S1 shows the SEM images of fresh fractured surface of PS-CCG pellets as function of CCG loading. The fractured surface was coated with thin film of Pt as conductive layer before imaging by SEM. The SEM images show that there are large difference in morphology of pristine PS and PS-CCG. The fractured surface of PS is quite flat with many slice layers with some fringe at the edge. The incorporation of CCG into PS matrix resulted to totally changing the morphology of fractured surface. On the fractured surface of PS-CCG, there are several wave-like flakes with the size from 1 to few microns raised from surface. The density and the

thickness of these wave-like flakes increased with CCG loading. By comparing the shape and length, density and distribution of the wave-like flakes with the CCG sheets dispersed in PS matrix characterized by SEM in charge contrast mode in Fig. 1, it can be concluded that the wave-like flakes are CCG sheets which were pull out of the surface during breaking the pellet. The thickness of the wave-like flake is tens of nanometer, which is significantly thicker than the thickness of CCG sheet can be explained by the adhesion of the PS. The appearance of the wave-like flakes on the fractured surface of PS-CCG indicates the good interaction between CCG sheets and PS matrix.

#### 4. Glass transition temperature of PS-CCG determined by DSC

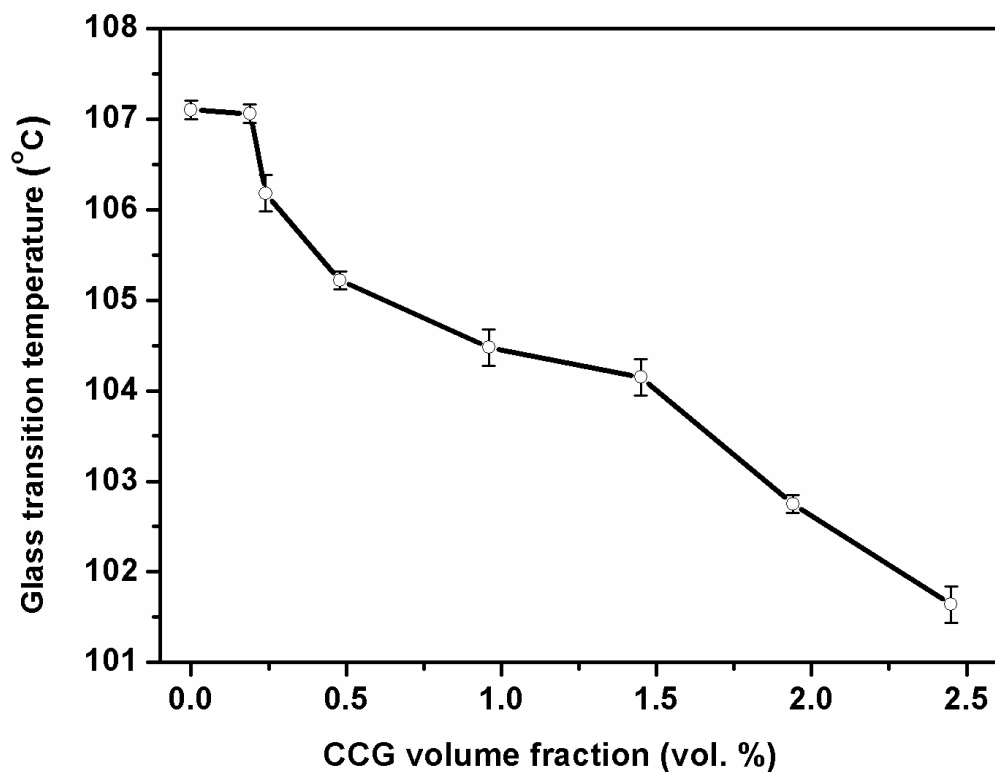


Fig. S2 The T<sub>g</sub> of PS-CCG as function of CCG loading