Supplementary Information (SI) for Journal of Materials Chemistry A.

Multifunctional MXene Composite Aerogels Modified via Hyperbranched Gels

*Tairan Wang, Hengzhi Zhang, Shengwei Tang, Chunyang Jia**

Tairan Wang, Hengzhi Zhang, Shengwei Tang, Chunyang Jia

National Key Laboratory of Electronic Thin Films and Integrated Devices, School of Integrated Circuit Science and Engineering

University of Electronic Science and Technology of China

Chengdu 610054, P. R. China

E-mail: cyjia@uestc.edu.cn

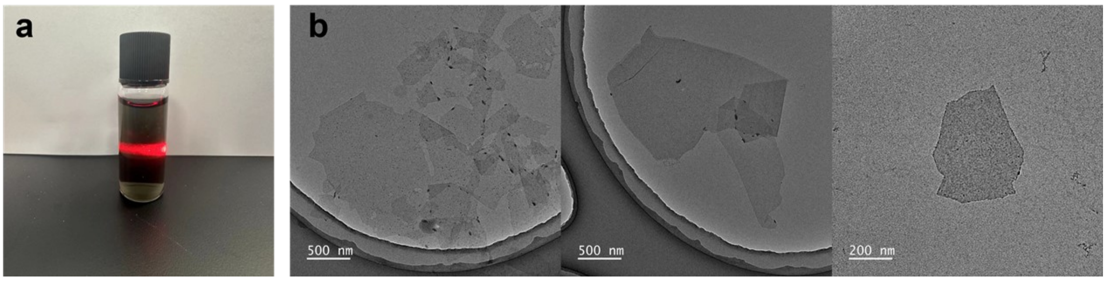

Fig. S1 (a) Photo of Tyndall effect of MXene dispersion. (b) TEM image of single/few layer MXene nanosheets.

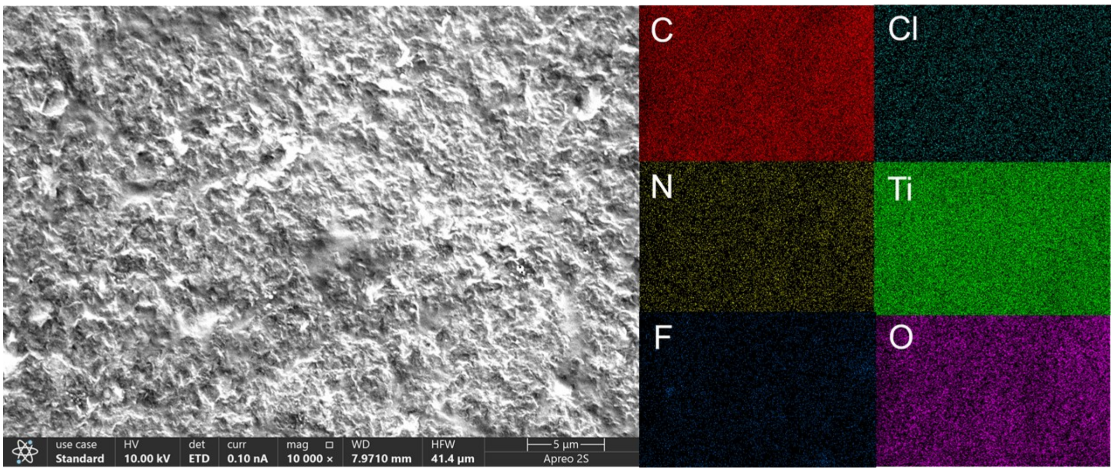

Fig. S2 Mapping image of aerogel M_1H_1.

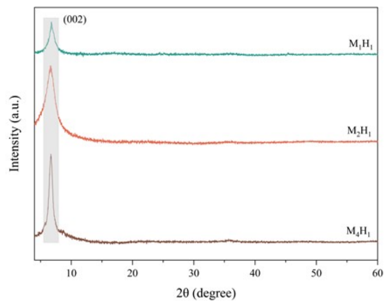

Fig. S3 XRD patterns of aerogel M_4H_1, M_2H_1 and M_1H_1.

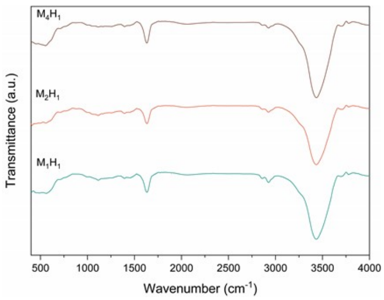

Fig. S4 FT-IR spectra of aerogel M_4H_1, M_2H_1 and M_1H_1.

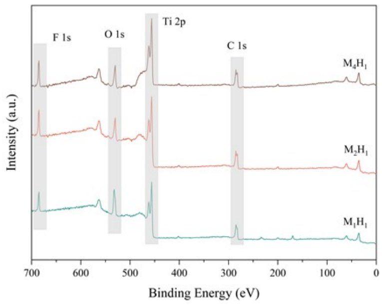

Fig. S5 Total XPS spectra of aerogel M_4H_1, M_2H_1 and M_1H_1.

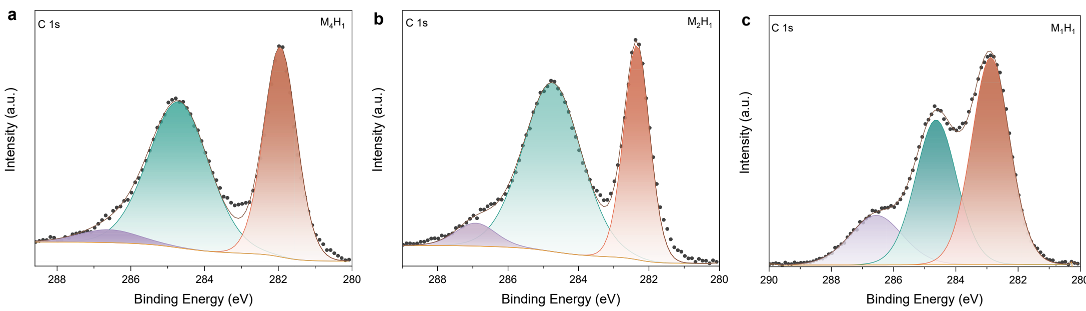

Fig. S6 XPS spectra of C 1S of (a) aerogel M_4H_1, (b) M_2H_1 (c) and M_1H_1.

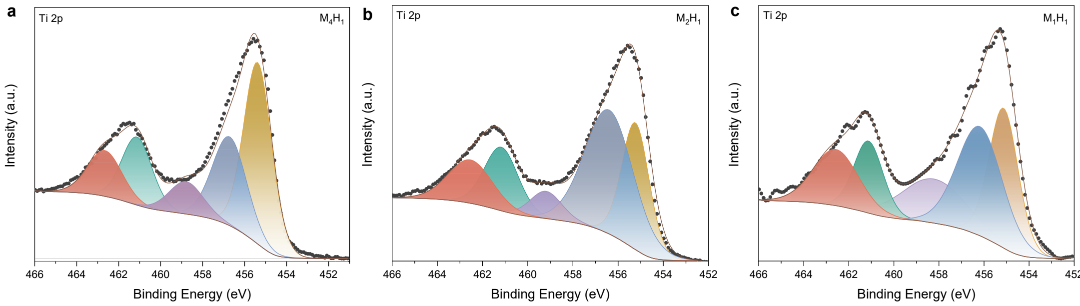

Fig. S7 XPS spectra of Ti 2p of (a) aerogel M_4H_1, (b) M_2H_1 (c) and M_1H_1.

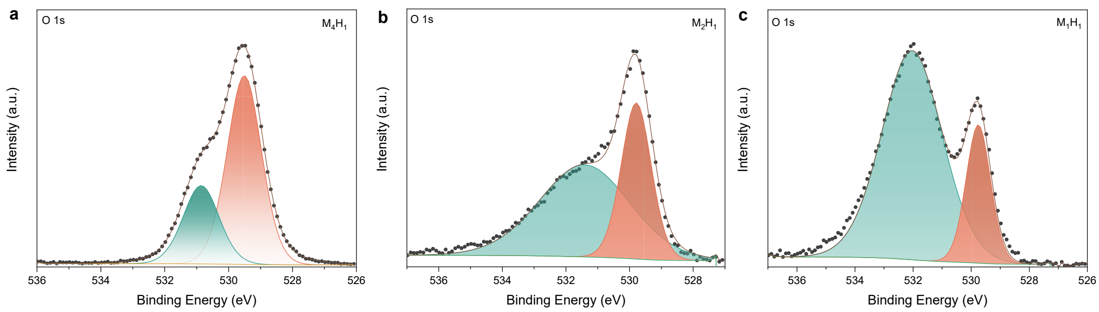

Fig. S8 XPS spectra of O 1S of (a) aerogel M_4H_1, (b) M_2H_1 (c) and M_1H_1.

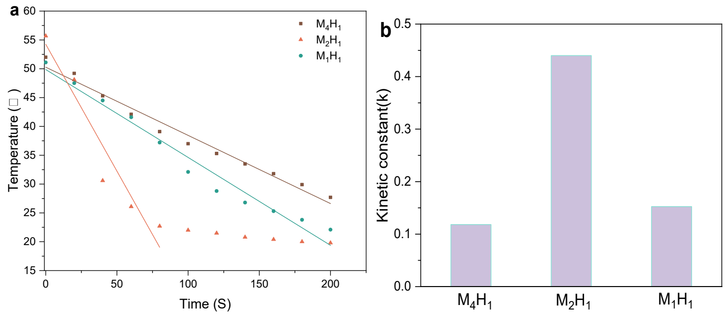

Fig. S9 (a) Fitted curves of the cooling kinetics of the three aerogels. (b) Cooling kinetic constants k of the three aerogels.

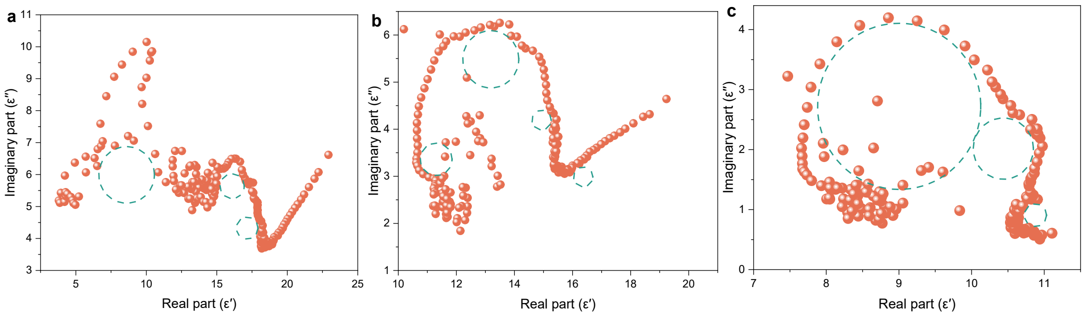

Fig. S10 Cole-Cole curves of (a) M_4H_1, (b) M_2H_1, and (c) M_1H_1.

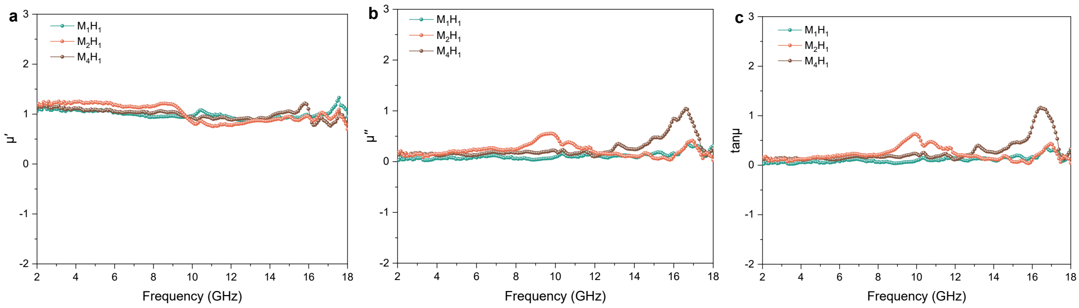

Fig. S11 Electromagnetic parameters at different frequencies: (a) μ', (b) μ'' and (c) tanδμ of all samples.

Table. S1 Comparison of the performance of this study with previous studies in countering multispectral detection.

Materials	RL_{min} (dB)	EAB (GHz)	Test tempera-ture	Time	Final temper-ature	Ref
GPCN	-56.5	6.4	60℃	10 min	33.2℃	[1]
CAs	-25.8	5.15	120℃	6 min	35.6℃	[2]
PPM80	-56.76	10.52	80℃	10 min	44.1℃	[3]
AMCA-2	-55.9	4.7	120℃	3 min	37.7℃	[4]
ATO/rGO	-40.92	9.8	130℃	/	45.5℃	[5]
PC800@CuS	-61.5	7.8	81.4℃	20 min	39.5℃	[6]
CRCCS	-56.1	8.4	80.0℃	20 min	58.4℃	[7]
GG33	-63.52	8.45	70.0℃	30 min	34.8℃	[8]
$Co_{1.29}Ni_{1.71}O_4$/rGO/CF	-53.45	7.45	55℃	20 min	25℃	[9]
Ni/OMMC	-43.6	5.6	70 ℃	5 min	30.3 ℃	[10]
C/Fe_3C	-57.6	7.8	85 ℃	30 min	33 ℃	[11]
CuS@rGO	-55.1	7.2	120 ℃	30 min	26.8 ℃	[12]

M_2H_1	-50.05	8.1	200 ℃	420 min	45.2 ℃	This work

References

1 H. Zhao, Y. Cheng, Z. Zhang, B. Zhang, C. Pei, F. Fan and G. Ji, *Carbon*, 2021, **173**, 501-511.
2 X. Chen, M. Zhou, Y. Zhao, W. Gu, Y. Wu, S. Tang and G. Ji, *Green Chem.*, 2022, **24**, 5280-5290.
3 W. Gu, S. J. H. Ong, Y. Shen, W. Guo, Y. Fang, G. Ji and Z. J. Xu, *Adv. Sci.*, 2022, **9**, 2204165.
4 X. Chen, Z. Wang, M. Zhou, Y. Zhao, S. Tang and G. Ji, *Chem. Eng. J.*, 2023, **452**, 139110.
5 Y. Zhao, H. Qi, X. Dong, Y. Yang and W. Zhai, *ACS Nano*, 2023, **17**, 15615-15628.
6 X. Zhang, L. Cai, Z. Xiang and W. Lu, *Carbon*, 2021, **184**, 514-525.
7 Y. Gao, Q. Wu, L. Pan, X. Zhuang, F. Tian, X. Jia, Q. Man and B. Shen, *Chem. Eng. J.*, 2024, **484**, 149422.
8 Y. Cheng, X. Sun, S. Yang, D. Wang, L. Liang, S. Wang, Y. Ning, W. Yin and Y. Li, *Chem. Eng. J.*, 2023, **452**, 139376.
9 Y. Shi, X. Ding, K. Pan, Z. Gao, J. Du and J. Qiu, *J. Mater. Chem. A*, 2022, **10**, 7705-7717.
10 H. Du, J. Ren, W. Zhang and R. Yang, *Carbon*, 2023, **204**, 325-335.
11 G. Fang, T. He, X. Hu, X. Yang, S. Zheng, G. Xu and C. Liu, *Chem. Eng. J.*, 2023, **467**, 143266.
12 Y. Wu, Y. Zhao, M. Zhou, S. Tan, R. Peymanfar, B. Aslibeiki and G. Ji, *Nano-Micro Lett.*, 2022, **14**, 171.