Supporting Information

A General Strategy for Dramatic Enhancement of Aerogels via an Aerogel-Functionalization-Aerogel Approach

Hong Li,[a,b] Yanan Chen,[a,b] Ling Liu,[b,c] Xueyan Hu,[b,c] Huan Sun,[b,c] Yaru Li,[b,c] Xiaodong Wu,[a] and Jin Wang*[b,c]*

[a] College of Materials Science and Engineering, Nanjing Tech University, Nanjing 211816, P. R. China. *E-mail: wuxiaodong@njtech.edu.cn (X.W.)

[b] Key Laboratory of Multifunctional Nanomaterials and Smart Systems, Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences, Suzhou 215123, P. R. China. *E-mail: jwang2014@sinano.ac.cn (J.W.)

[c] School of Nano-Tech and Nano-Bionics, University of Science and Technology of China, Hefei 230026, P. R. China.

* Corresponding authors

Fig. S1. CS-AFA (a, b); Gel-AFA (c, d); PVA-AFA (e, f); MC-AFA (g, h); PAM-AFA (i, j) before and after freeze-drying.

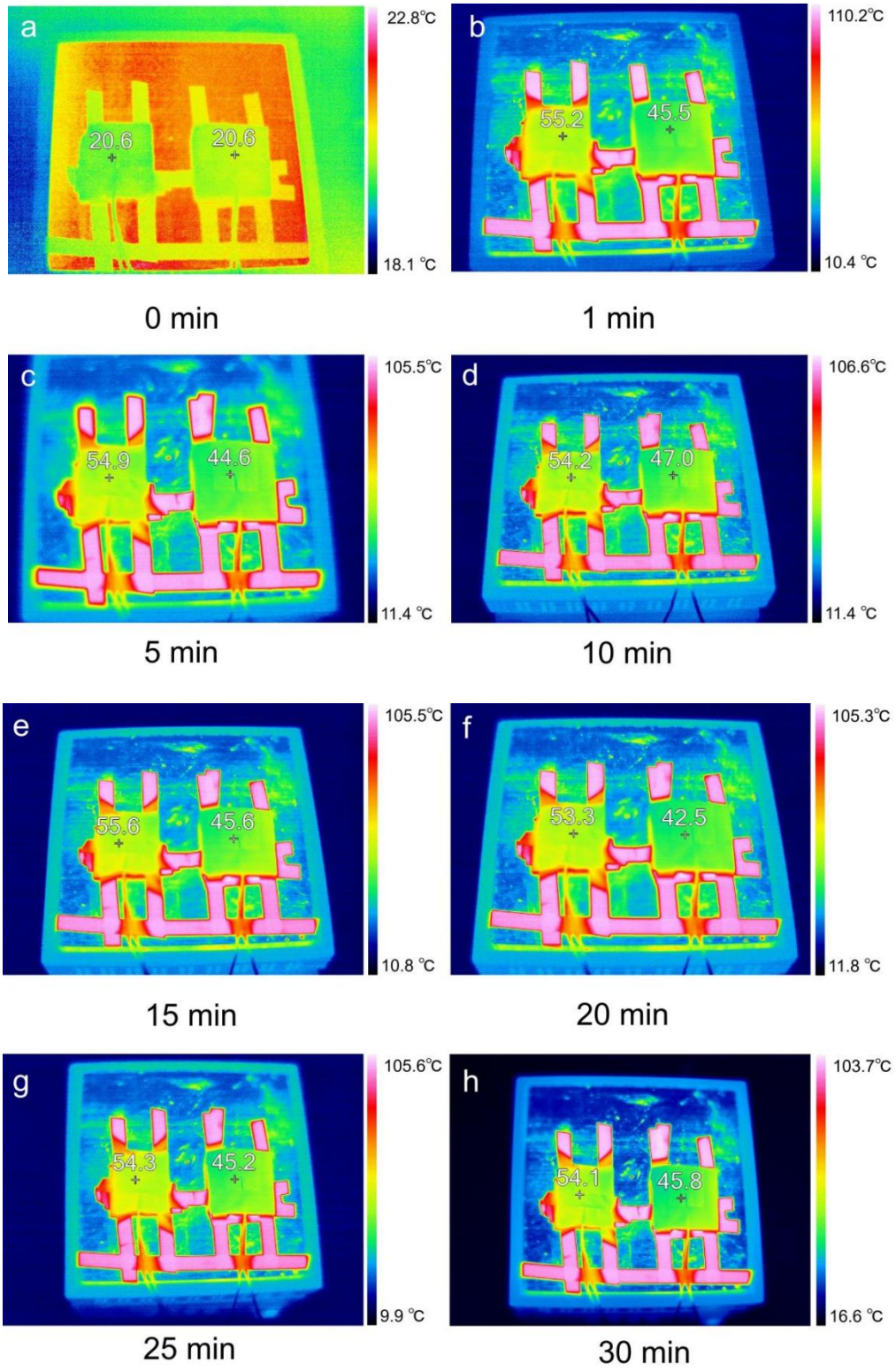

Fig. S2. Infrared photographs of CS-A and CS-AFA taken at 100 °C for 30 min on the hot stage.

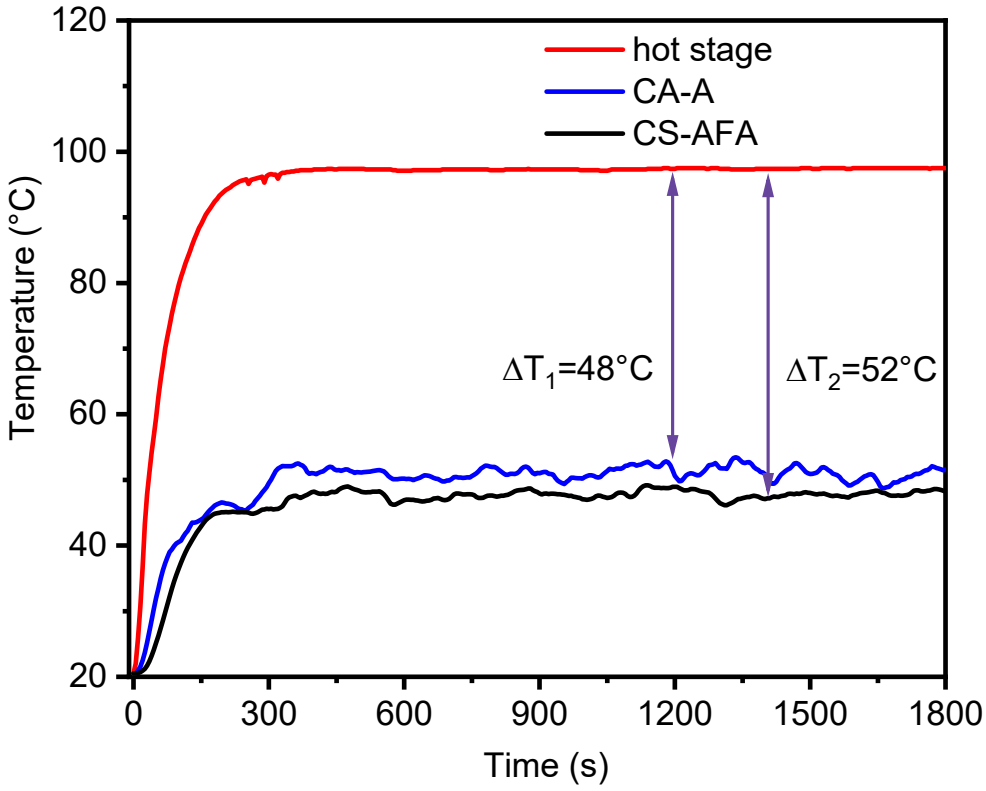

Fig. S3. The data of CS-A and CS-AFA taken at 100 °C for 30 min on the hot stage.

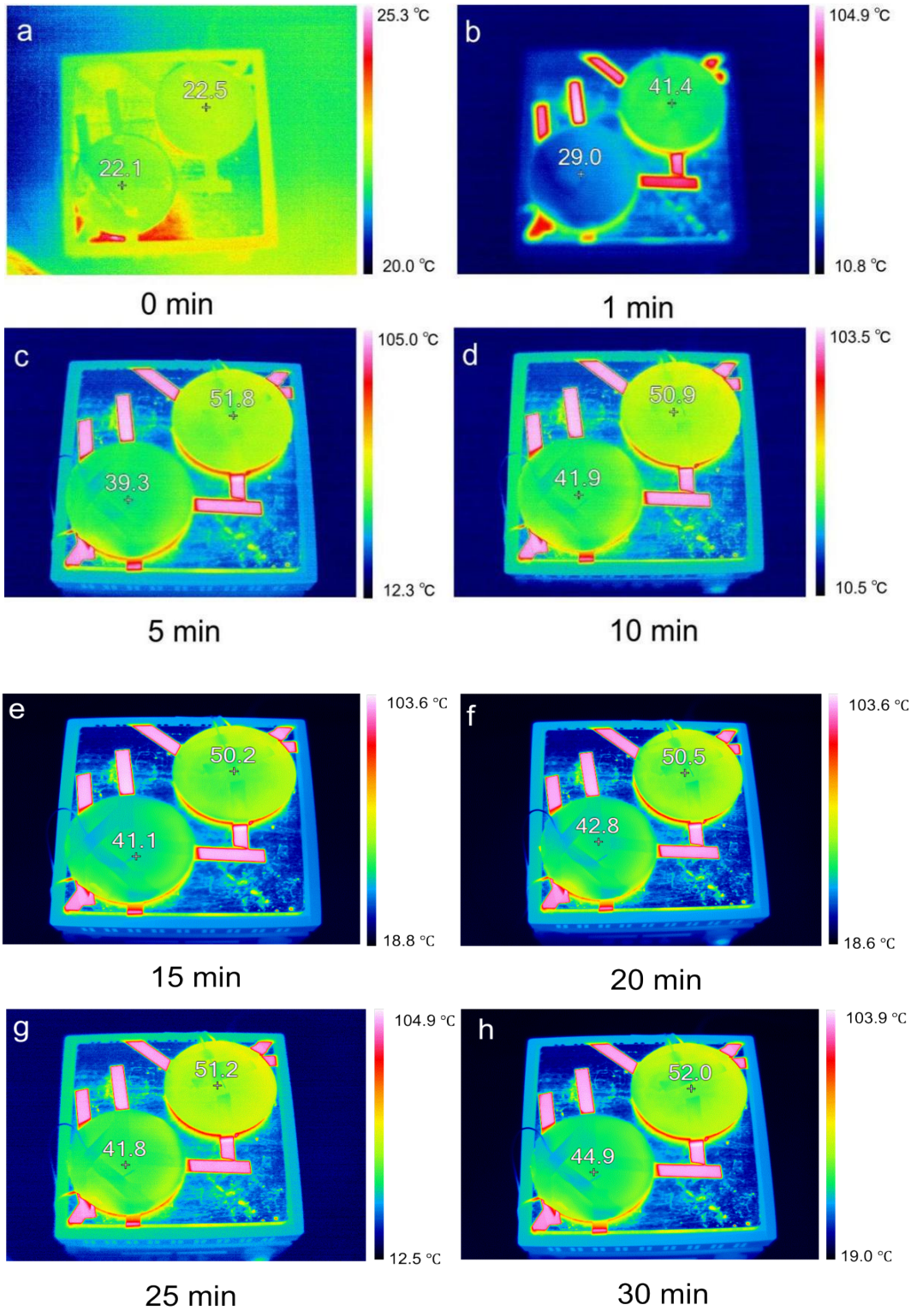

Fig. S4. Infrared photographs of Gel-A and Gel-AFA taken at 100 °C for 30 min on the hot stage.

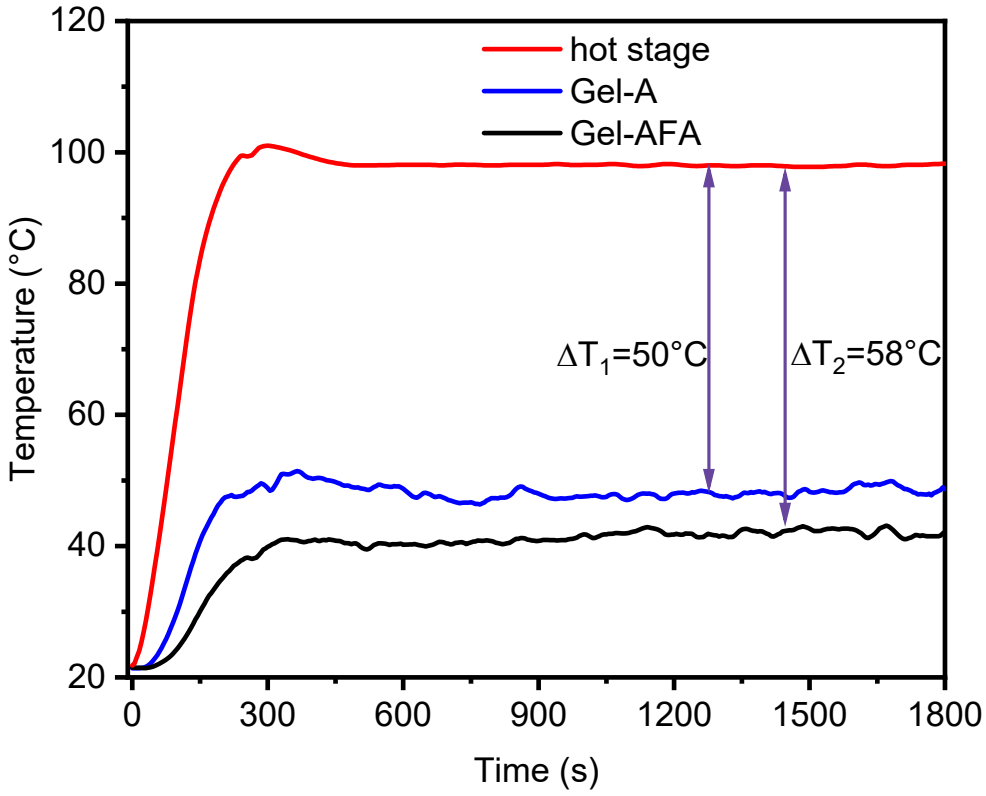

Fig. S5. The data of Gel-A and Gel-AFA taken at 100 °C for 30 min on the hot stage.

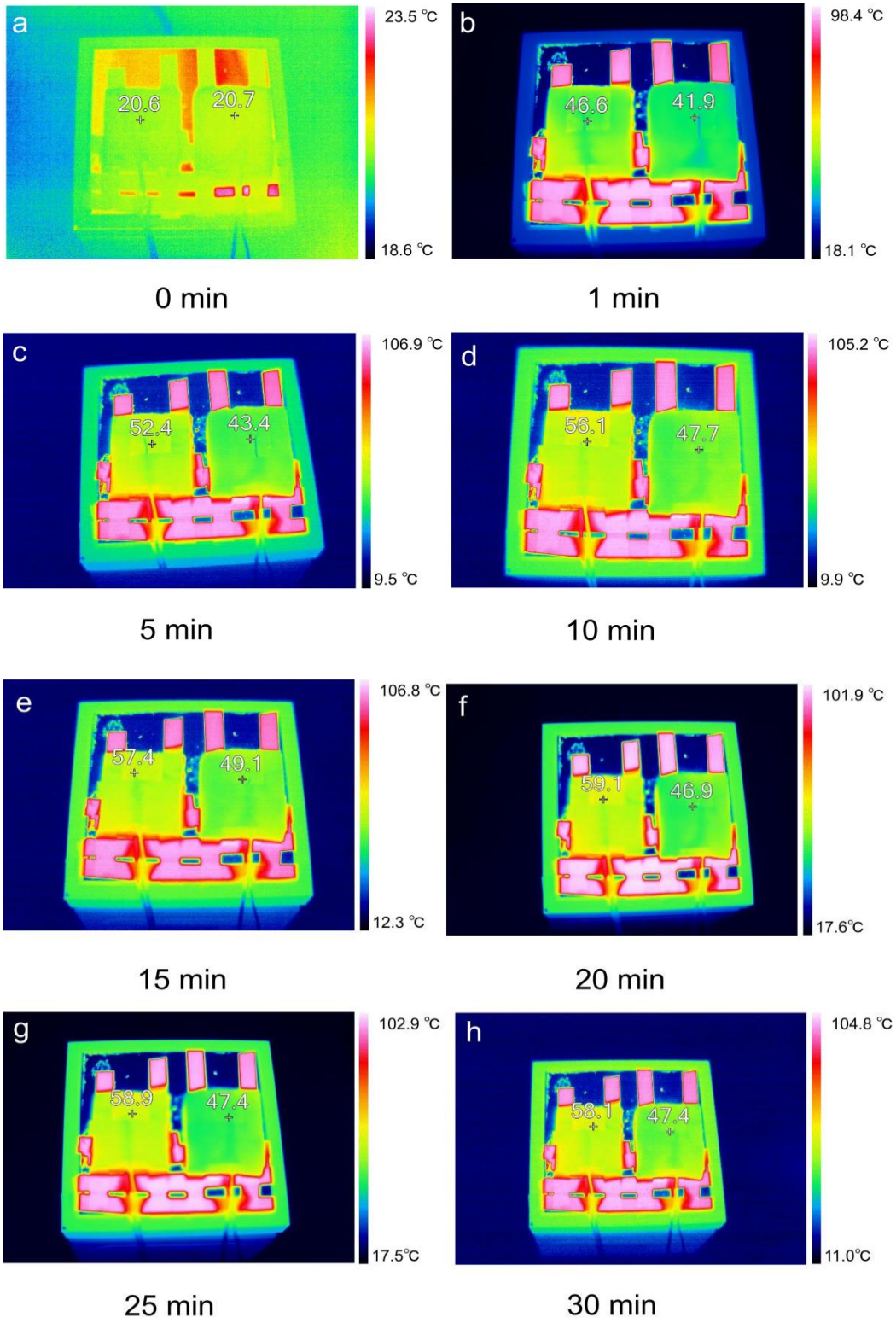

Fig. S6. Infrared photographs of PVA-A and PVA-AFA taken at 100 °C for 30 min on the hot stage.

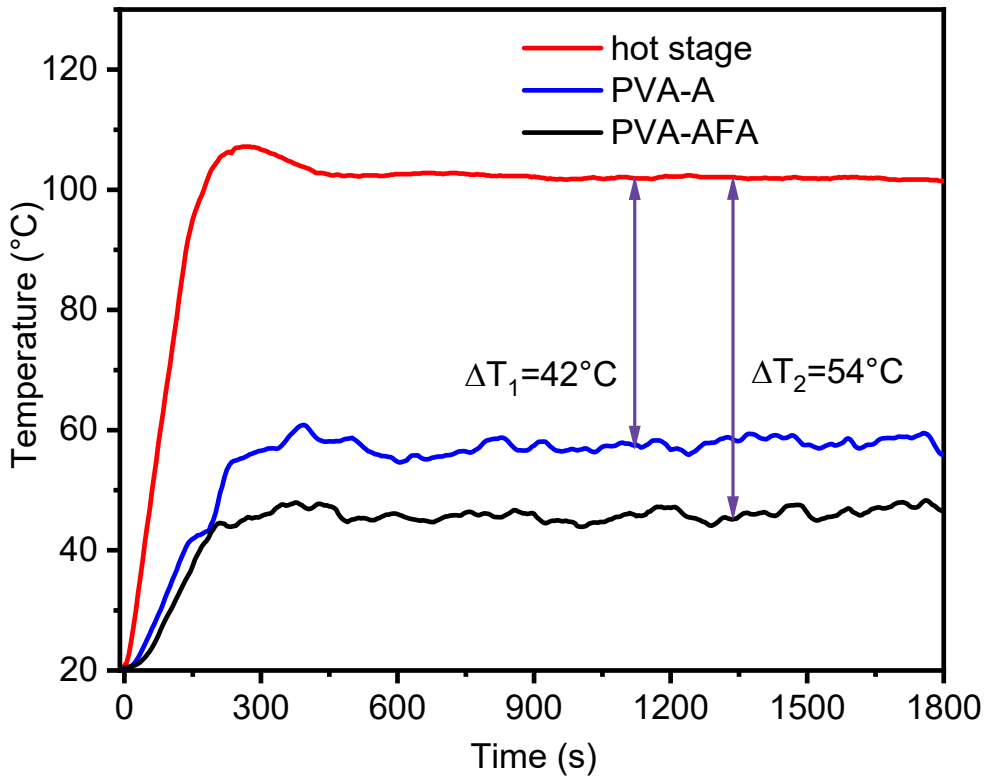

Fig. S7. The data of PVA-A and PVA-AFA taken at 100 °C for 30 min on the hot stage.

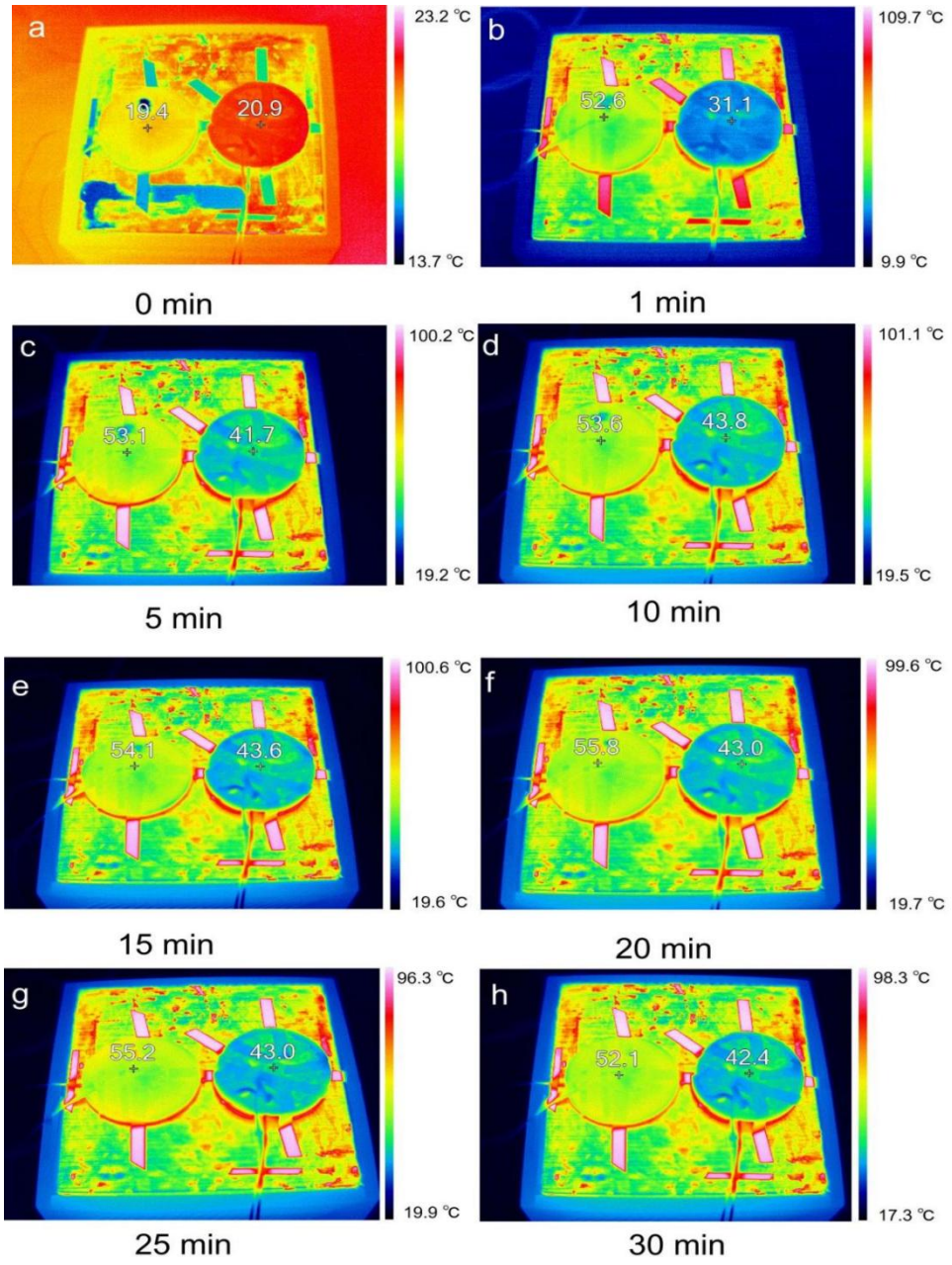

Fig. S8. Infrared photographs of MC-A and MC-AFA taken at 100 °C for 30 min on the hot stage.

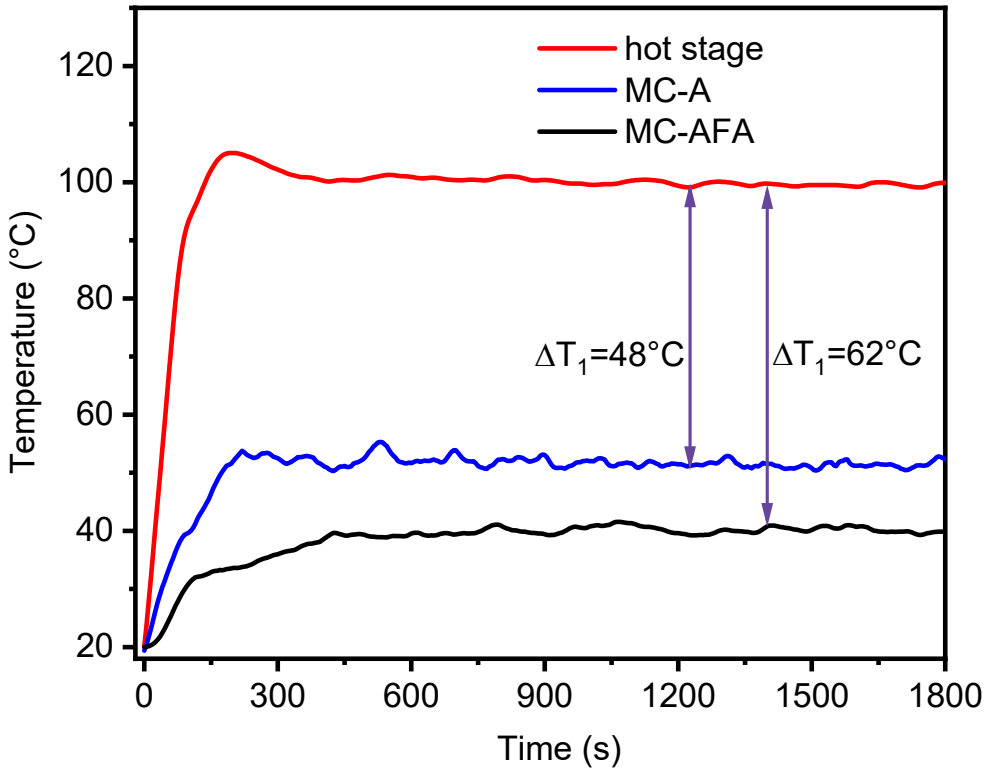

Fig. S9. The data of MC-A and MC-AFA taken at 100 °C for 30 min on the hot stage.

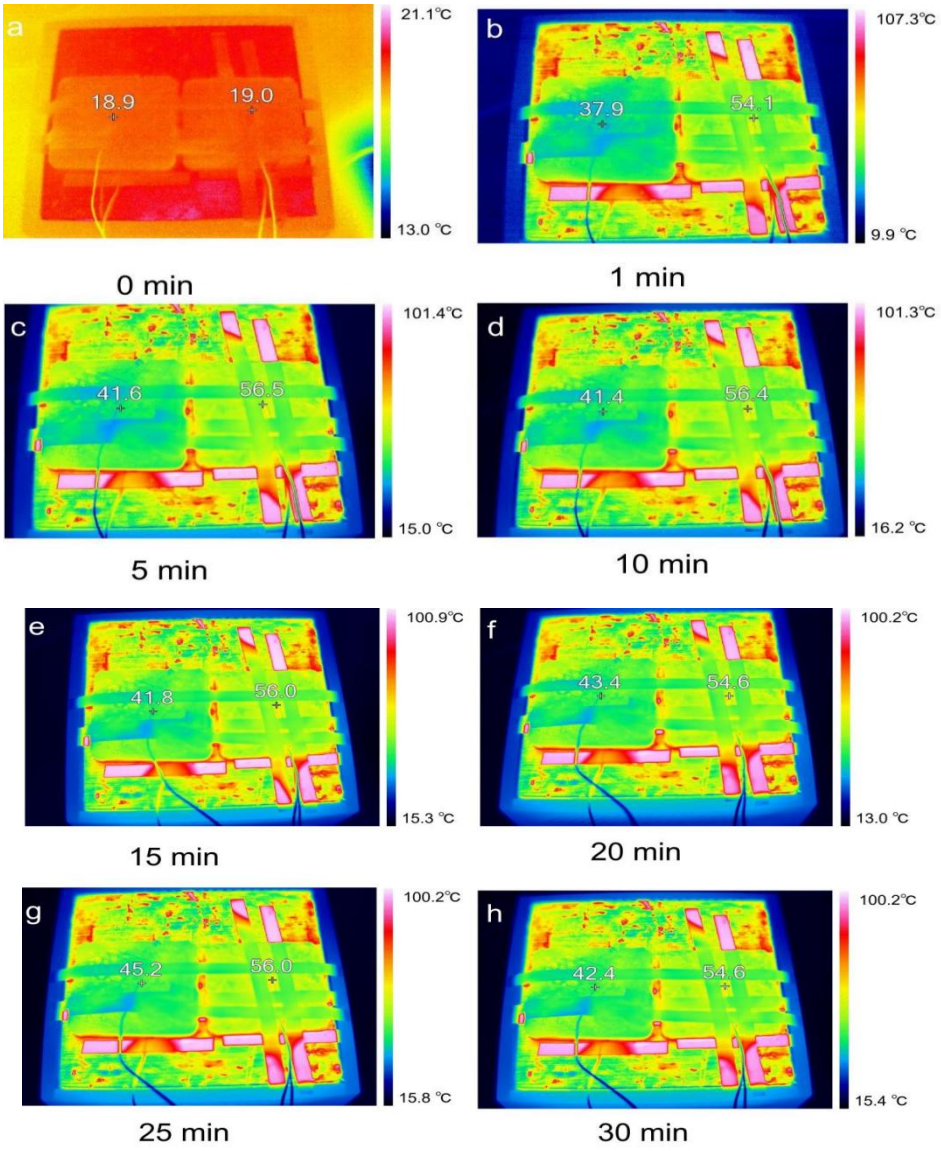

Fig. S10. Infrared photographs of PAM-A and PAM-AFA taken at 100 °C for 30 min on the hot stage.

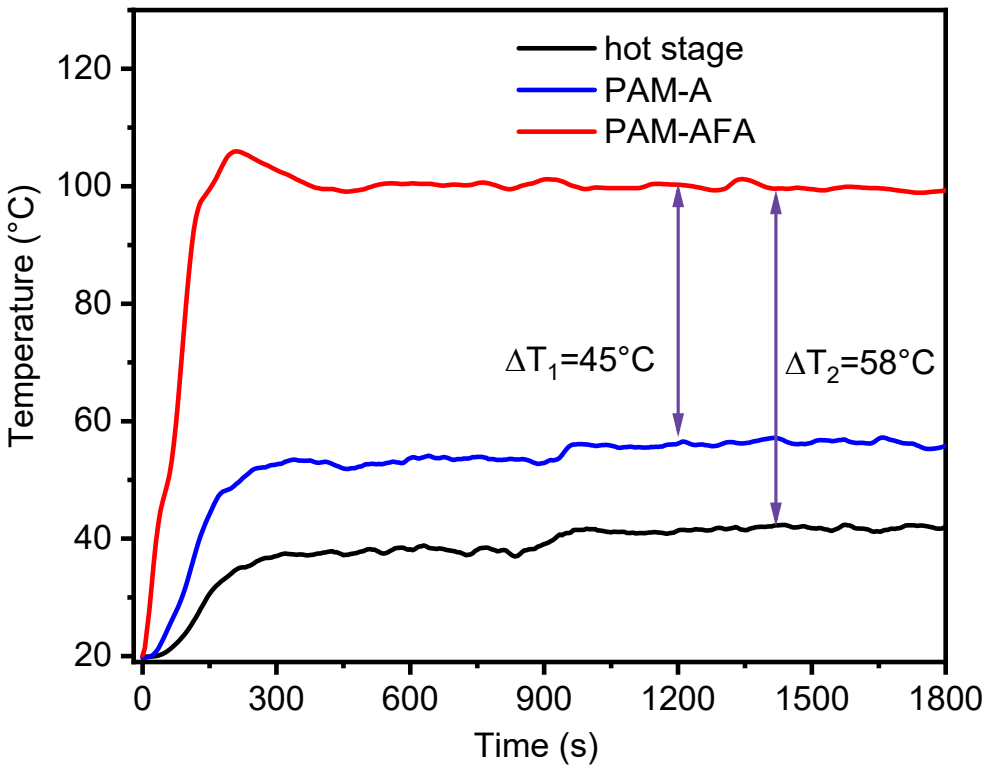

Fig. S11. The data of PAM-A and PAM-AFA taken at 100 °C for 30 min on the hot stage.

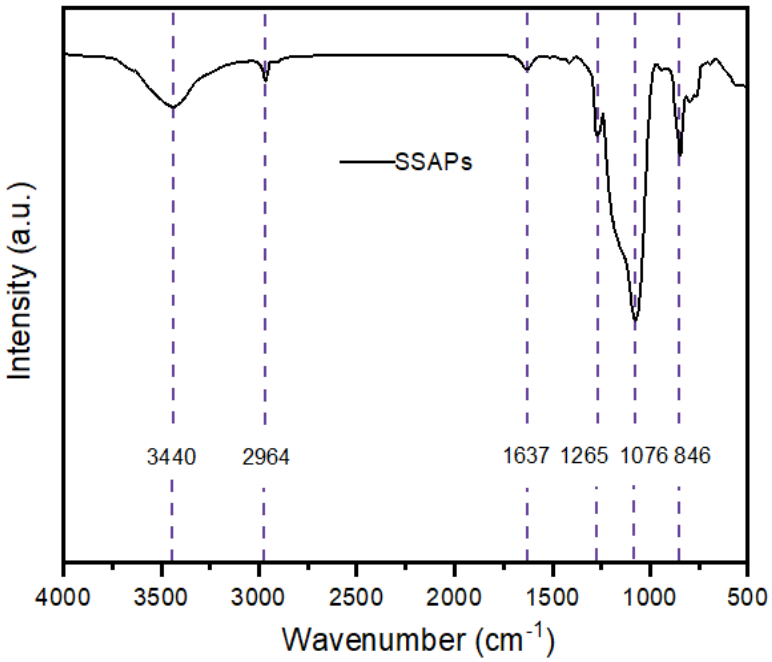

Fig. S12. FTIR spectra of SSAPs.

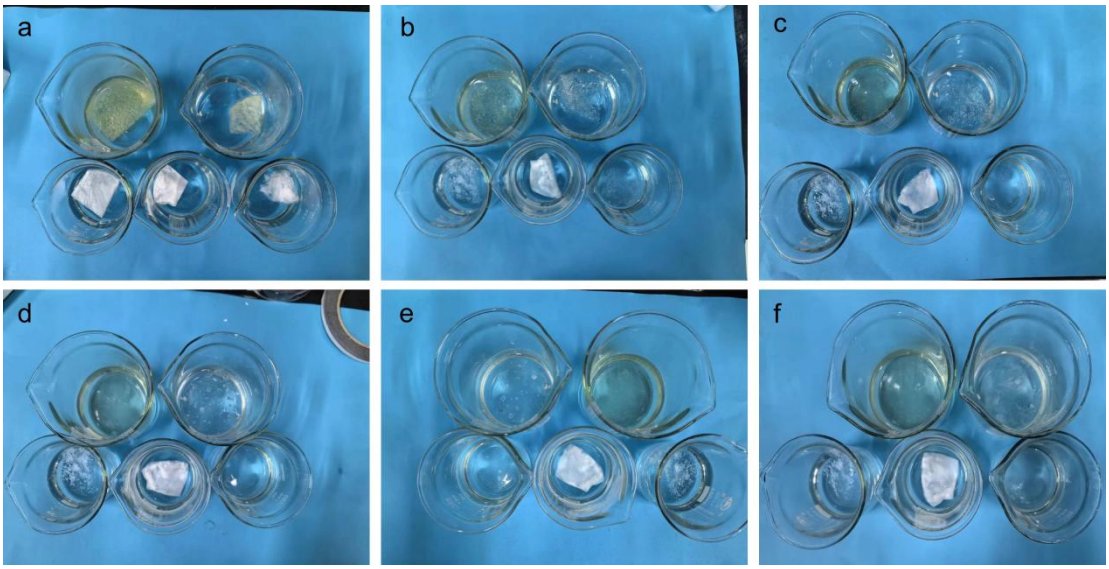

Fig. S13. Water Resistance Tests of native aerogels: (from top to bottom, left to right: CS-A, Gel-A, MC-A, PVA-A, PAM-A) (a) Soaking time is 1 min; (b) Soaking time is 1 day; (c) Soaking time is 2 days; (d) Soaking time is 3 days; (e) Soaking time is 4 days; (f) Soaking time is 7 days.

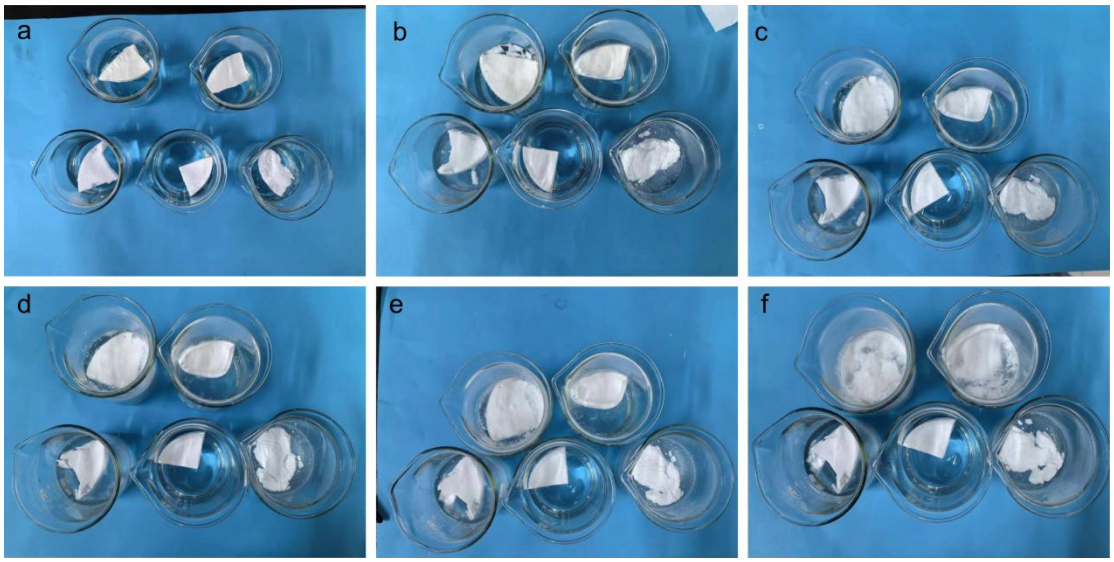

Fig. S14. Water Resistance Testing of composite aerogels: (from top to bottom, left to right: CS-AFA, Gel-A, MC-AFA, PVA-AFA, PAM-AFA. (a) Soaking time is 4 hours; (b) Soaking time is 1 day; (c) Soaking time is 2 days; (d) Soaking time is 3 days; (e) Soaking time is 4 days; (f) Soaking time is 7 days.

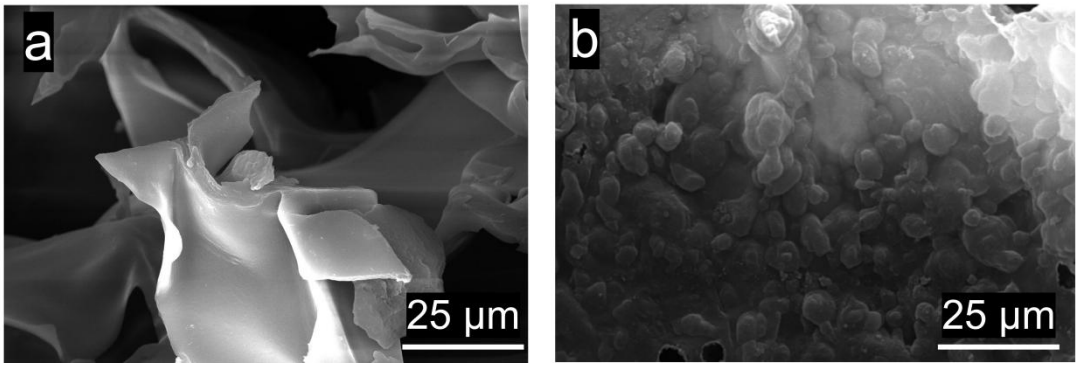

Fig. S15. The local cross-sectional SEM images of (a) CS-A, (b) CSA-AFA.

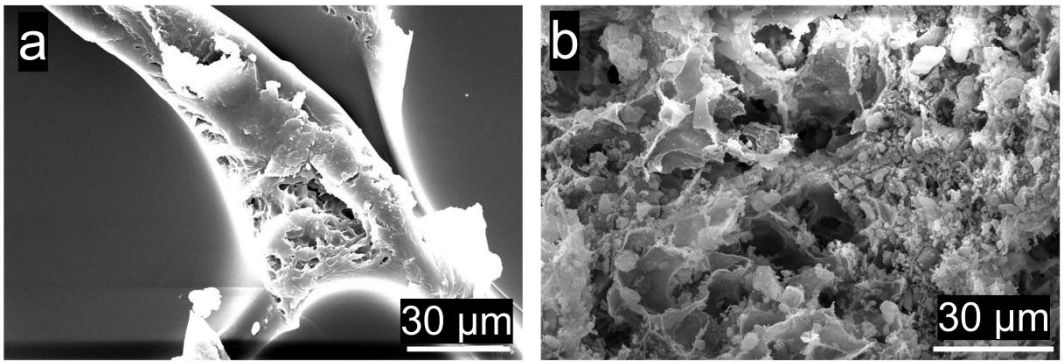

Fig. S16. The local cross-sectional SEM images of (a) Gel-A, (b) Gel-AFA.

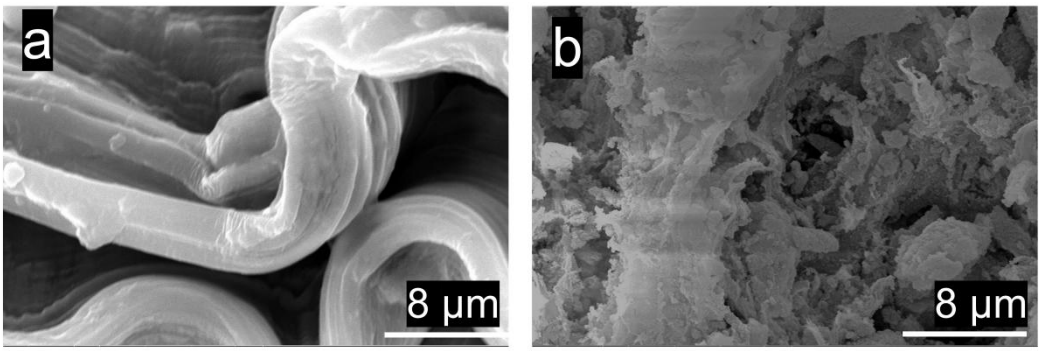

Fig. S17. The local cross-sectional SEM images of (a) PVA-A, (b) PVA-AFA.

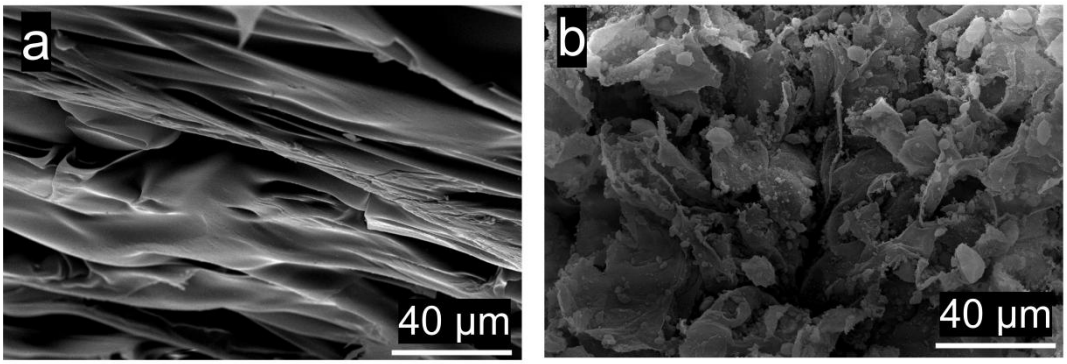

Fig. S18. The local cross-sectional SEM images of (a) MC-A, (b) MC-AFA.

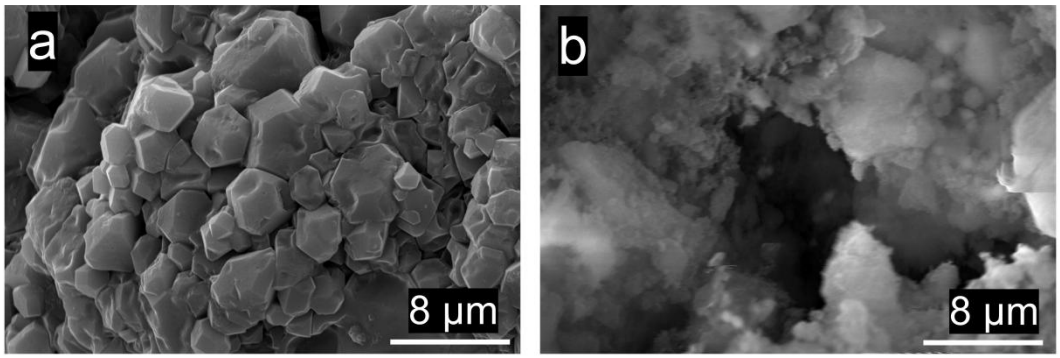

Fig. S19. The local cross-sectional SEM images of (a) PAM-A, (b) PAM-AFA.

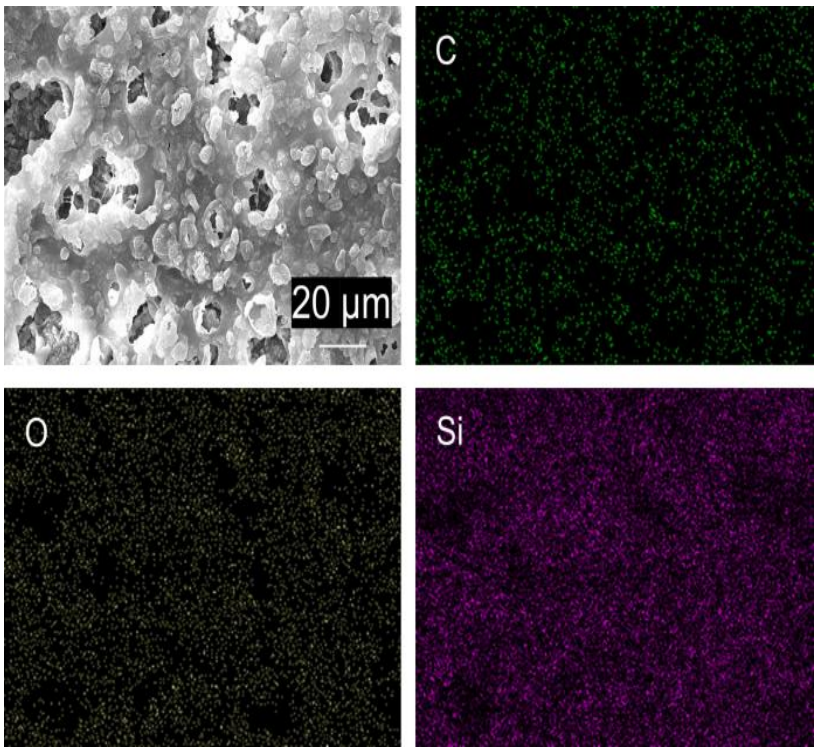

Fig. S20. Elemental mapping of CS-AFA.

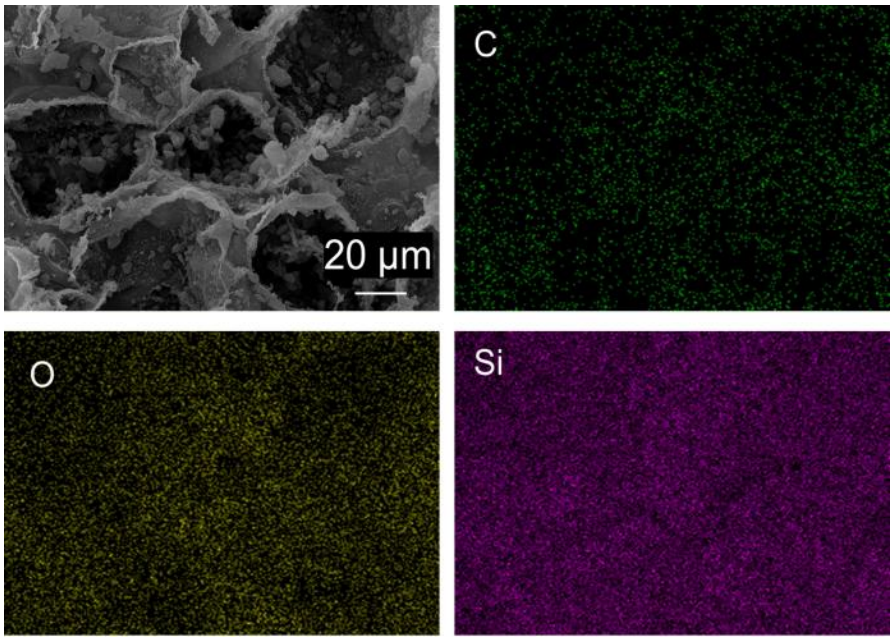

Fig. S21. Elemental mapping of Gel-AFA.

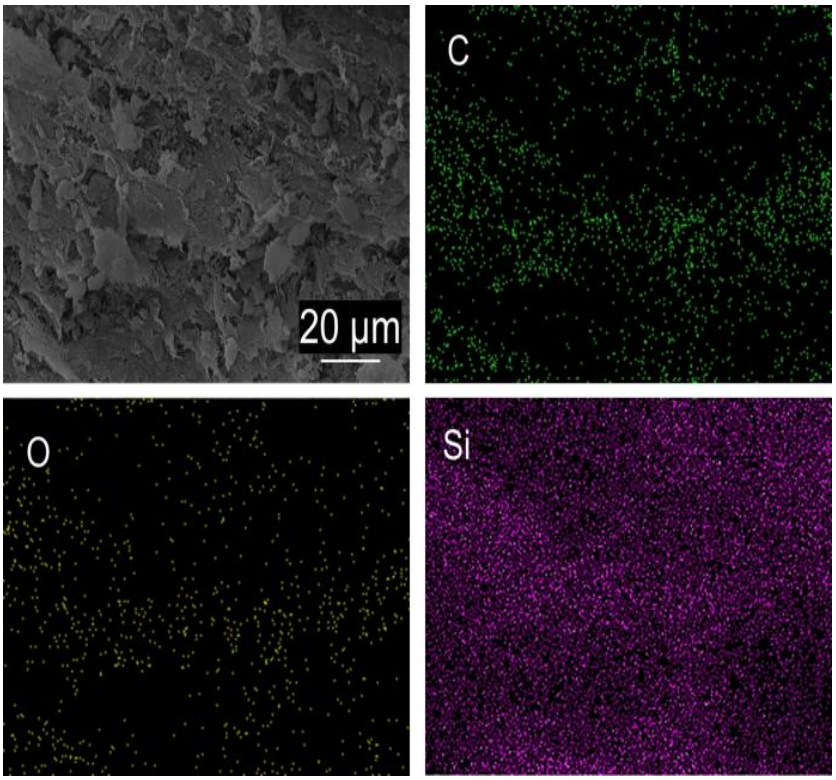

Fig. S22. Elemental mapping of PVA-AFA.

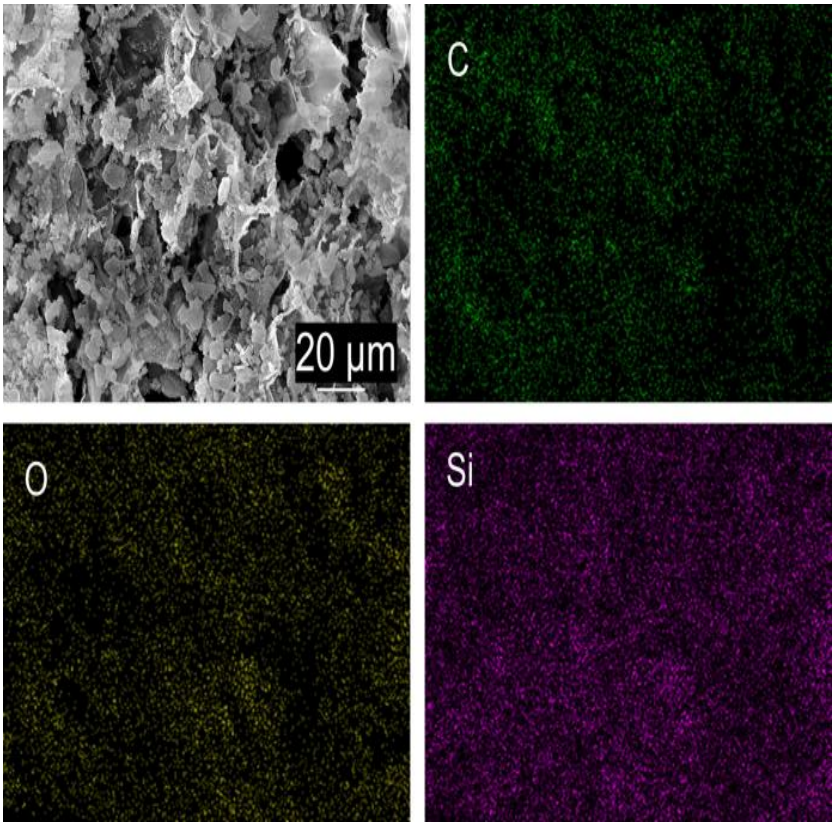

Fig. S23. Elemental mapping of MC-AFA.

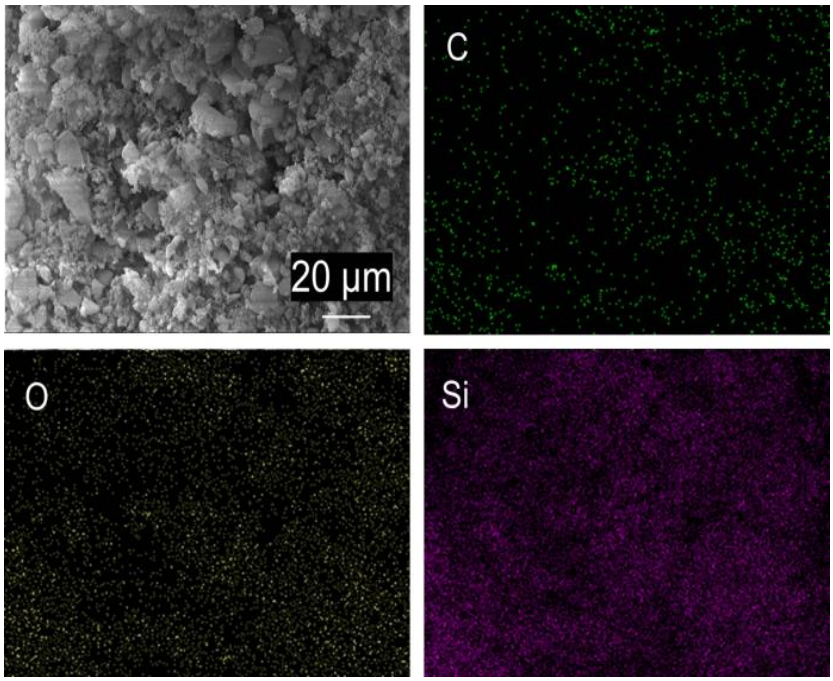

Fig. S24. Elemental mapping of PAM-AFA.

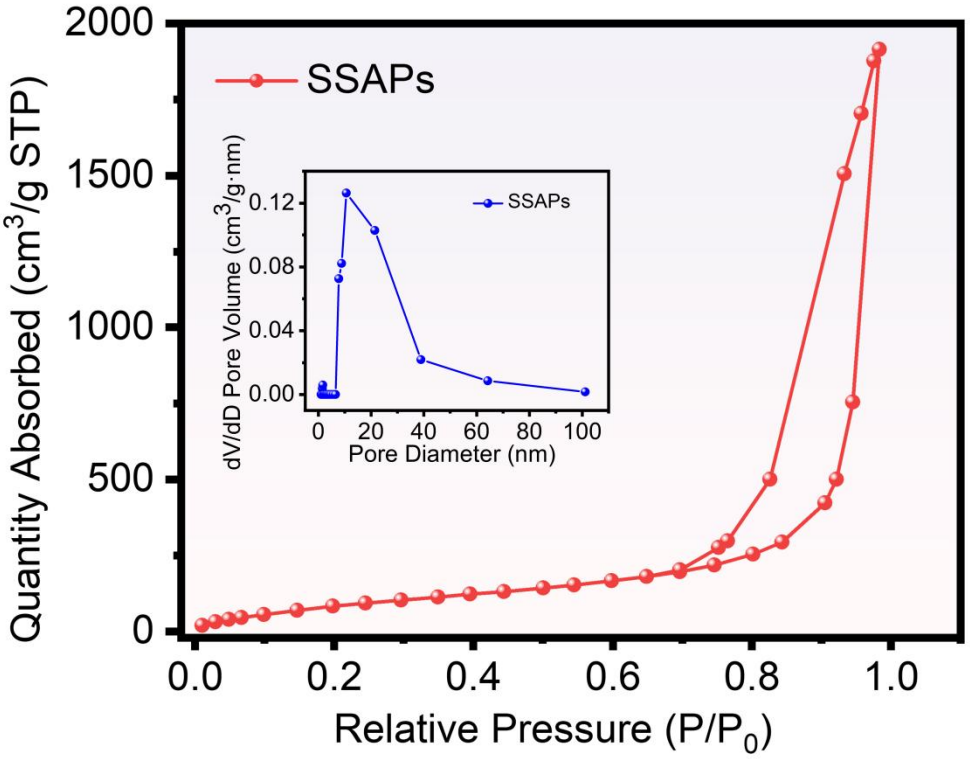

Fig. S25. BET desorption curves and pore size distributions of SSAPs.

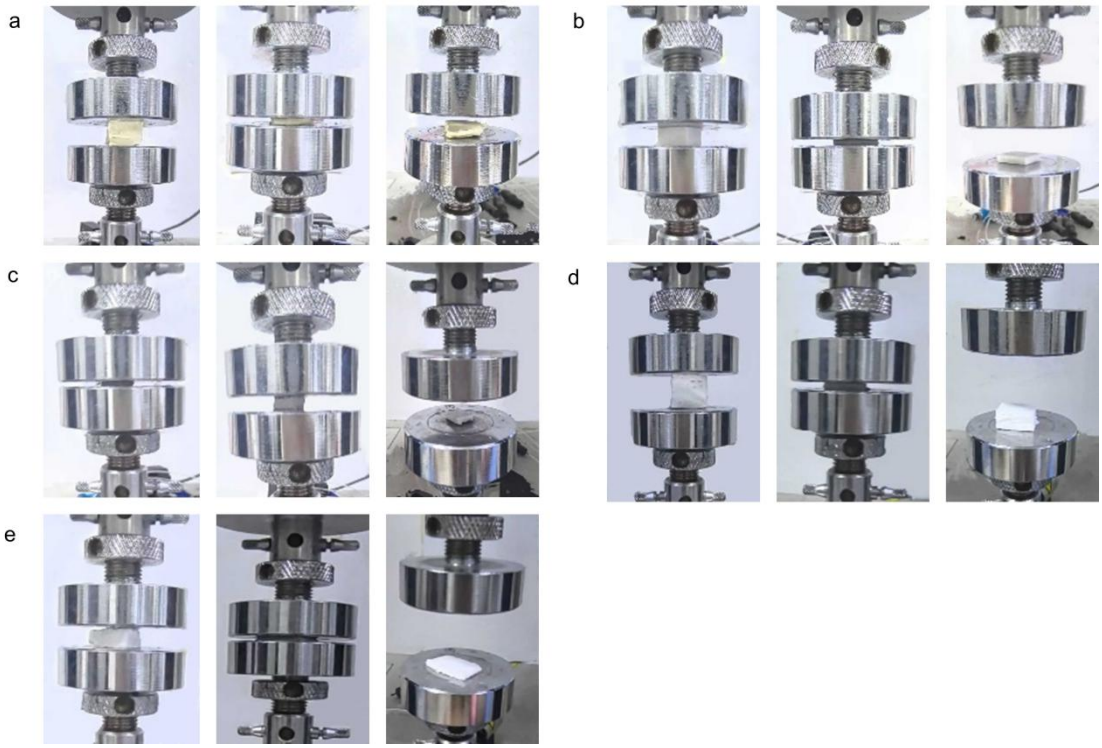

Fig. S26. Mechanical compression photos of (a) CS-A; (b) Gel-A; (c) PVA-A, (d) MC-A; (e) PAM-A.

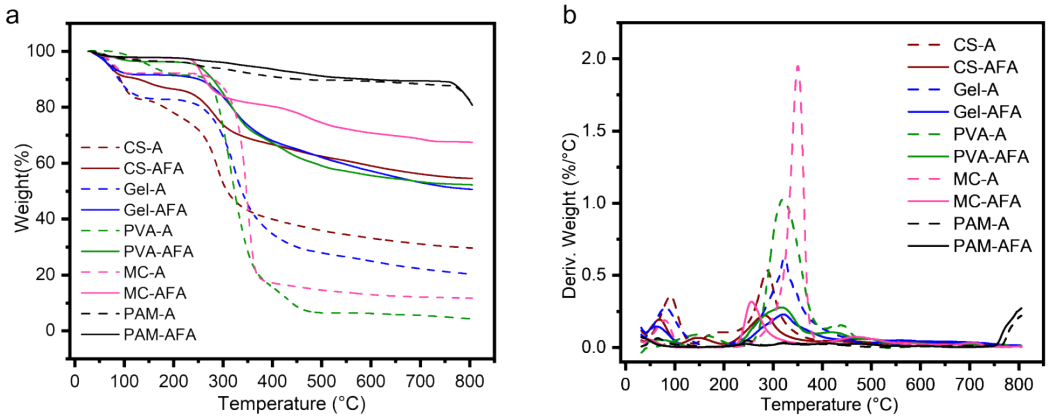

Fig. S27. (a) TG curves of native aerogels and composite aerogels; (b) DTG curves of native aerogels and composite aerogels.

Table S1. Ratios for making aerogels and basic information about aerogels

Name of sample	Raw materials	Mass fraction of solution (wt.%)	Mass fraction of SSAPs (wt.%)	Densities (g/cm^3)	Thermal conductivity ($W \cdot m^{-1} \cdot K^{-1}$)	Contact angle (°)
CS-A	Chitosan	6	0	0.089	0.05130±0.0003	0
CS-AFA		6	7.4	0.109	0.04487±0.0007	137±10.2
Gel-A	Gelatin	15	0	0.180	0.0479±0.0014	50±2.1
Gel-AFA		15	10	0.120	0.0344±0.0004	133±4.2
PVA-A	Polyvinyl alcohol	5	0	0.137	0.0709±0.0018	58±8.3
PVA-AFA		5	10	0.371	0.0506±0.0002	138±5.5
MC-A	Methyl cellulose	2	0	0.037	0.0434±0.0002	61±10.5
MC-AFA		2	7.2	0.066	0.0350±0.0002	132±10.2
PAM-A	Polyacrylamide	15	0	0.553	0.1071±0.0030	22±1
PAM-AFA		15	3.1	0.128	0.0589±0.0011	137±5.1

Table S2. Comparative data on five aspects of native and composite aerogels

Serial No.	Name of sample	Densities (g/cm^3)	Thermal conductivity ($W \cdot m^{-1} \cdot K^{-1}$)	Specific surface area(m^2/g)	Contact angle (°)	σ@ε=65% (MPa)
1	CS-A	0.089	0.0513±0.0003	14.022	0	1.43
	CS-AFA	0.109	0.0449±0.0007	259.037	137±10.2	3.91
	Rate of improvement (%)	-22.47	12.53	1747.36	∞	173.4
2	Gel-A	0.180	0.0479±0.0014	5.778	50±2.1	6.75
	Gel-AFA	0.120	0.0344±0.0004	193.503	133±4.2	15.71
	Rate of improvement (%)	33.33	28.18	3248.96	166	132.7
3	PVA-A	0.137	0.0709±0.0018	12.062	58±8.3	3.57
	PVA-AFA	0.371	0.0506±0.0002	252.939	138±5.5	47.41
	Rate of improvement (%)	-170.80	28.63	1996.99	137.93	1228.01
4	MC-A	0.037	0.0434±0.0002	14.591	61±10.5	0.17
	MC-AFA	0.066	0.0350±0.0002	432.83	132±10.2	0.46
	Rate of improvement (%)	-78.38	19.29	2886.42	116.39	170.6
5	PAM-A	0.553	0.1071±0.0030	11.183	22±1	0.48
	PAM-AFA	0.128	0.0589±0.0011	112.403	137±5.1	1.15
	Rate of improvement (%)	76.85	45	905.12	522.73	139.6