Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Enhanced electromagnetic wave absorption and mechanical performances of graphite nanosheet/ PVDF foams via ice dissolution and normal pressure drying

Xiaogang Su[a*], Yu Zhang[a], Jun Wang[a], Yaqing Liu[a*]

a. Key Laboratory of Functional Nanocomposites of Shanxi Province, School of Materials Science and Engineering, North University of China, Taiyuan, 030051, China

Preparation of GNS

Expanded graphite with a diameter of 200 mesh was selected as the raw material and treated in a high temperature furnace at 950°C for 15 s to obtain volumetric fluffy expanded graphite. Subsequently, 1 g of expanded graphite was placed in 500 mL of a mixture of 85:15 ethanol and water and sonicated for 10 h. Next, the mixture was filtered and the wet material was obtained, and then the ultrasonic dispersion was continued in a mixture of tert-butanol and water, where the proportion of tert-butanol was 30%. Finally, the desired graphene nanosheets were obtained after 48 h of freeze-drying.

Calculation of impedance matching

$$|\Delta| = \left|\sinh^2(Kfd) - M\right| \tag{1}$$

$$M = \frac{4\mu'\cos\delta_e\varepsilon'\cos\delta_m}{(\mu'\cos\delta_e - \varepsilon'\cos\delta_m)^2 + \left[\tan\left(\frac{\delta_m}{2} - \frac{\delta_e}{2}\right)\right]^2(\mu'\cos\delta_e + \varepsilon'\cos\delta_m)^2} \tag{2}$$

$$K = \frac{4\pi\sqrt{\varepsilon'\mu'}\sin\frac{\delta_e + \delta_m}{2}}{c\cdot\cos\delta_e\cdot\cos\delta_m} \tag{3}$$

Calculation of total loss capacity

$$\alpha = \frac{\pi f}{c}\left(2\left(\mu''\varepsilon'' - \mu'\varepsilon' + \left(\left(\mu''^2 + \mu'^2\right)\left(\varepsilon''^2 + \varepsilon'^2\right)\right)^{1/2}\right)\right)^{1/2} \tag{4}$$

$$\alpha_T = \sum_{2}^{18}\alpha_f \tag{5}$$

Here, α_f is loss capacity at f frequency, and α_T is total loss capacity in the range of 2-18 GHz.

Figure S1. The digital image of foam

Figure S2. Results of EDS for PG-3. (a) Original diagram, (b) Carbon element, (c) Fluorine element.

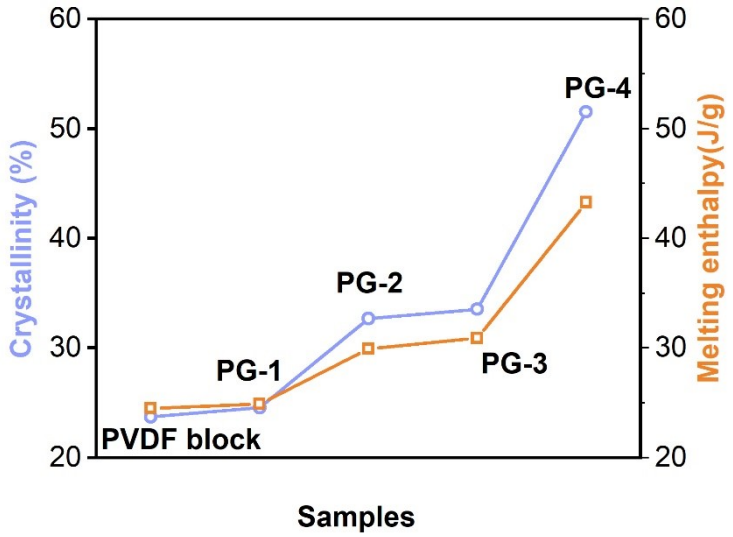

Figure S3. Crystallinity and melting enthalpy of PVDF block, PG-1, PG-2, PG-3, and PG-4

$$x_c = \frac{\Delta H}{\Delta H_0 \times W_f} \times 100\%$$

ΔH_0 is the enthalpy of melting of 100% crystallized PVDF, ΔH_0=105 J/g; ΔH is the enthalpy of melting required for actual crystallization of the sample; W_f is the proportion of a substance in the mixture.

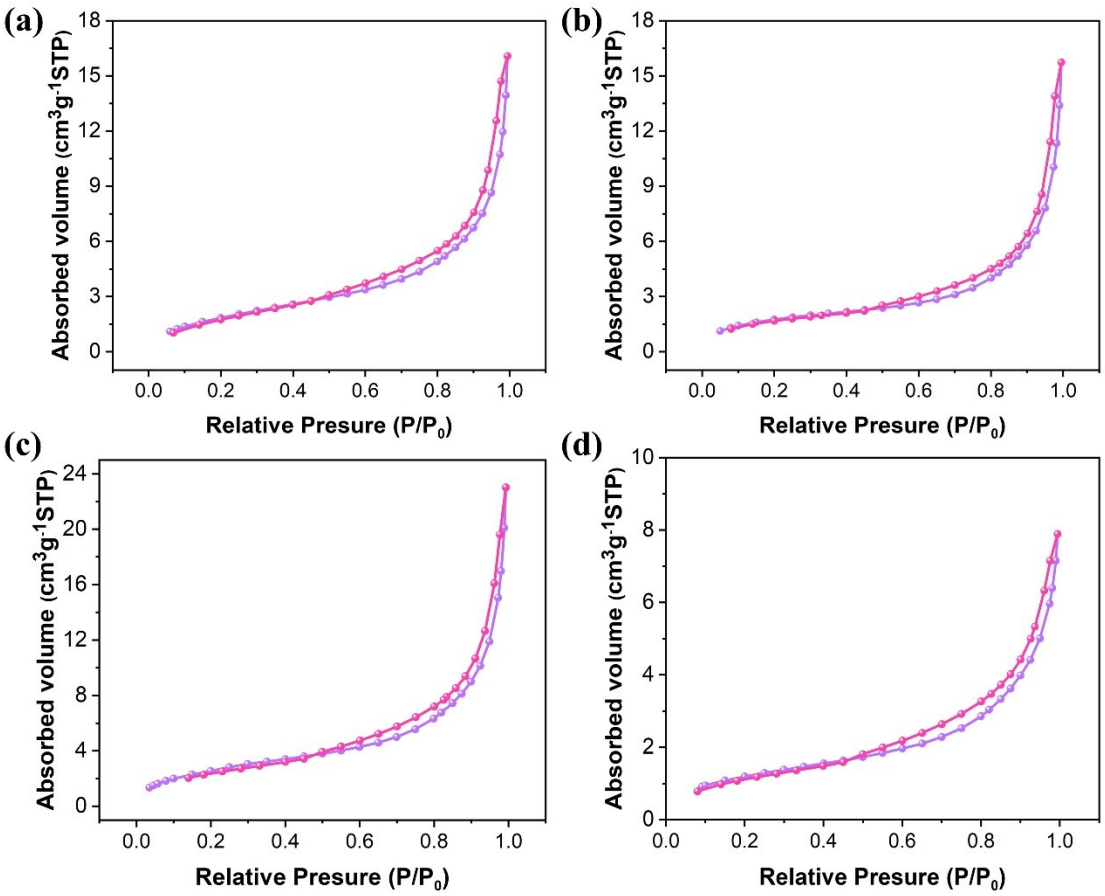

Figure S4. (a-d) The nitrogen isothermal adsorption and desorption curves of PG-1, PG-2, PG-3, and PG-4.

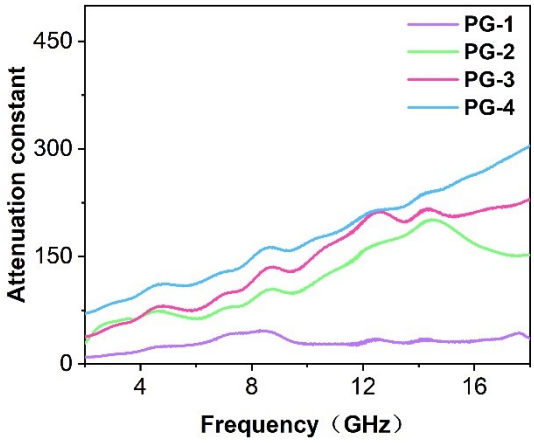

Figure S5. The curves of attenuation constant for four samples

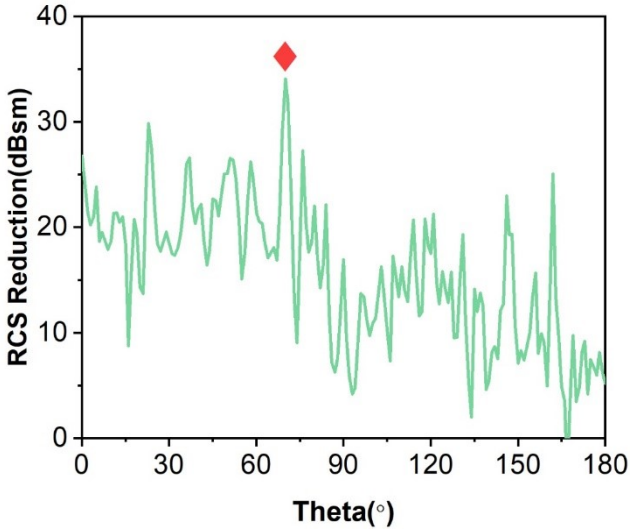

Figure S6. RCS reduction at the incidence angle in the range of 0° to 180°.

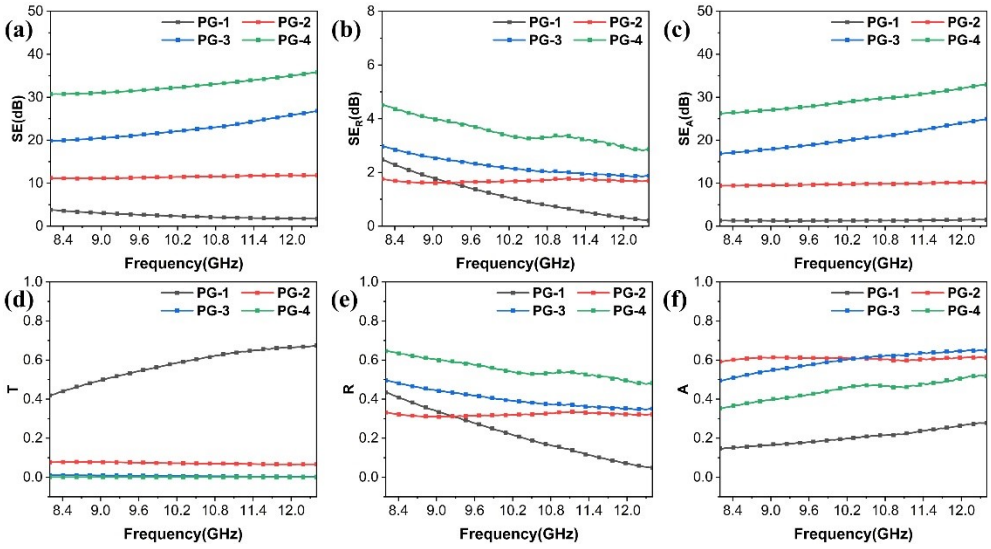

Figure S7. (a-f) SE, SE_R, SE_A, T, R and A of PG-x foams

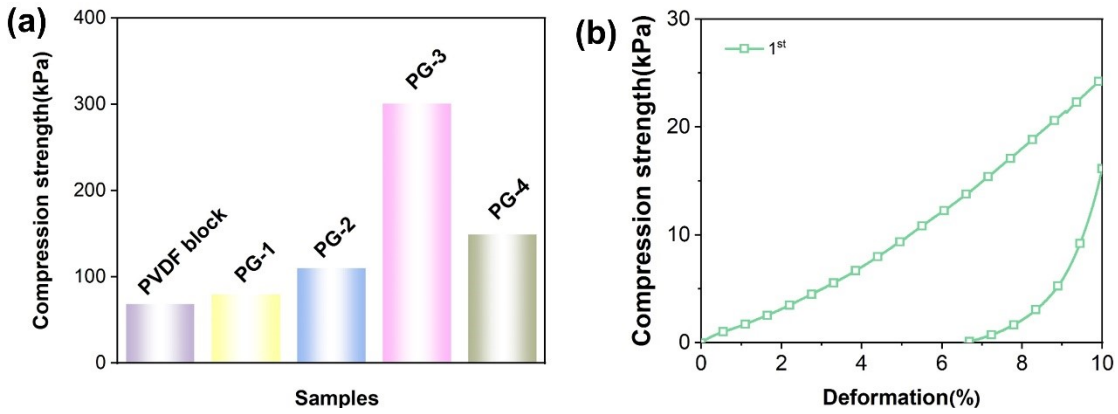

Figure S8. (a)Maximum compressive strength of deformation of 15%; (b) Curve of a cycle