Supporting Information

Fast and All-Weather Cleanup of Viscous Crude-Oil Spills with $Ti_3C_2T_X$ MXene Wrapped Sponge

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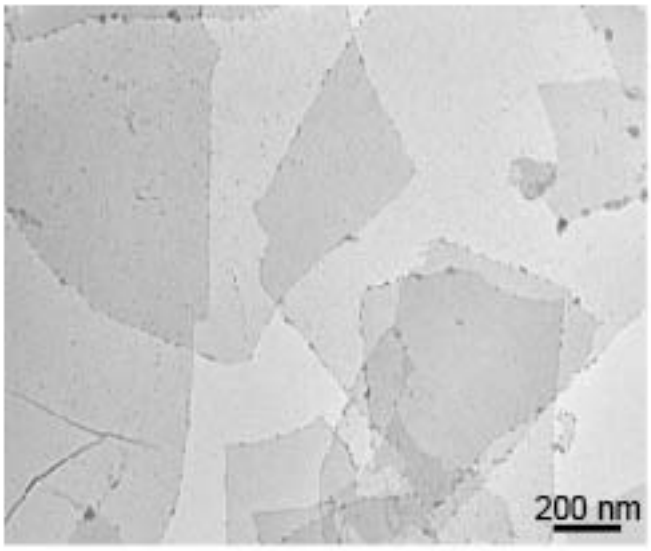

Figure S1. TEM image of $Ti_3C_2T_X$ nanosheets.

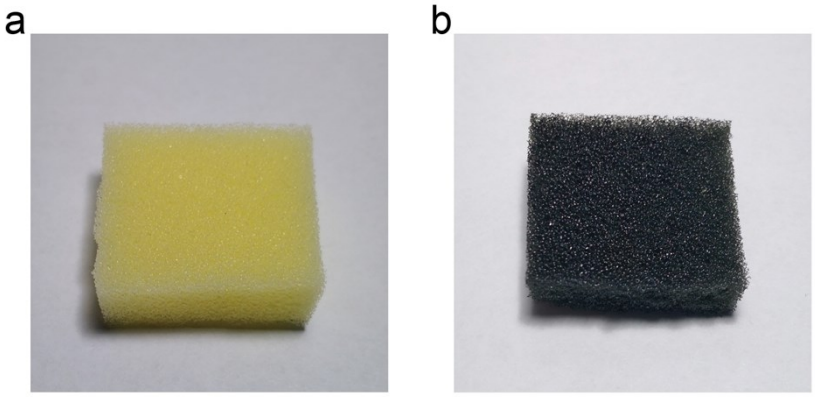

Figure S2. Photographs of original PU sponge (a) and $Ti_3C_2T_X$@PU (b).

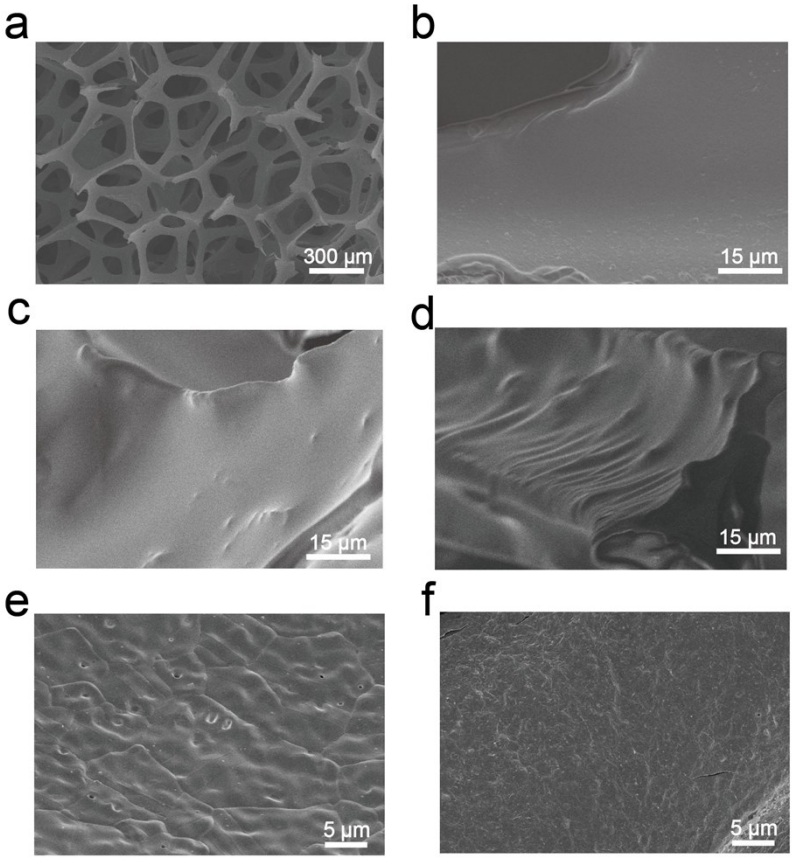

Figure S3. SEM images of original PU sponge (a, b) and $Ti_3C_2T_X$@PU (c-f).

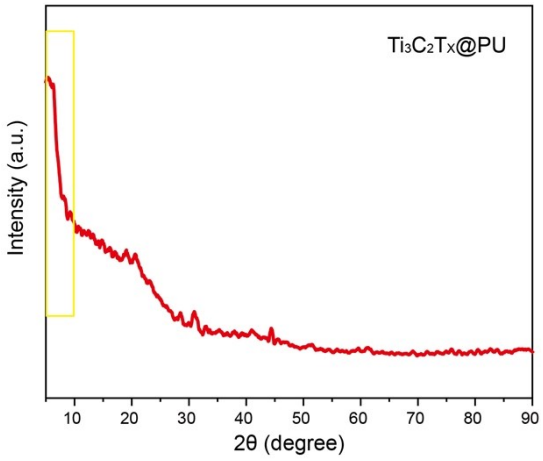

Figure S4. XRD pattern of $Ti_3C_2T_X$@PU, suggesting the presence of $Ti_3C_2T_X$.

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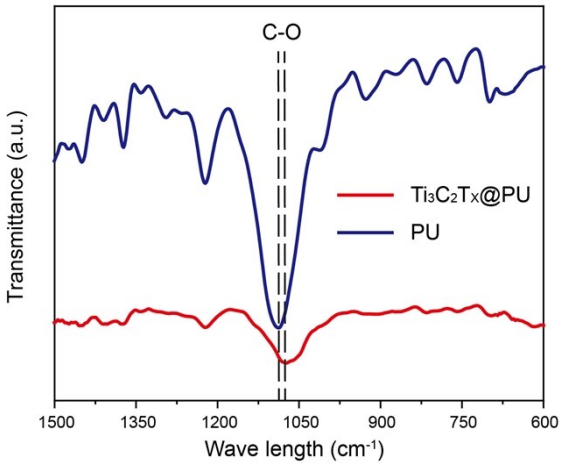

Figure S5. FTIR spectrums of $Ti_3C_2T_X$@PU and PU sponge.

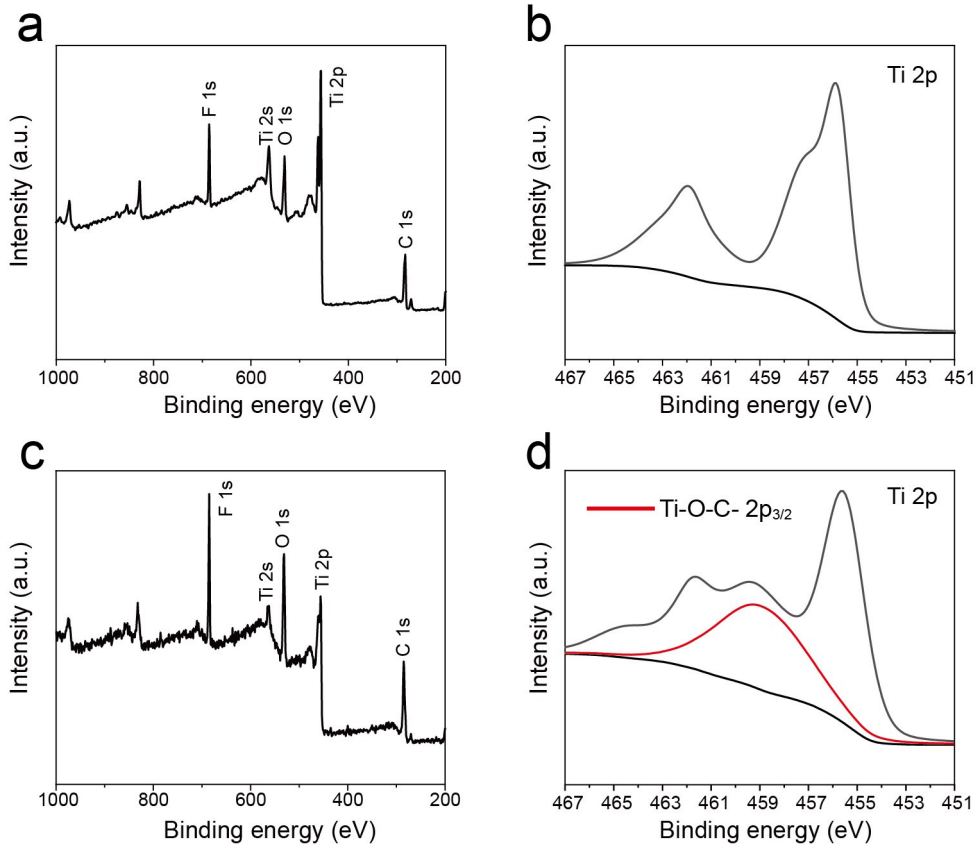

Figure S6. XPS survey spectrum and high-resolution Ti 2p of $Ti_3C_2T_X$ nanosheets (a, b) and $Ti_3C_2T_X$@PU (c, d), suggesting the nature of chemical adhesion of MXene to PU sponge.

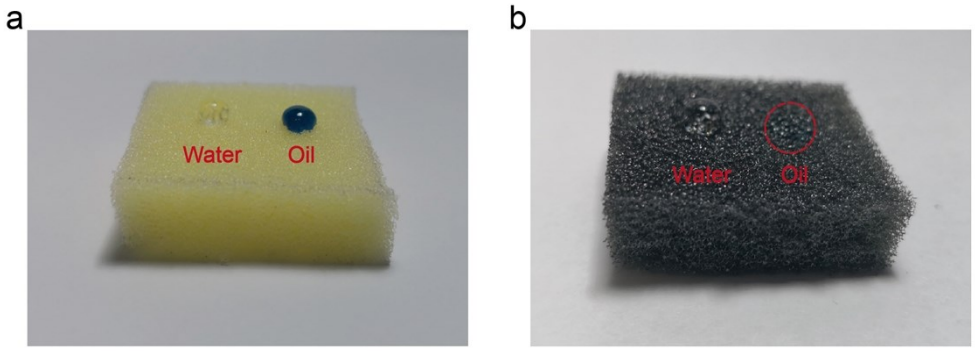

Figure S7. Hydrophobic and oleophobic feature of PU sponge (a) and hydrophobic and oleophilic feature of $Ti_3C_2T_X$@PU (b).

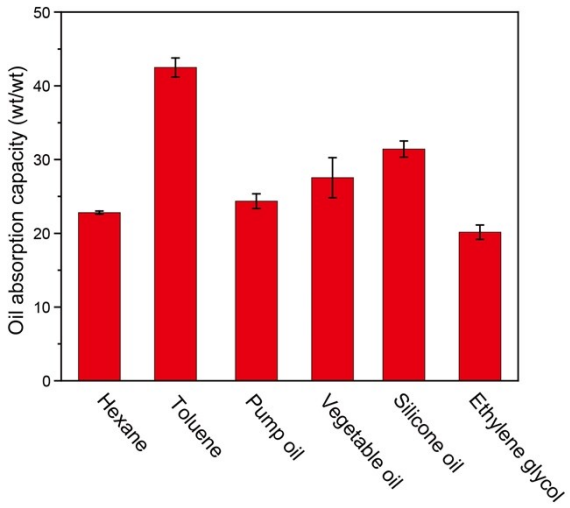

Figure S8. Absorption capacity of $Ti_3C_2T_X$@PU for various organic liquids.

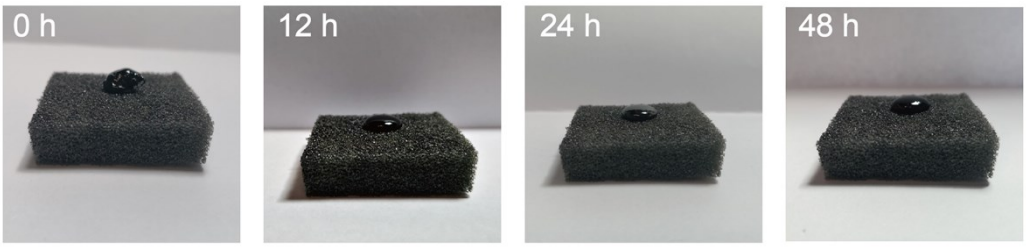

Figure S9. Permeating behavior of one heavy oil droplet (200 μL) on the surface of $Ti_3C_2T_X$@PU at 20 °C.

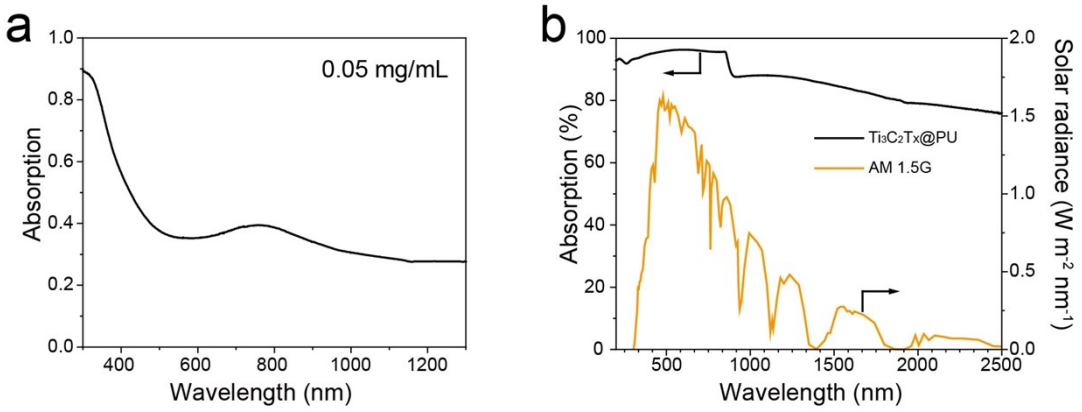

Figure S10. UV-vis-NIR absorption spectrum of MXene solution with the mass concentration of 0.05 mg/mL (a) and absorption spectrum of $Ti_3C_2T_X$@PU in the range of the standard solar spectrum (AM 1.5G) (b).

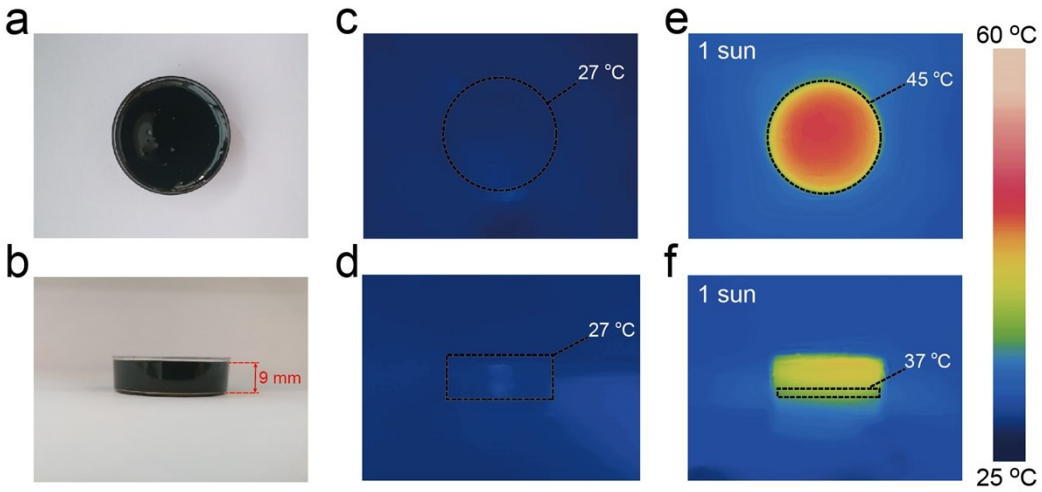

Figure S11. Photographs (a, b) and IR images of top and side surface of crude oil which has been placed at 27 °C (c, d) and irradiated under 100 mW cm^{-2} for 10 min (e, f).

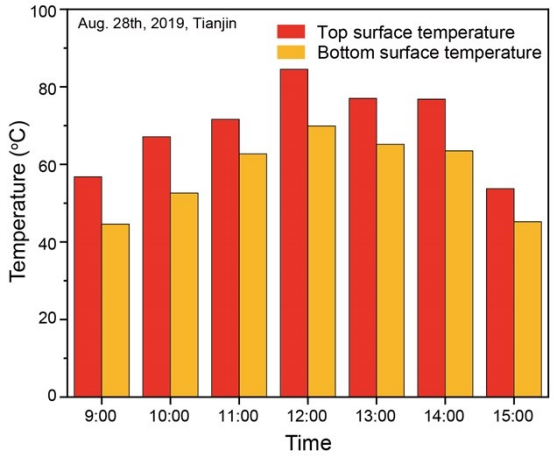

Figure S12. Temperatures of top surface and bottom surface of $Ti_3C_2T_X$@PU under the irradiation of the natural sunlight (Aug. 28th, 2019, Tianjin).

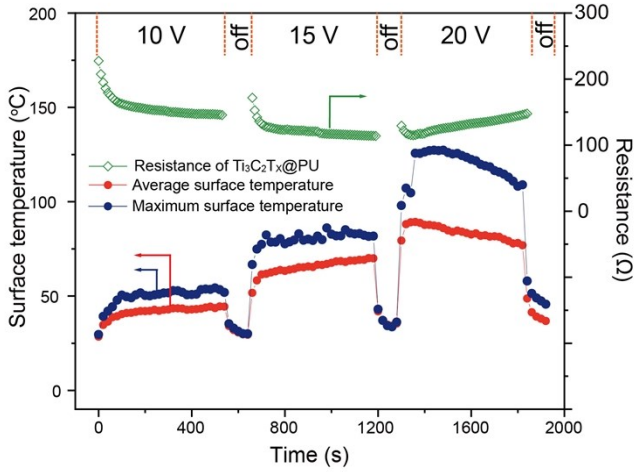

Figure S13. Resistance and surface temperature of $Ti_3C_2T_X$@PU (3×3×1 cm^3) at different applied voltages.

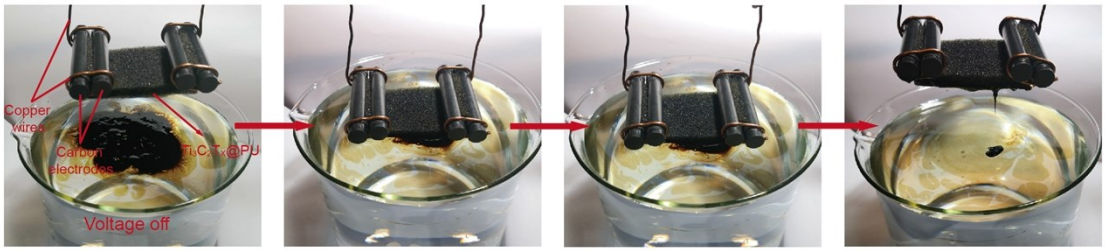

Figure S14. Photographs of the absorbing process without the aid of Joule heating.

Table S1. Summary of the property parameters of $Ti_3C_2T_X$@PU, graphene-wrapped sponge, HC-wood and CNT/PDMS-PU sponge.

Sorbent	Energy source	Maximum surface temperature (°C)	Absorption ability (g cm^{-3})	Absorption ability (g g^{-1})	Reference
Graphene-wrapped melamine sponge	Electricity	350	0.910	N/A	[27]
HC-wood	Solar energy	61 (1 sun)	0.694	N/A	[28]
CNT/PDMS-PU sponge	Solar energy	88 (1 sun)	0.237	20	[29]
$Ti_3C_2T_X$@PU	Solar energy Electricity	75 (1 sun) 120	0.972	48	This work

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29. J. Chang, Y. Shi, M. Wu, R. Li, L. Shi, Y. Jin, W. Qing, C. Tang and P. Wang, *J. Mater. Chem. A*, 2018, **6**, 9192-9199.