Supporting Information

Moldable clay-like unit for synthesis of highly elastic polydimethysiloxane sponge with nanofiller modification

Shi Qiu,[a] Hengchang Bi,[a] Xiaohui Hu,[a] Mingbo Wu,*[b] Yongfeng Li[c] and Litao Sun*[a]

a. SEU-FEI Nano-Pico Center, Key Laboratory of MEMS of Ministry of Education, Southeast University, Nanjing, 210096, P. R. China. E-mail: slt@seu.edu.cn
b. CPCIF Key Lab for Carbon Materials from Heavy Oil, State Key Laboratory of Heavy Oil Processing, China University of Petroleum, Qingdao, 266580, P. R. China. E-mail: wumb@upc.edu.cn
c. State Key Laboratory of Heavy Oil Processing, China University of Petroleum, Beijing 102249, P. R. China.

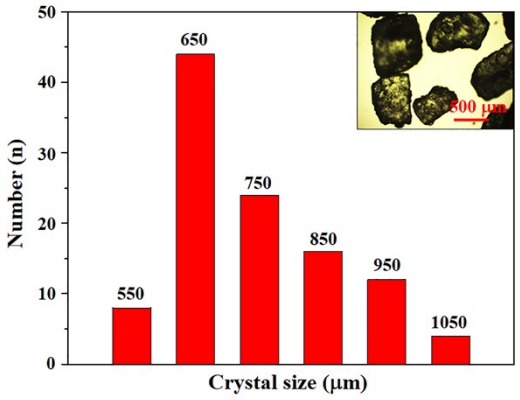

Fig. S1 Plot showing size number distribution of commercial sea salt crystals and the corresponding optical microscope image of salt crystals.

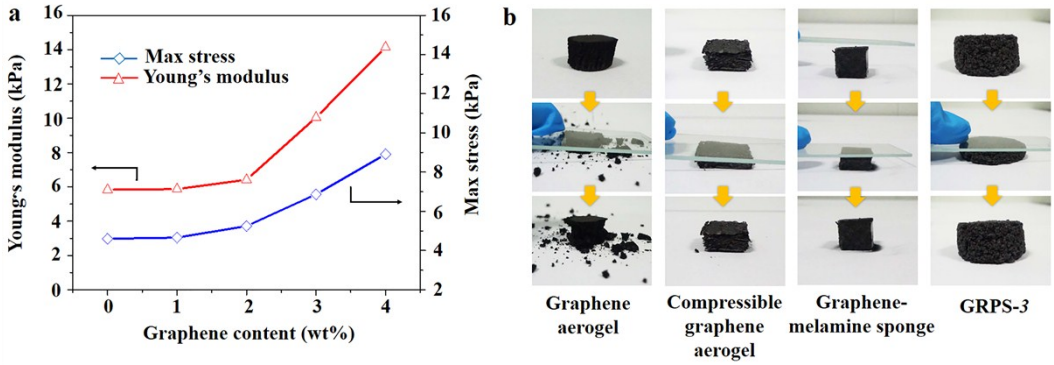

Fig. S2 (a) The corresponding Young's modulus and ultimate stress for different graphene loading contents of GRPSs at 50% strain deformation. (b) Sequential photographs showing compression–recovery processes of the graphene-based sponges.

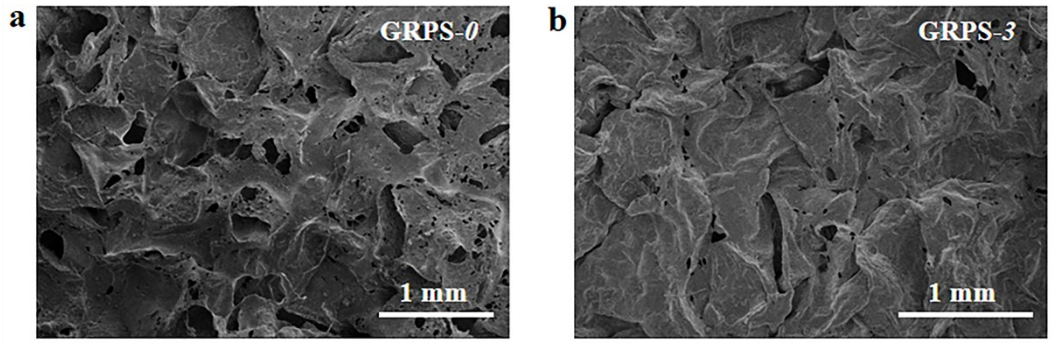

Fig. S3 SEM images of the top surface structures of (a) GRPS-*0* and (b) GRPS-*3*.

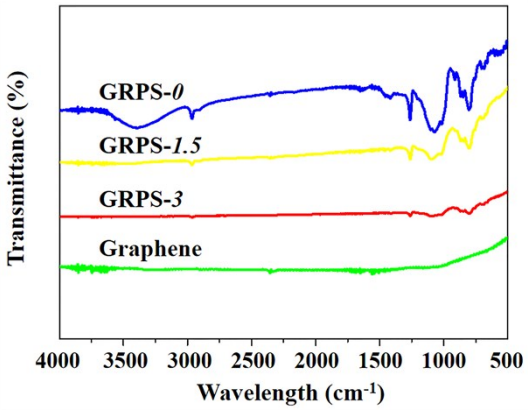

Fig. S4 FTIR spectra of as-prepared GRPSs and graphene nanosheets.

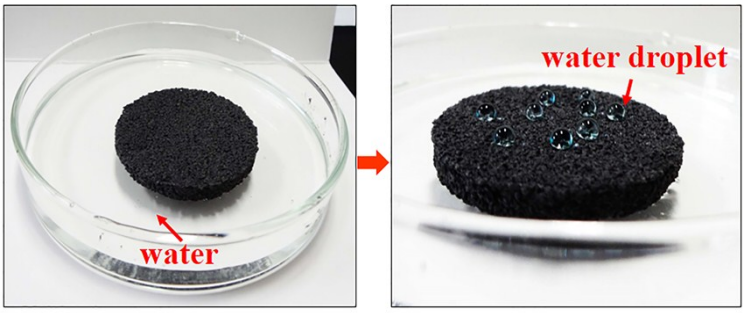

Fig. S5 Photographs showing GRPS-*3* can float on the water surface, and water droplets (dyed by methylene blue) can keep uniformly spherical shapes on the GRPS-*3* surface.

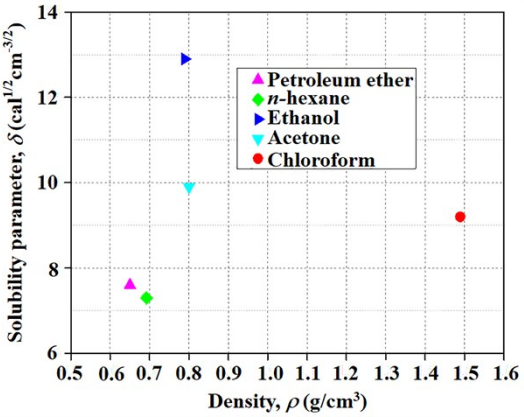

Fig. S6 The relationship between density (ρ) and solubility parameter (δ) of various solvents.

Table S1. Comparison of mechanical properties of typical PDMS sponges.

Sample name	Synthetic method	Linear Elastic region (%)	Young's modulus (kPa)	Max stress at 50% strain (kPa)	Ref.
Porous PDMS sponge	Sugar leaching technique	~20	~600		1
PDMS sponge	Vacuum-assisted sugar template method		~20		2
PDMS oil absorbent	Solvent evaporation method	~30	~5.56	~3.33	3
Durable PDMS sponge	Salt-template approach	~30	~100	~75	4
CNT-PDMS sponge	Post dip-coating method	~20	~169	~39.44	5
Piezoelectric polymer composite foams	Sugar-template strategy via roll-out method	~15	~32		6
PDMS/MWNT nanocomposite	Solvent evaporation by piston motion	~20	~157	~197	7
Graphene-reinforced PDMS sponge	Solvent evaporation by ultrasound	~30	5.83~14.14	4.61~8.92	Our work

Table S2. Comparison of mechanical properties of as-made GRPSs at different graphene loading contents.

Sample name	Graphene content (wt%)	Young's modulus (kPa)	Max stress at 50% strain (kPa)	Energy loss coefficient		
				ε [a)] = 30%	ε = 50%	ε = 70%
GRPS-*0*	0	5.83	4.61	0.14	0.16	0.18
GRPS-*1*	1	5.87	4.66	0.15	0.19	0.21
GRPS-*2*	2	6.42	5.25	0.21	0.24	0.25
GRPS-*3*	3	10.05	6.87	0.19	0.23	0.27
GRPS-*4*	4	14.14	8.92	0.18	0.23	0.29

a) ε means the strain deformation.

Table S3. Comparison of typical PDMS-based adsorbent sponges.

Sample name	Synthetic method	Adsorption capacity [a)] ($g\ g^{-1}$)	Density ($g\ cm^{-3}$)	Porosity (%)	Swell ratio	Ref.
PDMS sponge	Vacuum-assisted polymerization	13.8	0.12	83	1.5	2
PDMS oil absorbent	Evaporation-induced polymerization	20.8	0.18	81	6.0	3
Graphene-reinforced PDMS sponge	Ultrasound-assisted in situ polymerization	11.7	0.14	80	2.7	This work

a) The adsorbed oil is petroleum ether.

Experiment S1.

Preparation of Graphene Aerogel and Compressible Graphene Aerogel

Graphene aerogel (GA) and compressible graphene aerogel (CGA) were prepared by hydrothermal method described elsewhere in reported work.[8] 60 mg GO (graphene oxide) was dispersed in 20 mL ammonia solution, followed by sonication for 15 min. The dark brown colloidal dispersion was transferred to a sealed rector, heated at 180 °C for 20 h, and then cooled down to room temperature. The as-prepared graphene gels were subsequently freeze-dried at minus 20 °C and minus 170 °C for 48 h to obtain GA and CGA, respectively.

Preparation of Graphene-Melamine Sponge

Graphene-melamine sponge was prepared by a dip-coating method described elsewhere in detail.[9] 0.1 g commercial melamine sponge was dipped into the graphene dispersion in ethanol solution. Gaphene nanosheets physically coated onto the sponge skeleton by capillary action. After being dried in the vacuum oven at 100 °C for 2 h, the graphene-melamine sponge was obtained. The repeated steps of the infiltration process were carried out to guarantee melamine sponge uniformly coated with graphene nanosheets.

References

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