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

Supporting information

Sensitivity-stability trade-off in conductive foam-based piezoresistive sensors

Weigang Zhu[a,†], Xianzhe Liu[a,†*], Xinqing Chen[b], Kai Chen[c], Min Huang[a], Fengming Hu[d] Fanchao Zeng[c], Mengxia Yu[e], Mingxin Chen[e], Aiping Huang[a,], Zhiming Chen[a,*], Jianyi Luo[a,*]

[a] *Research Center of Flexible Sensing Materials and Devices, School of Applied Physics and Materials, Wuyi University, Jiangmen 529020, China.*

[b] *School of Machinery and Automation Engineering, Wuyi University, Jiangmen, 529020, China.*

[c] *School of Electronics and Information Engineering, Wuyi University, Jiangmen, 529020, China.*

[d] *Institute of Applied Physics and Materials Engineering, University of Macau,Macau,519000，China.*

[e] *School of Environmental and Chemical Engineering, Wuyi University, Jiangmen, 529020, China.*

[*]Corresponding author. E-mail: chenzhiming@wyu.edu.cn (Z. Chen),
liuxianzhe@wyu.edu.cn (X. Liu), luojiany@mail3.sysu.edu.cn (J. Luo)

[†]These authors contributed equally to this work.

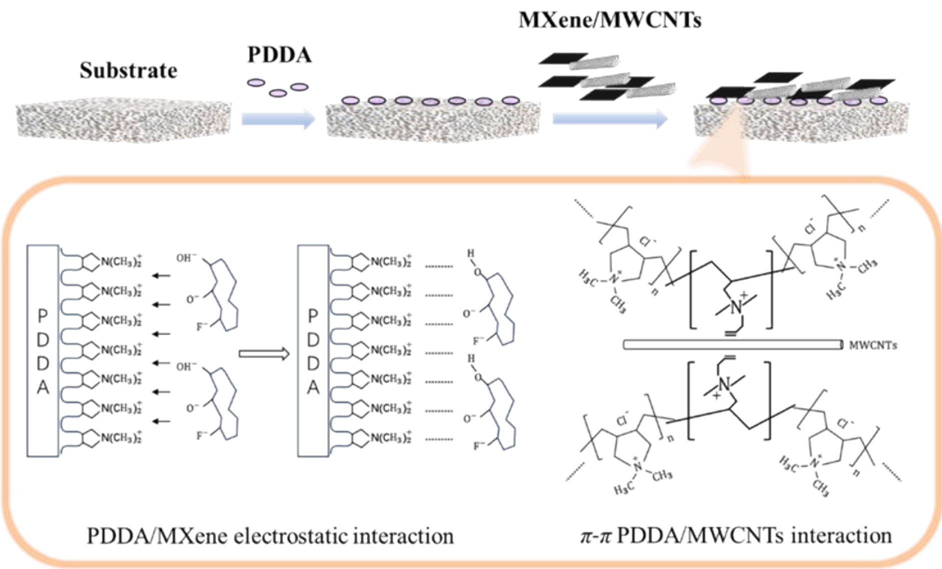

Figure S1. Schematic procedure for simultaneous self-assembly of MXene and MWCNTs.

Figure S2. The foam was ultrasonically cleaned in deionised water.

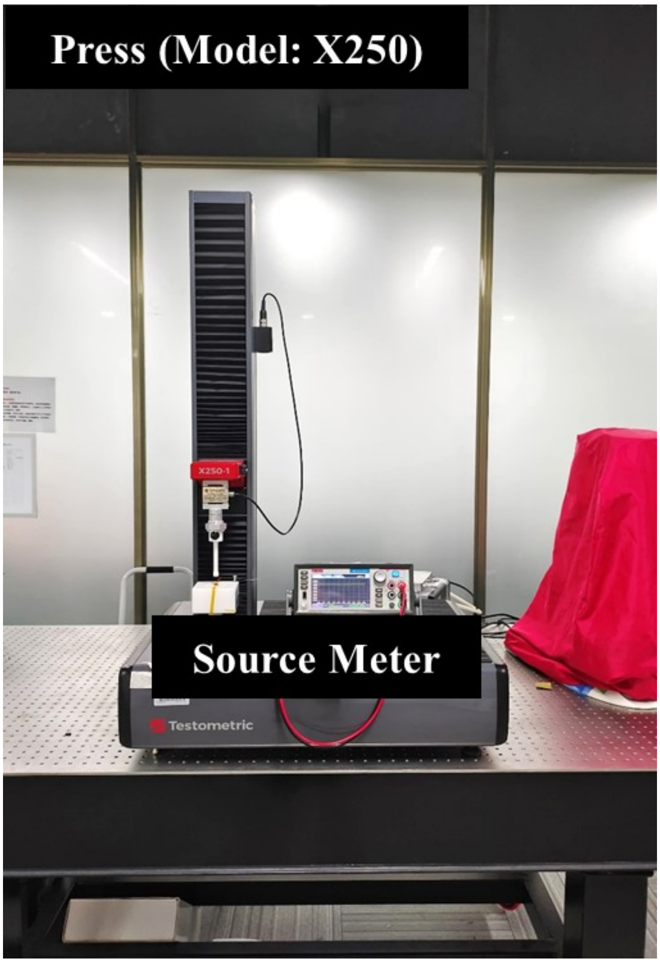

Figure S3. Photogram of Testometric material testing system.

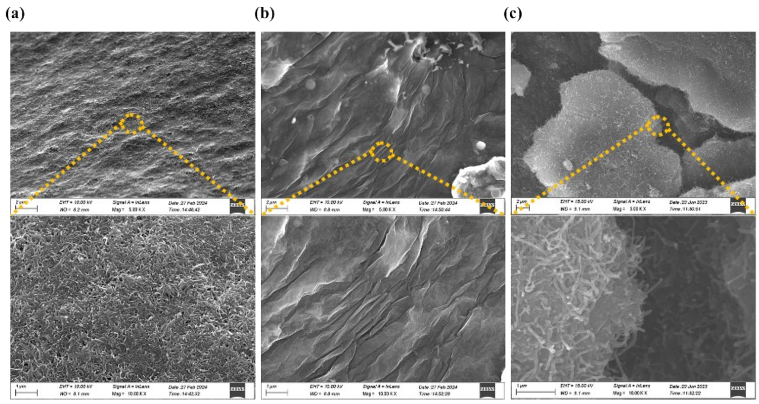

Figure S4. The SEM images of (a) MWCNTs&PDMS foam, (b) MXene&PDMS foam and (c) MWCNTs&MXene&PDMS (PMM) foam.

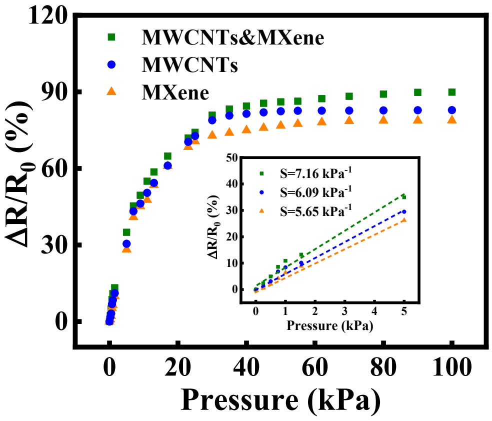

Figure S5. The resistance-pressure curve of the different samples and the sensitivity in the low-pressure rang of 0-5 kPa.

$$Porosity = \frac{Void\ Volume}{Total\ Volume} = \frac{Total\ Volume - \frac{Weight\ of\ porous\ PDMS\ Sponge}{PDMS\ Density}}{Total\ Volume}$$

Table S1. The porosity of PDMS foam prepared with different NaCl particle contents.

NaCl : PDMS (wt%)	Porosity (%)	Standard deviation
1:1	57.3%	0.0138
3:1	71.7%	0.0167
6:1	77.7%	0.0152

*The weight of porous PDMS sponge was measured by electronic balance (ME403E), and the density (1100 kg/m^3) of PDMS material is retrieved from Polymer Data Handbook (Oxford University Press, New York, 1999).

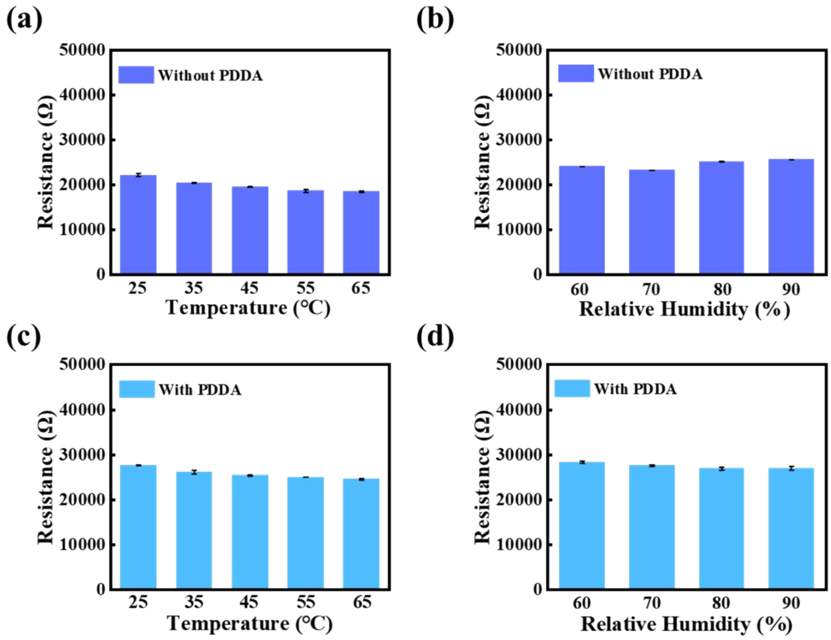

Figure S6. Electrical response of sensors without PDDA modification and PI packaging under different temperature (a) and humidity (b) conditions. Electrical response of sensors with PDDA modification and PI packaging under different temperature (c) and humidity (d) conditions.

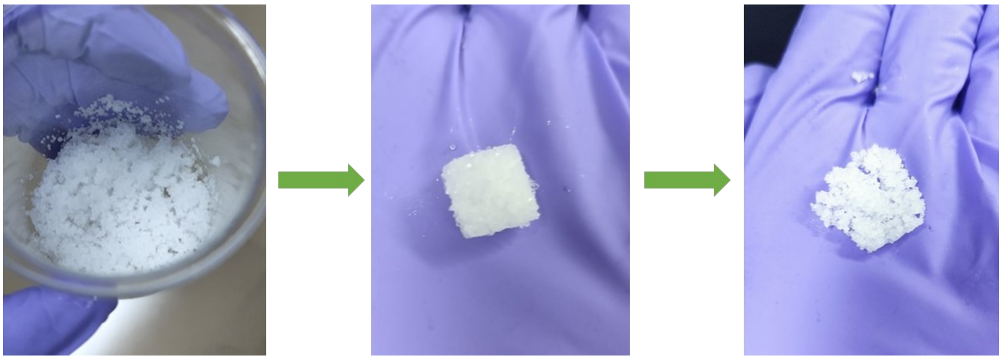

Figure S7. The failed formation of porous PDMS foam when the mass ratio of NaCl/PDMS increases to 7:1.

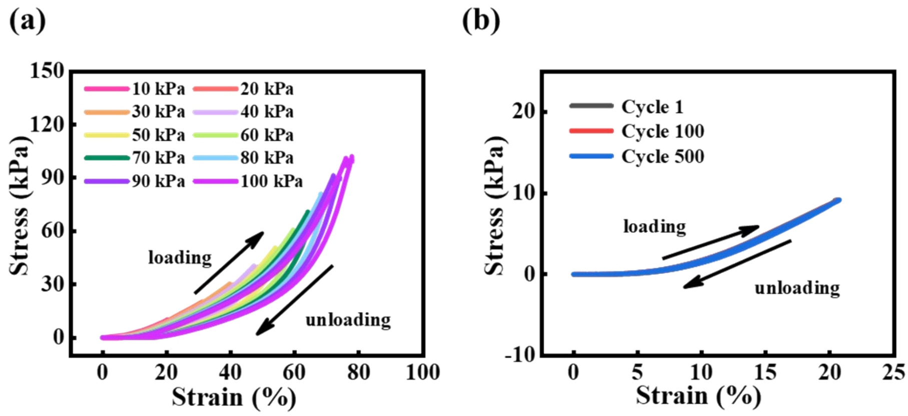

Figure S8. Mechanical testing (a) different pressure ranges (10kPa-100kPa), (b) within the pressure range of 10kPa.

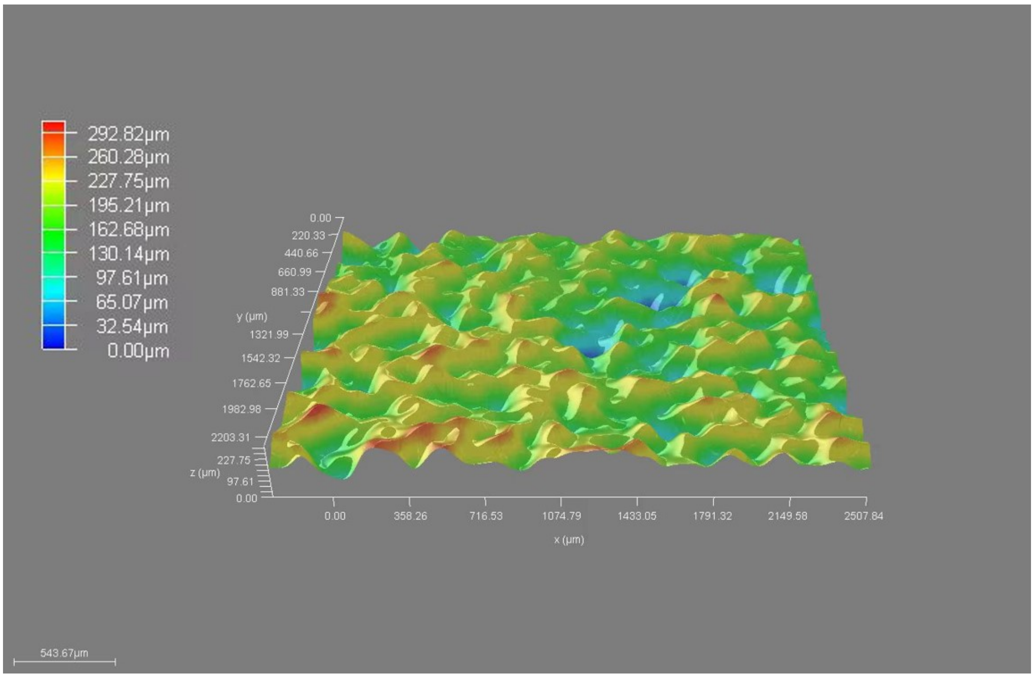

Figure S9. The surface morphology of PMM foam.

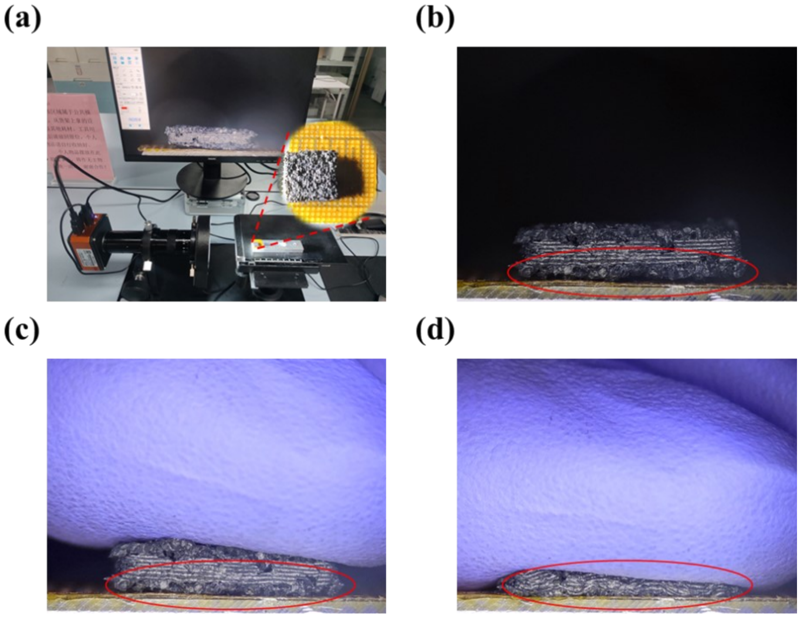

Figure S10. (a) Test system (b) Initial state (c) Micro-compression state (d) Strong compression state.

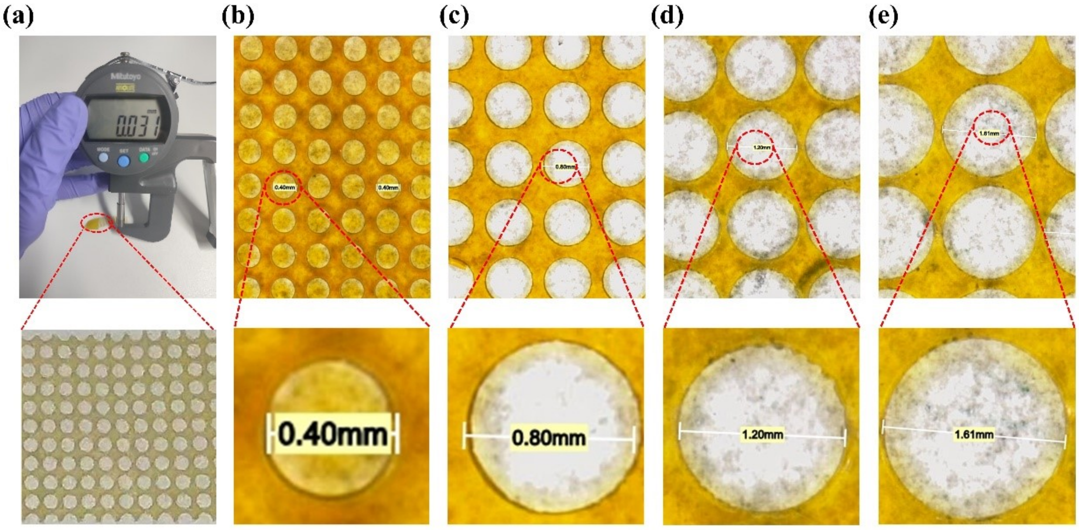

Figure S11. (a) The thickness of the porous array membrane. The porous array membrane with different pore radii: (b) 0.2mm, (c) 0.4mm, (d) 0.6mm and (e) 0.8mm.

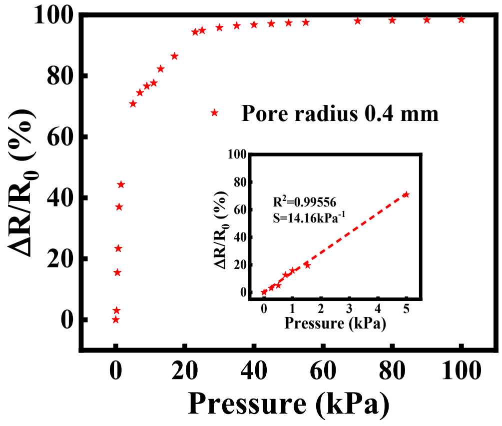

Figure S12. The resistance-pressure curve of PMM pressure sensor and the sensitivity in the low-pressure rang of 0-5 kPa.

Figure S13. The waterproof property of PMM pressure sensor tested by stirring at a rotation speeding of 500 rmp in the water.

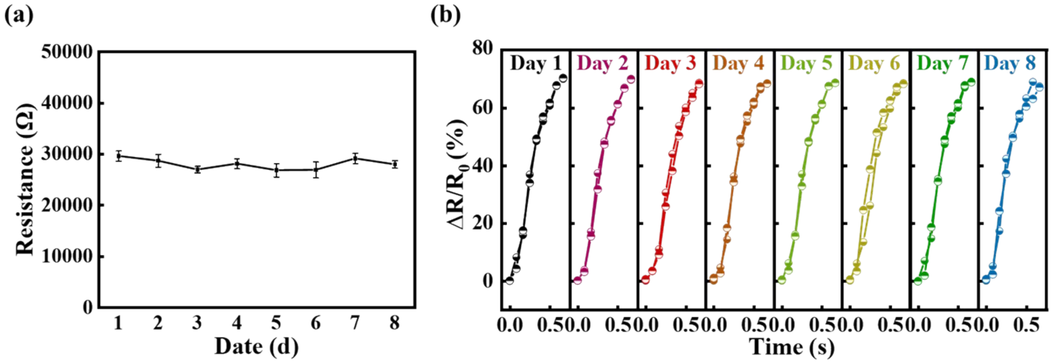

Figure S14. (a) Sensor resistance value. (b) The electrical response of the pressure sensor in the pressure rang of 0-5 kPa.