Electronic Supplementary Material (ESI) for Nanoscale.
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Supporting Information

A highly sensitive piezoresistive sensor based on MXene and polyvinyl butyral with wide detection limit and low power consumption

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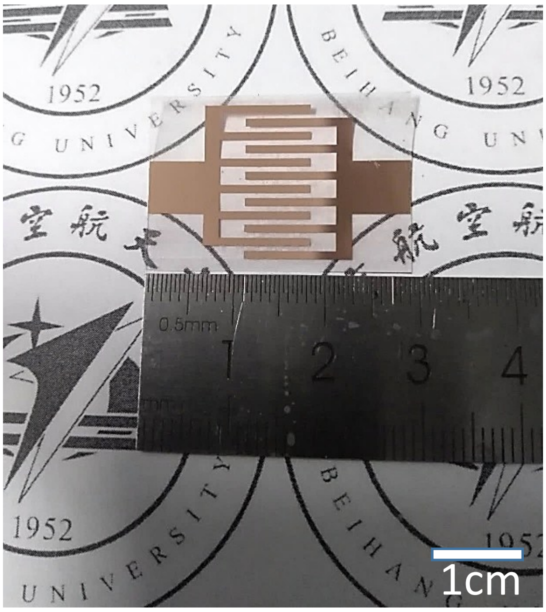
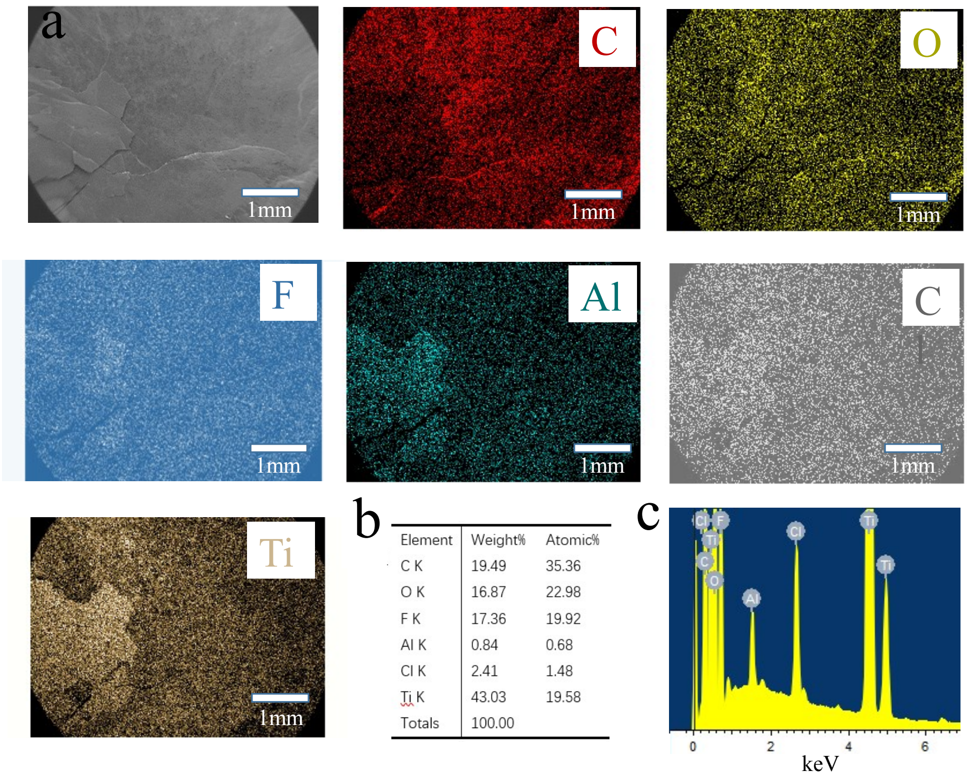


Fig. S1. The interdigital electrode on flexible PET substrate was prepared by laser ablation strategy.



Element	Weight%	Atomic%
C K	19.49	35.36
O K	16.87	22.98
F K	17.36	19.92
Al K	0.84	0.68
Cl K	2.41	1.48
Ti K	43.03	19.58
Totals	100.00	

Fig. S2. (a) SEM image and EDS mapping of MXene layer of the MXene/PVB sensor. (b) The weight and atomic percentage of each element. (c) The x-ray energy dispersion spectrum (EDS).

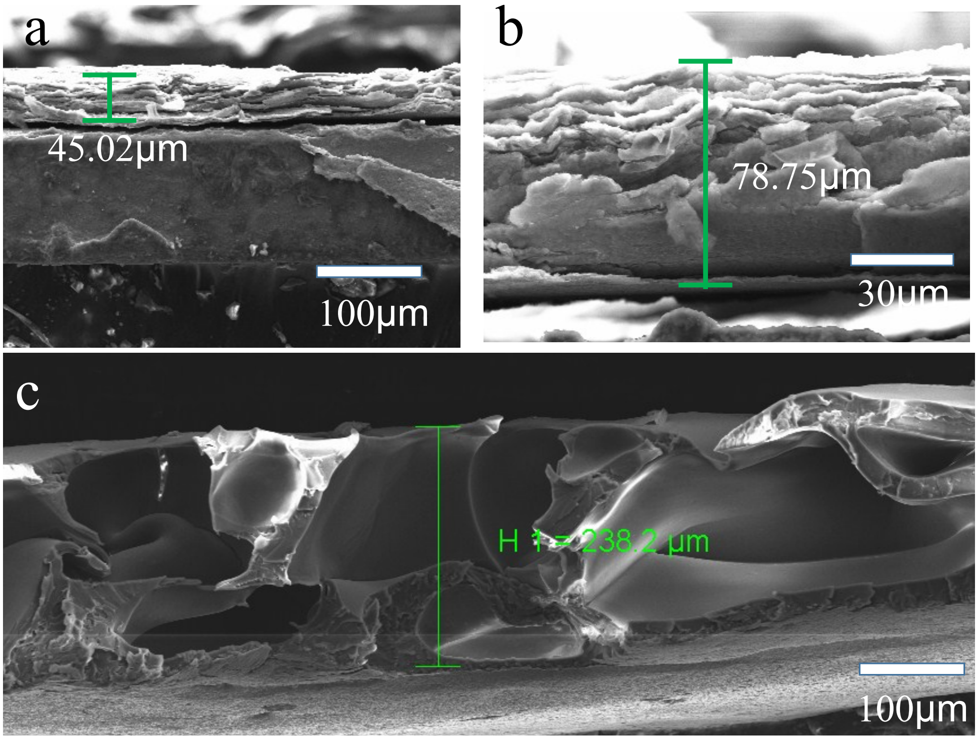


Fig. S3. (a-b) The thickness of MXene layer (5 mL and 10 mL aqueous 2.1 mg/mL MXene solutions are separately sprayed onto PET substrates containing the interdigital finger). (c) The thickness of PVB layer after spraying a solution of 1 g of PVB in 10 mL of ethanol onto the PET substrate.

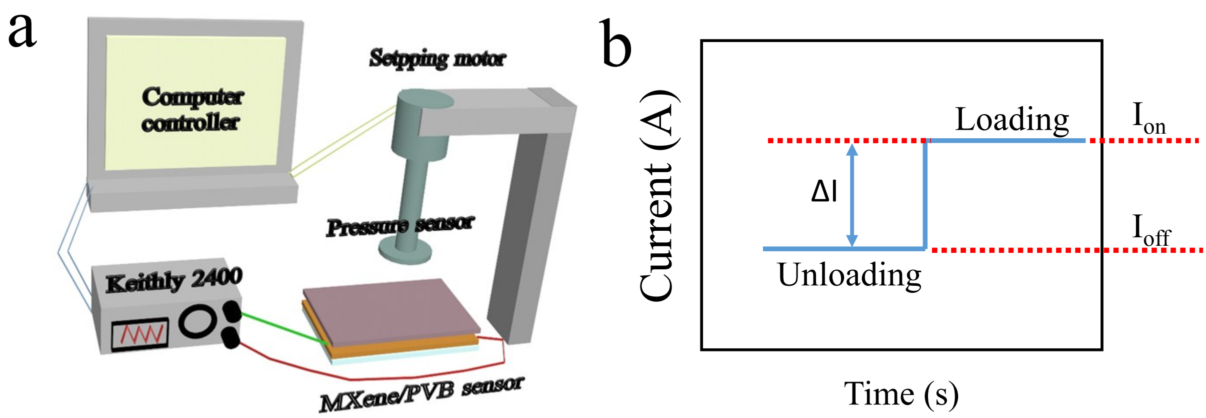


Fig. S4. (a)The universal pressure machine and associated source meter used to test sensor performance. (b) The testing principle of sensor performance.

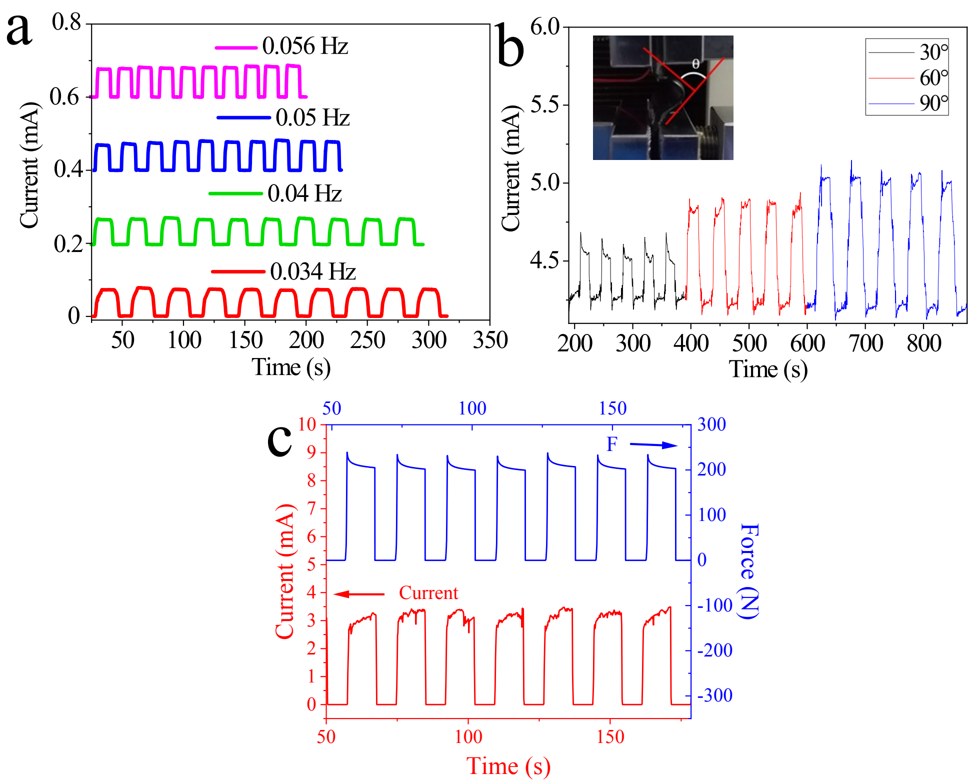


Fig. S5. (a) I-T response curve of different frequencies at ~1 kPa stress. (b) I-T response curves at different bending angles. (c) The output current and external pressure are in good synchronization with loading and unloading.

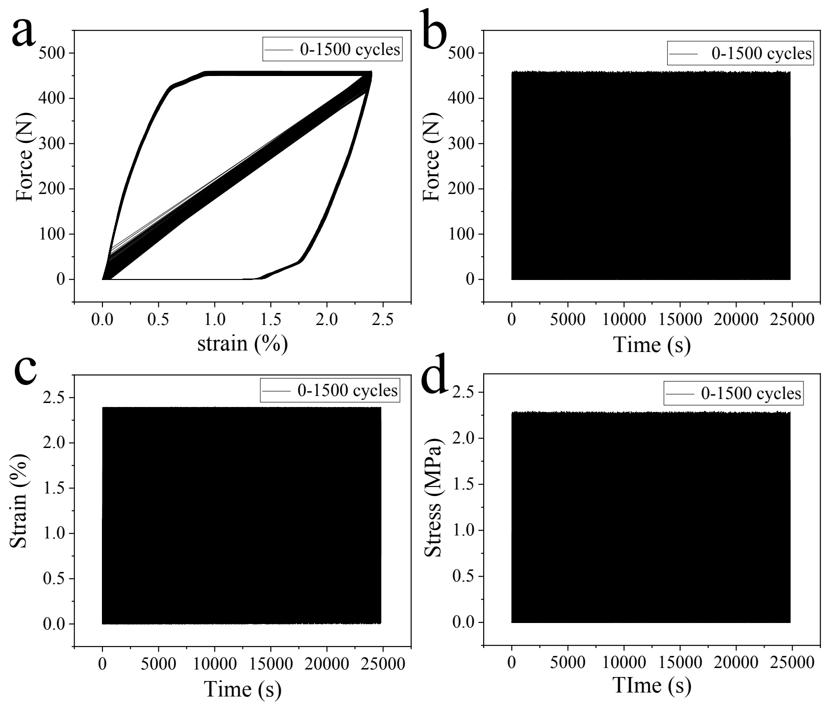


Fig. S6 (a) The relationship between force and strain. (b) The relationship between force and time. (c) The relationship between strain and time. (d) The relationship between stress and time.

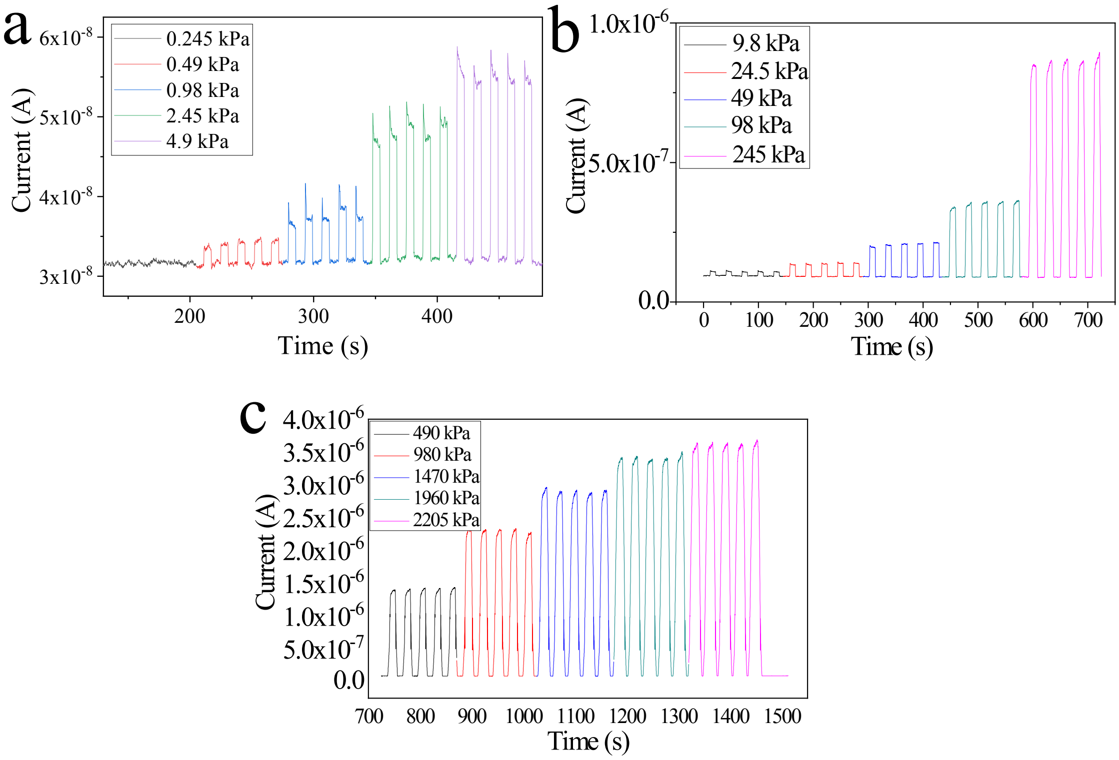


Fig. S7. (a-c) The I-T response curves of the sensor under different pressure at 0.1 mV working voltage.

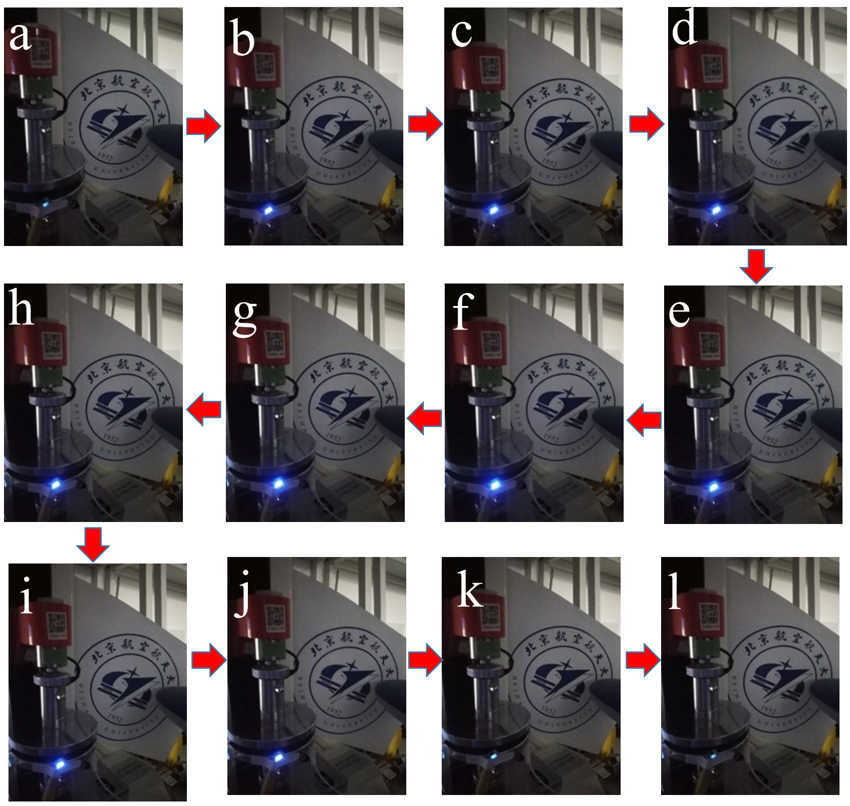


Fig. S8. (a-f) Optical images showing the circuit resistance decrease and the lamp become brighter with increasing pressure. (g-l) Optical images showing the circuit resistance increase and the lamp become darker with decreasing pressure.

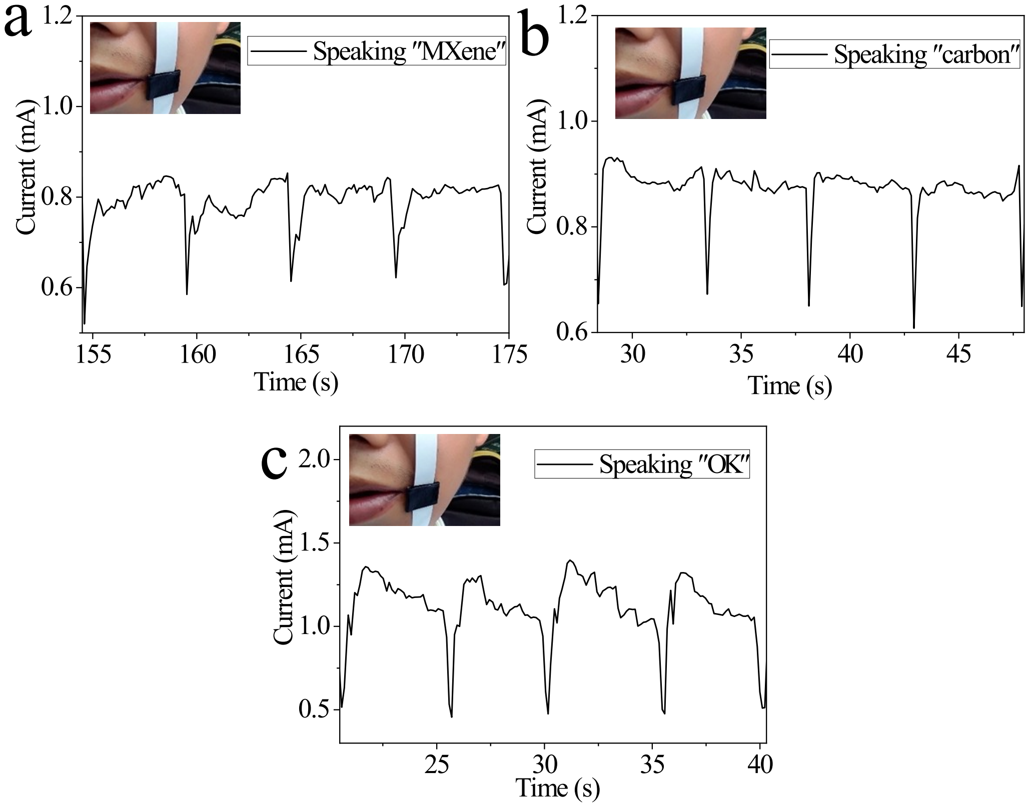


Fig. S9. (a-c) I-T response curves of speaking the words "MXene", "Carbon" and "OK" by sticking the sensor near the mouth.

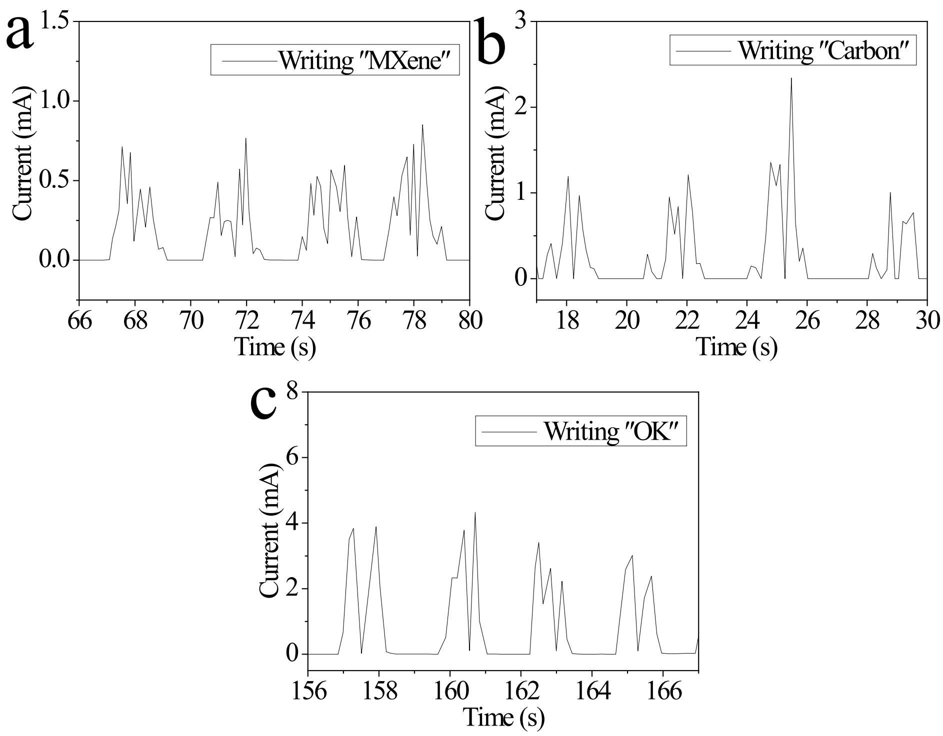


Fig. S10. (a-c) I-T response curves of writing "MXene", "Carbon" and "OK" words directly on the sensor with a pen.

Table S1. Comparison of sensor performance based on MXene material.

Sensing mechanism	Materials	Detection limit	Sensing range	Sensitivity	Response /recovery time	Stability (cycle number)	Working Voltage /power consumption	References
Piezoresistive	MXene annosheets	10.2 Pa	23 Pa - 30 kPa	0.55 kPa^{-1} (23 - 982 Pa), 3.81 kPa^{-1} (982 - 10 kPa), 2.52 kPa^{-1} (10 - 30 kPa).	11 ms /25 ms	10000	0.01V/ 10^{-8} W	[26]
Piezoresistive	MXene/CS/PU	9 Pa	<245.7 kPa	0.014 kPa^{-1} (<6.5 kPa), 0.015 kPa^{-1} (6.5 - 85.1 kPa), 0.001 kPa^{-1} (>85.1 kPa).	19 ms	5000	/	[27]
Piezoresistive	MXene/textile	/	<40 kPa	3.844 kPa^{-1}(<29 kPa), 12.095 kPa^{-1}(29 - 40 kPa)	26 ms /52 ms	5600	/	[28]
Piezoresistive	MXene/rGO	10 Pa	<3.5 kPa	4.05 kPa^{-1} (<1 kPa), 22.56 kPa^{-1} (1.25 - 3.4 kPa).	245 ms/ 212 ms	10000	/	[30]
Piezoresistive	MXene /NMC	8 Pa	10 Pa – 7 kPa	24.63 kPa^{-1} (10 - 200 Pa), 1.18 kPa^{-1} (200 Pa - 7 kPa)	14 ms	5000	/	[47]
Piezoresistive	MXene/PVB	6.8 Pa	31.2 Pa - 2.205 MPa	11.9 kpa^{-1} (31.2Pa -312 Pa), 1.15 kPa^{-1} (312 Pa - 62.4 kPa), 0.20 kPa^{-1} (62.4 kPa - 1248.4 kPa).	100 ms /110 ms	10000	0.1 mV/ 3.6×10^{-10} W	This work

Movie S1:
The brightness of a LED can be controlled by loading different finger pressure on the MXene/PVB-based sensor.
Movie S2:
The brightness of a LED can be controlled by loading different pressure on MXene/PVB-based sensor with pressure machine.