

A Novel Green Route for $\text{Ti}_3\text{C}_2\text{T}_x$ MXene Monolayer Fabrication for Nanoelectronic Applications

Jovana Paskaš^a

Sara Joksović^a, Jovana Stanojev^a, Zdeněk Sofer^b, Branimir Bajac^a, Vasa Radonić^a, V. Divakar Botcha^a

^aBioSense Institute, University of Novi Sad, Novi Sad, 21000 Serbia

^bUniversity of Chemistry and Technology Prague, Technická 5, 166 28, Prague, Czech Republic

jovana.paskas@biosense.rs

Controlled fabrication of high-quality $\text{Ti}_3\text{C}_2\text{T}_x$ MXene monolayers is essential for electronic and optoelectronic applications [1]. Here, we present a green and scalable approach for morphology-controlled monolayer fabrication by combining minimally intensive layer delamination (MILD) synthesis [2] with a modified Langmuir-Blodgett (MLB) technique (Fig. 1a)[3]. This method enables simple and cost-effective transfer of $\text{Ti}_3\text{C}_2\text{T}_x$ nanosheets onto SiO_2/Si substrates from the air–water interface without complex equipment. By optimizing ultrasonication time, subphase pH, and spreading volume, uniform, flat, and well-distributed monolayers were obtained (Fig. 1b). The resulting $\text{Ti}_3\text{C}_2\text{T}_x$ sheets exhibit high electrical conductivity (up to ~ 8700 S/cm) (Fig. 1c) and electron mobility (up to 30 cm^2/Vs), demonstrating strong potential for future nanoelectronic and optoelectronic devices.

References

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Figures

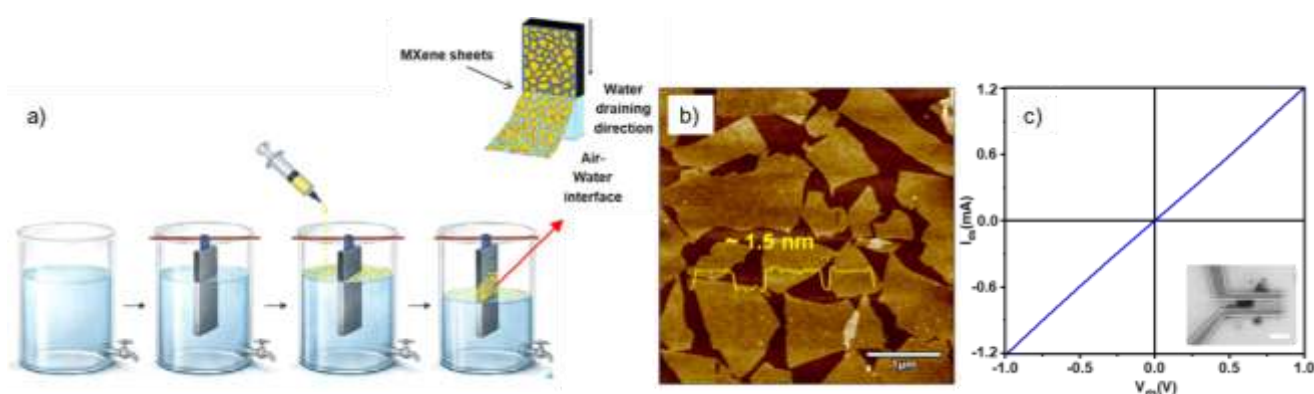


Figure 1: (a) Modified-LB Deposition process of MXene films on a substrate from aqueous dispersion, highlighting the assembly of MXene sheets into a continuous coating. (b) AFM image with corresponding height profile confirming the monolayer thickness of MXene sheets on the SiO_2/Si substrate. (c) Typical output characteristics ($I_{\text{ds}}-V_{\text{ds}}$) measured under ambient conditions, demonstrating linear and symmetric current-voltage behavior indicative of ohmic contact formation; the inset displays an SEM image of a two-terminal device fabricated on a monolayer sheet (scale bar: $3\mu\text{m}$).