

## Electronic Supporting Information

# **Functionalized single-layered titanium carbide MXene based biosensor for selective H<sub>2</sub>O<sub>2</sub> detection using covalently immobilized horseradish peroxidase**

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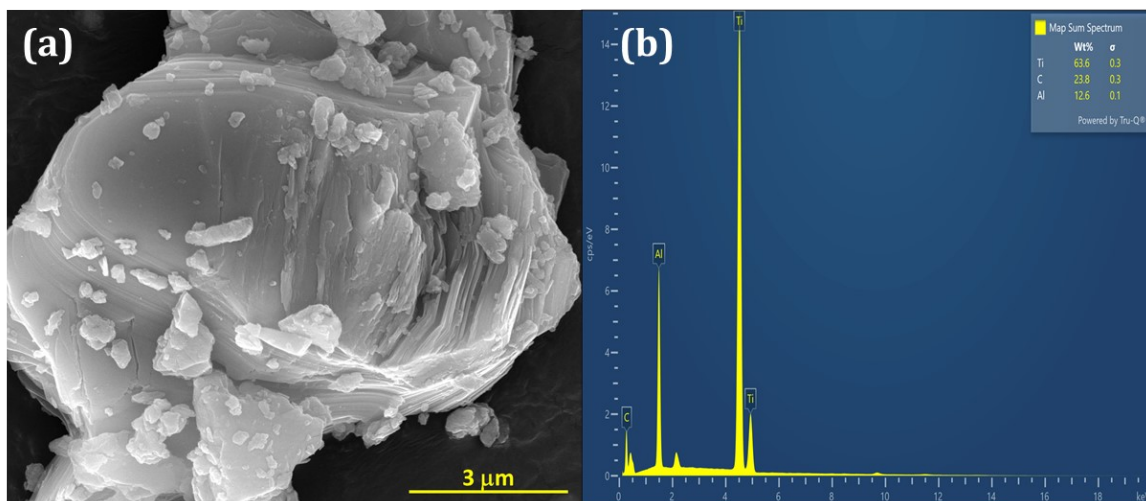
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## Chemicals and Materials

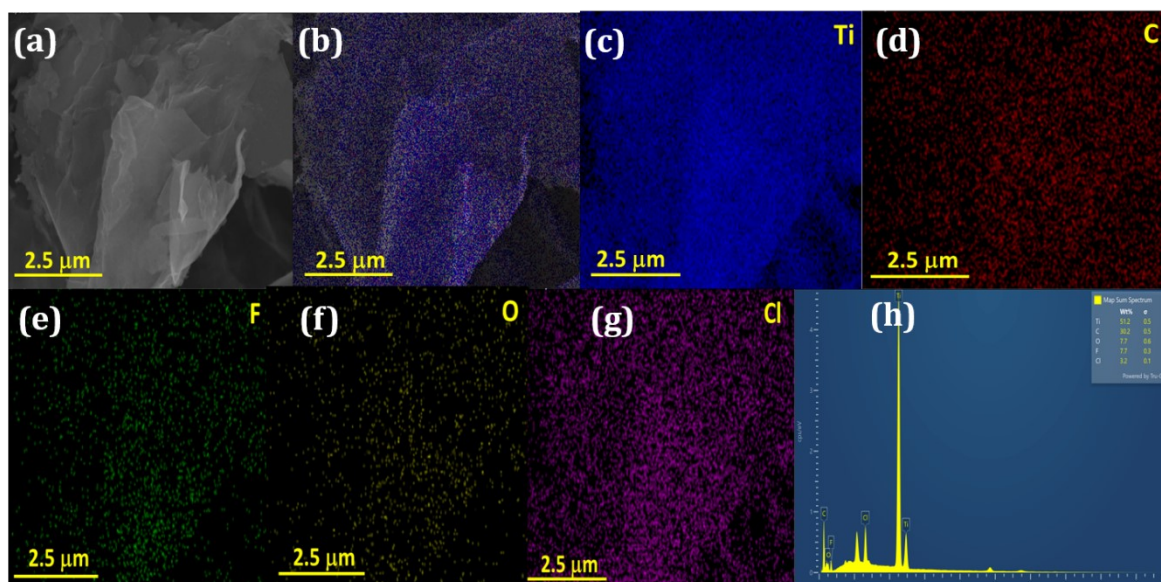
Ti<sub>3</sub>AlC<sub>2</sub> was obtained from Nano Research Element, India. Lithium fluoride (LiF), hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>), ascorbic acid (AA), dopamine hydrochloride (DA), ammonia solution, glutaraldehyde (GA) and 3-Aminopropyltriethoxysilane (APTES) were purchased from Sigma-Aldrich, India. Resorcinol (RS) and hydrochloric acid (HCl) were purchased from SD Fine Chem Limited, India. Uric acid (UA), glucose (Glu), cholesterol (Chol), tryptophan (L-Tryp), cystine (Cys), sodium phosphate dibasic (Na<sub>2</sub>HPO<sub>4</sub>) and sodium phosphate monobasic (NaH<sub>2</sub>PO<sub>4</sub>) were bought from SRL Chemicals, India. Potassium nitrite (KNO<sub>2</sub>) was bought from Avra Chemicals, India. Valine (Val) was purchased from Spectrochem, India. All the acquired solvents and compounds were utilized as procured without extra purification. All the aqueous solutions were prepared using 0.1 M phosphate buffer solution (PBS) and Milli-Q water.

## Instrumentation

Powder X-ray diffraction (PXRD) patterns of the Ti<sub>3</sub>AlC<sub>2</sub>, Ti<sub>3</sub>C<sub>2</sub>T<sub>x</sub> MXene and NH<sub>2</sub>-Ti<sub>3</sub>C<sub>2</sub>T<sub>x</sub> were recorded using Bruker D8 advance X-ray diffractometer. FTIR results were obtained on IRAffinity-1, Thermo Nicolet iS50 spectrometer with inbuilt ATR. Field Emission Scanning Electron Microscopic (FE-SEM) images were obtained from Thermo-Fisher FEI QUANTA 250 FEG. The X-ray photoelectron spectroscopic (XPS) analysis was carried out using PHI - Versa Probe 4. All the electrochemical measurements were performed using CHI-760E electrochemical workstation. A standard three-electrode system was used, comprising glassy carbon electrode (GCE) as the working electrode, platinum coil as auxiliary electrode and Ag/AgCl as the reference electrode.



**Fig. S1** (a) FESEM image and (b) EDX analysis of  $Ti_3AlC_2$ .



**Fig. S2** (a) FESEM image (b-g) Elemental mapping and (h) EDX analysis of  $S-Ti_3C_2T_x$ .

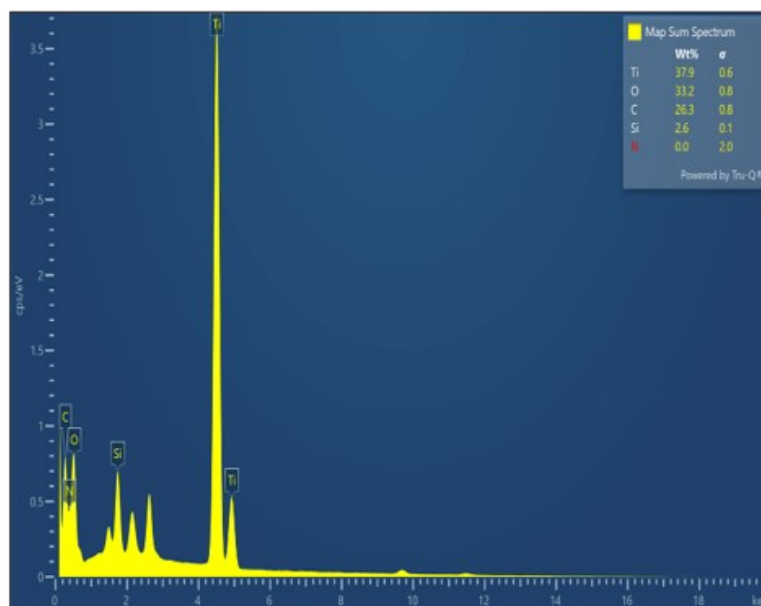


Fig. S3 EDX analysis of  $\text{NH}_2\text{-S-Ti}_3\text{C}_2\text{T}_x$ .

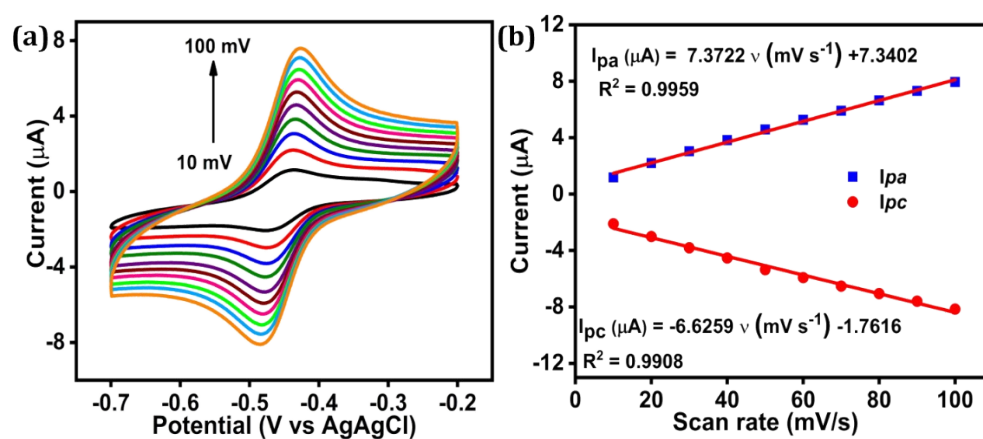
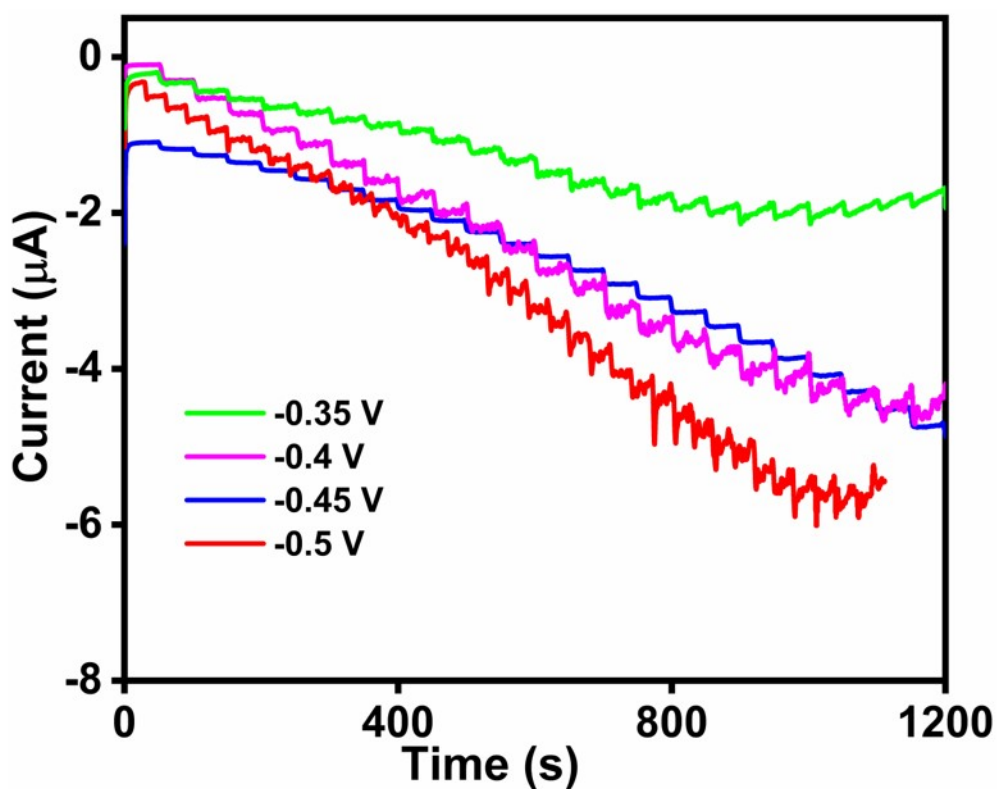


Fig. S4 (a) Effect of scan rate at  $\text{HRP/NH}_2\text{-S-Ti}_3\text{C}_2\text{T}_x/\text{GCE}$ , (b) corresponding calibration graph.



**Fig. S5** Amperometric (i-t) curve of HRP/NH<sub>2</sub>-S-Ti<sub>3</sub>C<sub>2</sub>T<sub>x</sub>/GCE for the sequential addition of H<sub>2</sub>O<sub>2</sub> into a constantly stirred N<sub>2</sub>-saturated 0.1 M PBS at an applied potential of -0.35 V, -0.4 V, -0.45 V and -0.5 V.

**Table S1** Detection of H<sub>2</sub>O<sub>2</sub> in real samples.

Sample	Spiked (µM)	Found <sup>a</sup> (µM)	Recovery (%)
Milk	50	48.7	97.6
	100	102.2	102.1
Orange Juice	50	47.9	95.7
	100	105.5	105.4
Serum sample	50	47.8	95.6
	100	105.6	105.5

<sup>a</sup>Measurements were performed in triplicate.