Electronic Supplementary Material (ESI) for Sensors & Diagnostics.

Upconversion Fluorescence of MXenes Nanosheets and the Sensitive Detection of L-Tryptophan

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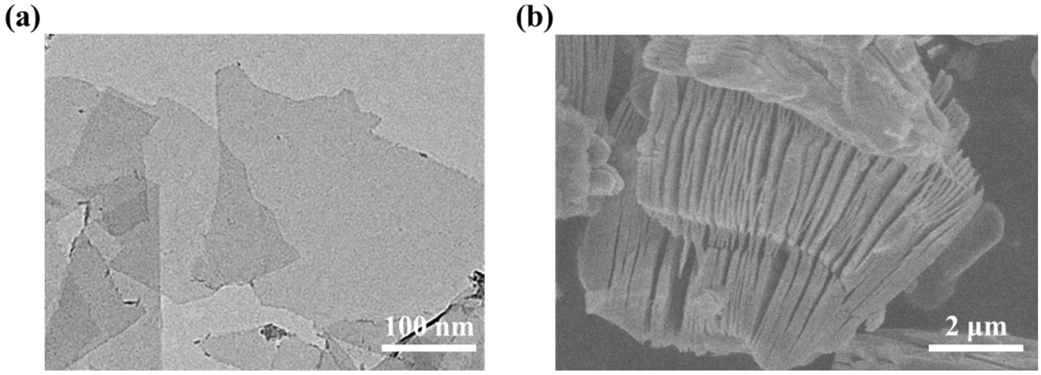

Fig.S1 (a) TEM image of Ti_3C_2 nanosheets. (b) SEM image of accordion-like Ti_3C_2.

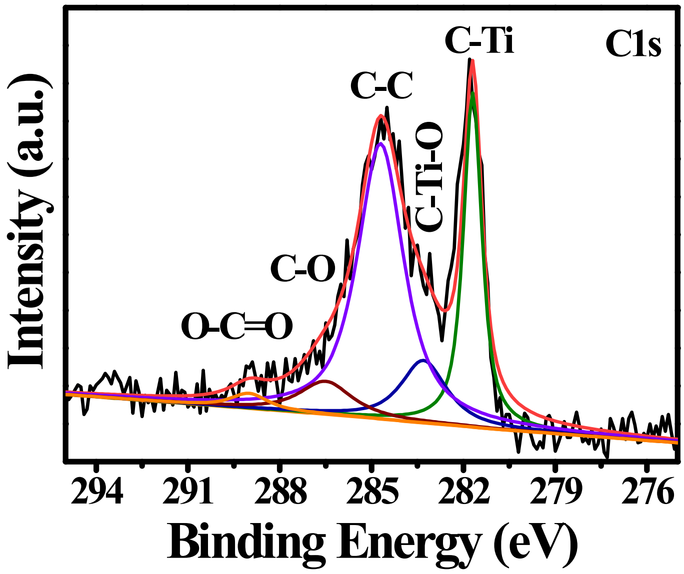

Fig.S2 High-resolution XPS spectrum of C 1s of Ti_3C_2 nanosheets.

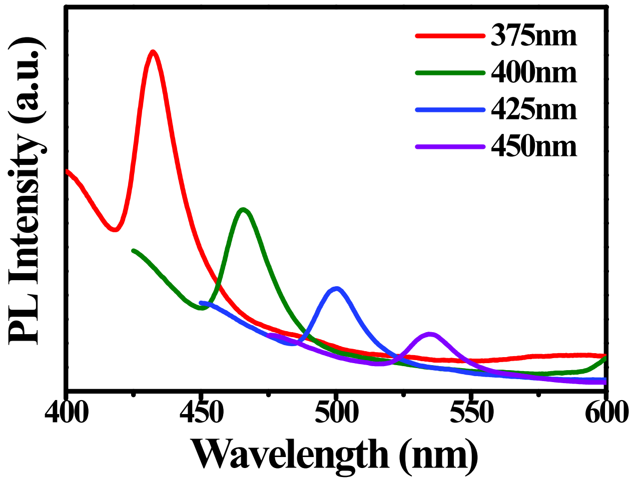

Fig.S3 Fluorescence emission spectra of Ti_3C_2 nanosheets in an aqueous solution at different excitation wavelengths.

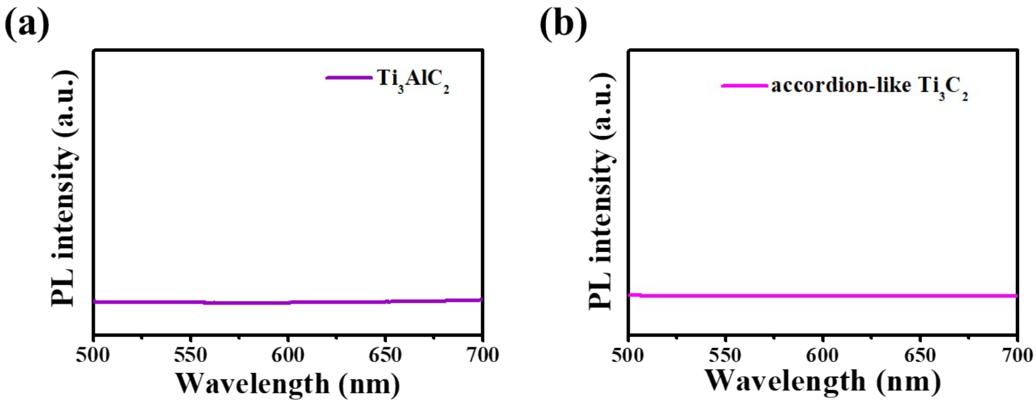

Fig.S4 The fluorescence emission spectra of a) Ti_3AlC_2 powder and b) accordion-like Ti_3C_2.

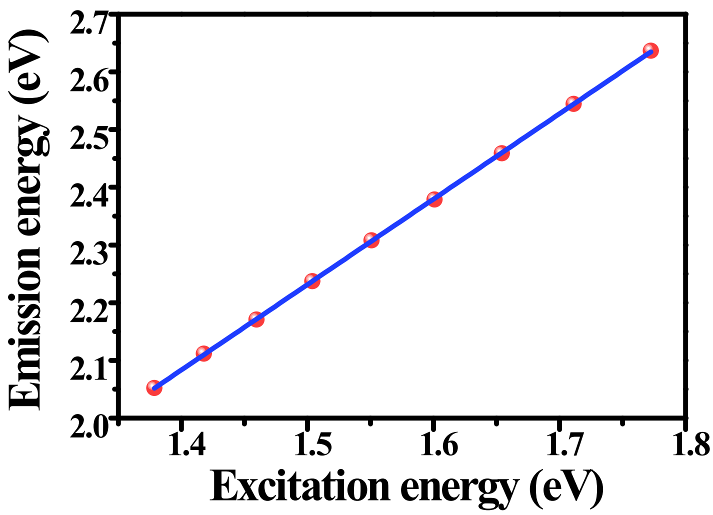

Fig.S5 The relationship between the energy of emission light and excitation light.

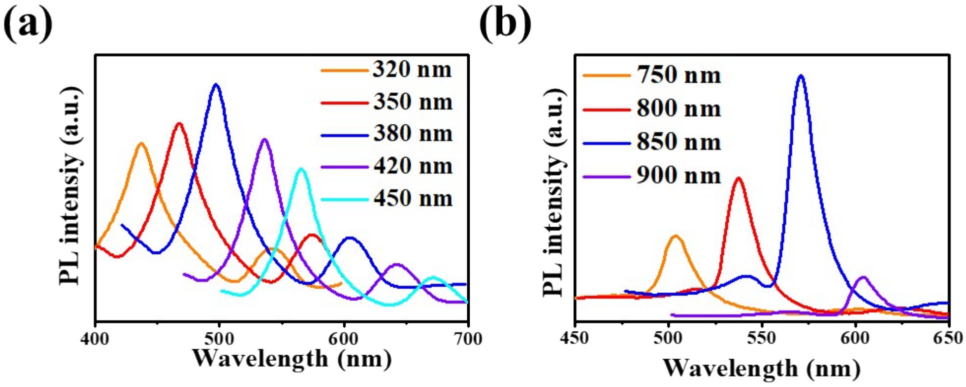

Fig.S6 (a) Fluorescence emission spectra of Ti_3C_2 nanosheets stripped by TMAOH at different wavelength (320 nm to 450 nm) excitation. (b) Fluorescence emission spectra of Ti_3C_2 nanosheet stripped by TMAOH at different wavelength (750 nm to 900 nm) excitation.

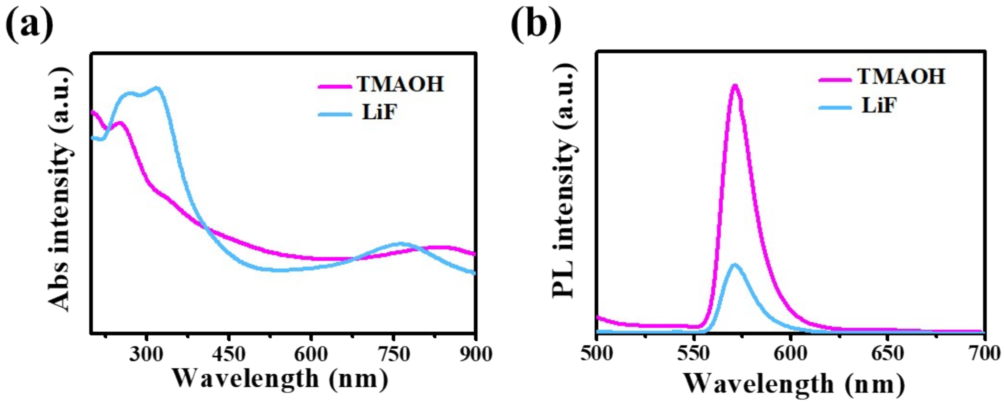

Fig.S7 (a) The UV-Vis spectra of the Ti_3C_2 nanosheets prepared by LiF and HCl and S-Ti_3C_2 NPs. (b) The fluorescence emission spectra of the Ti_3C_2 nanosheets prepared by LiF and HCl and S-Ti_3C_2 NPs at 850 nm.

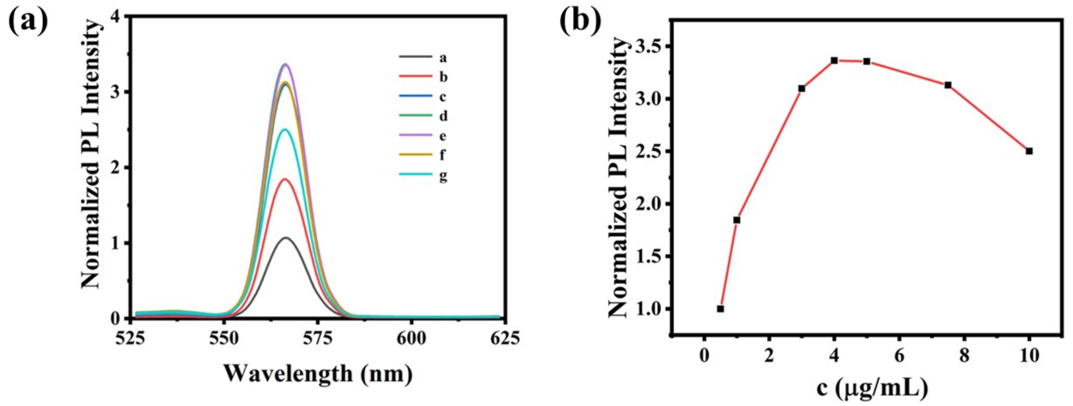

Fig.S8 (a) The normalized fluorescence emission spectra of Ti_3C_2 nanosheets at different concentration (a-g: 0.5, 1, 3, 4, 5, 7.5, 10 μg/mL, respectively). (b) Plots of relative normalized PL intensity *vs* the concentration of Ti_3C_2 nanosheets

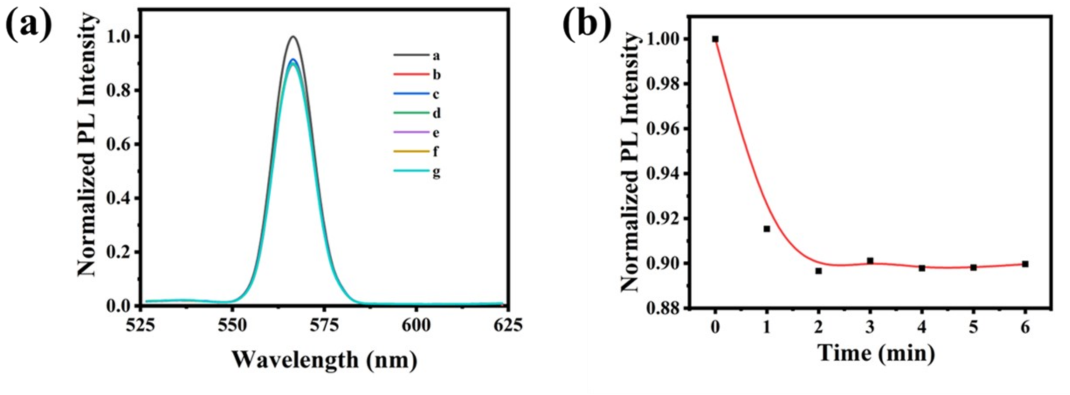

Fig.S9 (a) The fluorescence emission spectra of 4 μg/mL Ti_3C_2 with 500 nM L-Tryptophen at different incubation time (a-g: 0, 1, 2, 3, 4, 5, 6 min, respectively). (b) Plots of relative normalized PL intensity *vs* incubation time.

Method	materials	linear range	Detection limit	Refrence
Electrochemical	Cu_2O nanoparticles- coated reduced graphene oxide nanocomposite	0.02-20 μM	0.01 μM	[1]
Chronoamperometry	Conductor polymer polypyrrole doped with potassium hexacyanoferrate (II)	3.3×10^{-7}-1.06×10^{-5} M	1.05×10^{-7} M	[2]
Electrocatalytic	Fe_3O_4/C composite	1.0-80μM and 80-800 μM	0.26 μM	[3]
Cyclic voltammetry	Polymethionine modified carbon nanotube	1.5 - 8.0×10^{-5} M	6.99×10^{-7} M	[4]
Electrochemical	Exfoliated graphene and poly (3,4-ethylenedioxythiophene): poly (styrene sulfonate)	0.1-100μM and 100-1000μM	0.015 μ M	[5]
Voltammetric	Silver dendrites decorated polythiophene nanocomposite	200 nM-400 μM	20 nM	[6]
Colorimetric method	purified tryptophanases	100 μM to 600 μM	100 μM	[7]
Fluorescence	the TF-Splinting Duplex	0–100 μM	790 nM	[8]
Fluorescence	Single layer of MXene (Ti_3C_2) nanosheets	0-5 μM	91 nM	Our work

Table. S1 The detection performance of sensors based on different nanomaterials for L-Tryptophan.

References

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