Supporting information

System design of large-area vertical photothermoelectric detector based on carbon nanotube forest with MXene electrodes

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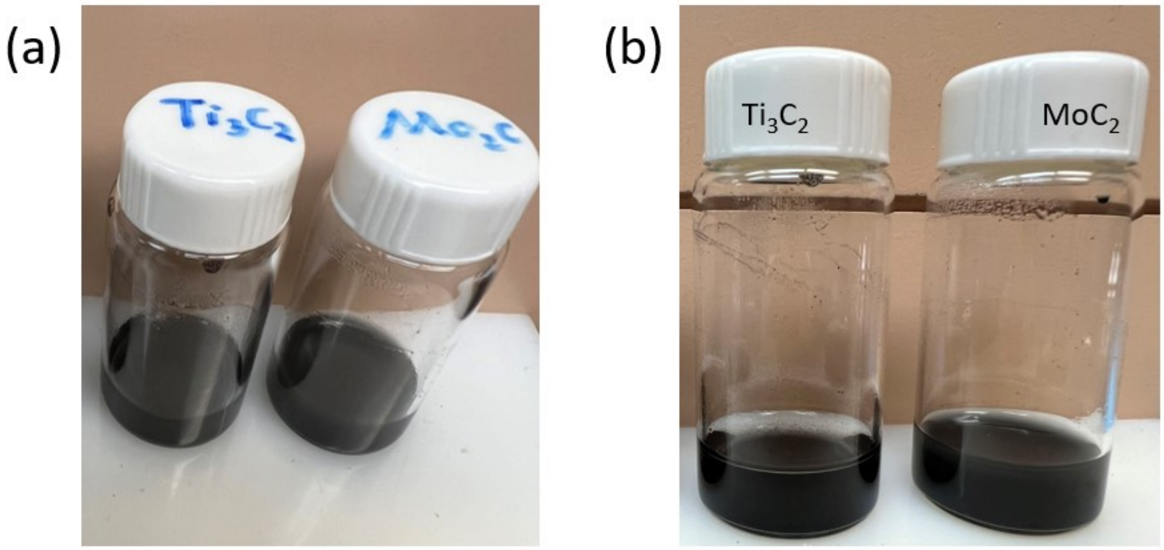
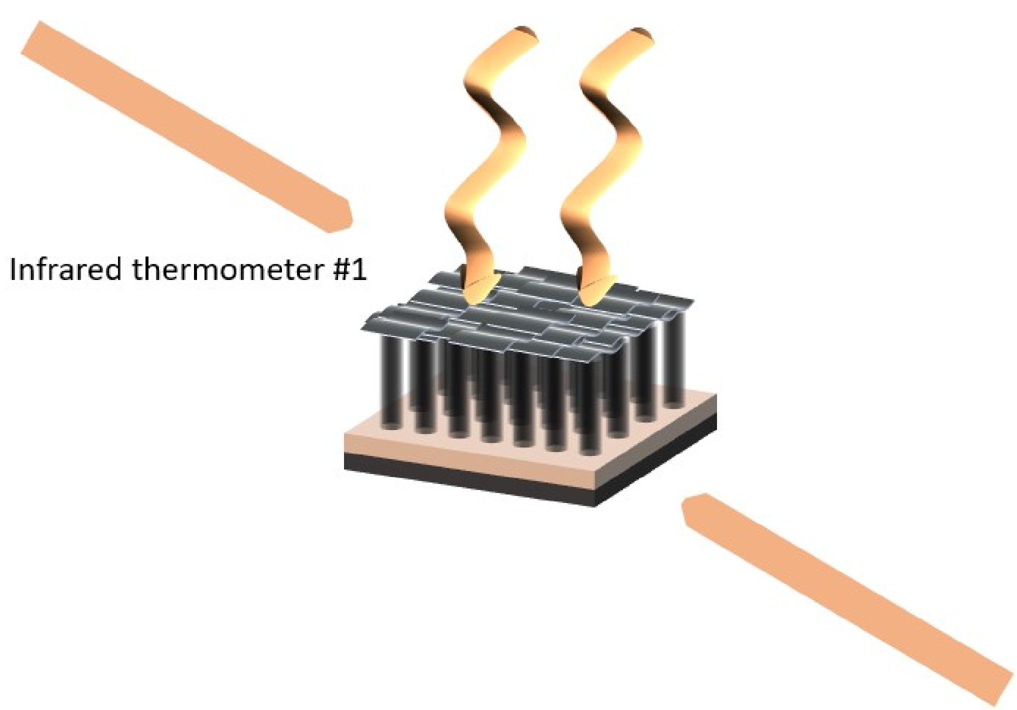


Fig. S1. The photographic image of the prepared MXene solution.

Fig. S2. The illustration of temperature measurement by infrared thermometer. With the blackbody radiation vertically illuminates on the top of the PTE detector, infrared thermometer #1 and #2 measures the temperature of top MXene electrode and bottom Si substrate.



In this measurement, we use the PTE detector with Ti_3C_2 electrode of 0.9 µm. With the 873K blackbody radiation, the temperature of top MXene electrode and bottom Si substrate is 29.6 °C and 22.5 °C. The ambient temperature is 22.5 °C. The temperature difference is 7.1 °C. According to the PTE voltage calculation equation, $V_{PTE} = S_{eff}\Delta T$, where S_{eff} the effective Seebeck coefficient of the detector and ΔT is the temperature difference of two electrodes. The estimated S_{eff} should be 33.8 µV/K.

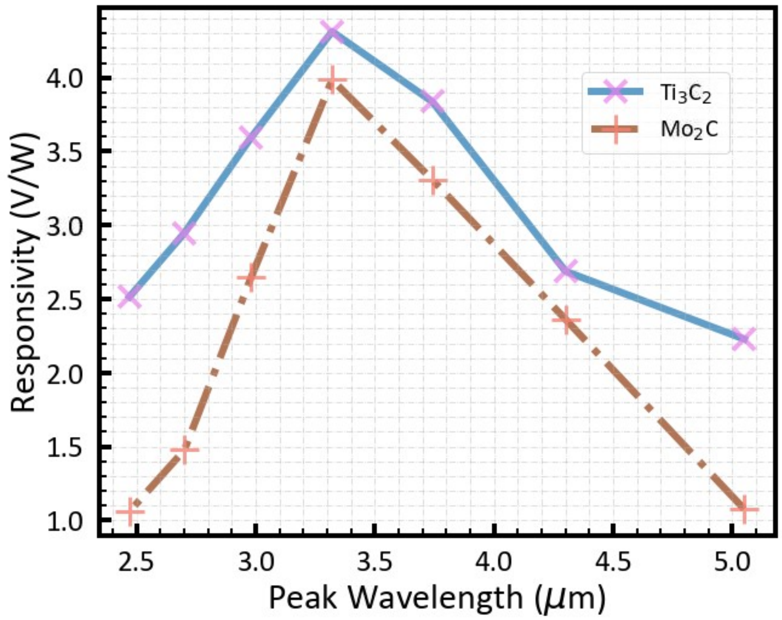


Fig. S3. The realtionsihip between responsivity and blackbody peak wavelength.

Table S1. Performance Comparison of PTE detectors.

Detection Spectrum	Active layer	Electrodes	Response time	Detectivity ($\times 10^8$ Jones)	Ref.
MIR	CNTF	MXene/Metal	2.3 s	2.2	This work
MIR	Graphene/PEDOT:PSS	Metal/Metal	>10 s	0.14	[1]
MIR	Graphene/polyaniline	Metal/Metal	>5 s	0.68	[2]
MIR	CNT/(Polyvinyl alcohol)	Metal/Metal	/	0.049	[3]
Terahertz (THz)	CNT	Metal/Metal	/	1.2	[4]
THz	$EuBiTe_3$	Metal/Metal	0.1 s	2.3	[5]

References

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(4) Suzuki, D.; Oda, S.; Kawano, Y. A Flexible and Wearable Terahertz Scanner. *Nat. Photonics* **2016**, *10*, 809–813.

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