

## Supporting Information

### **Solvents dramatically influence the atomic composition and catalytic properties of $\text{Ti}_3\text{C}_2\text{T}_x$ MXenes**

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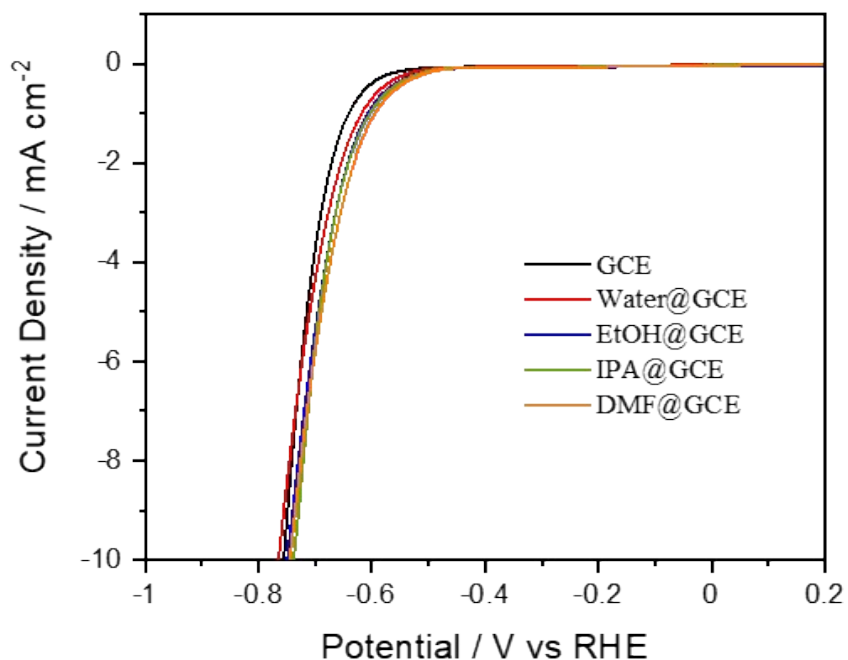
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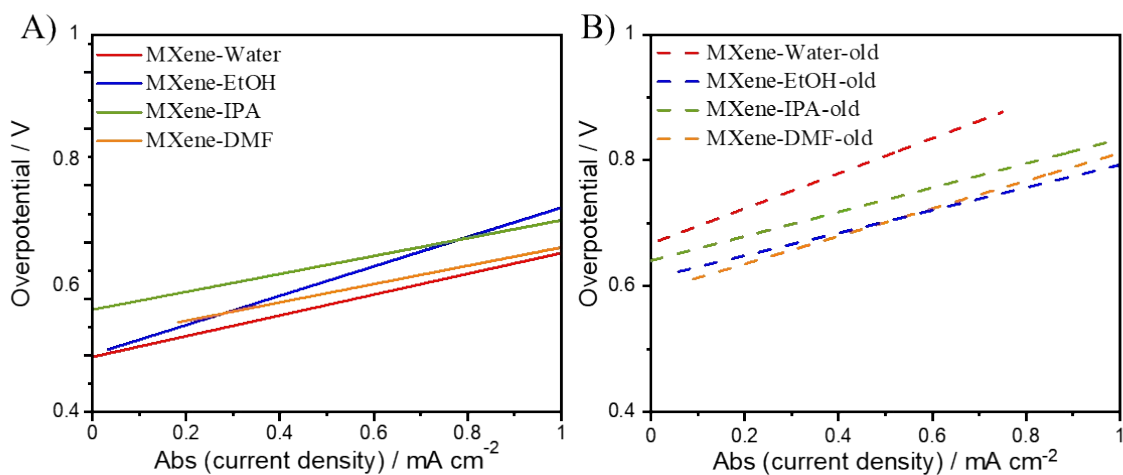
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**Figure S1.** The electrochemical characterization of the bare electrodes. Linear sweep voltammograms for the water, EtOH, IPA, and DMF solvents (without any material support) drop-casted on the bare GCE.

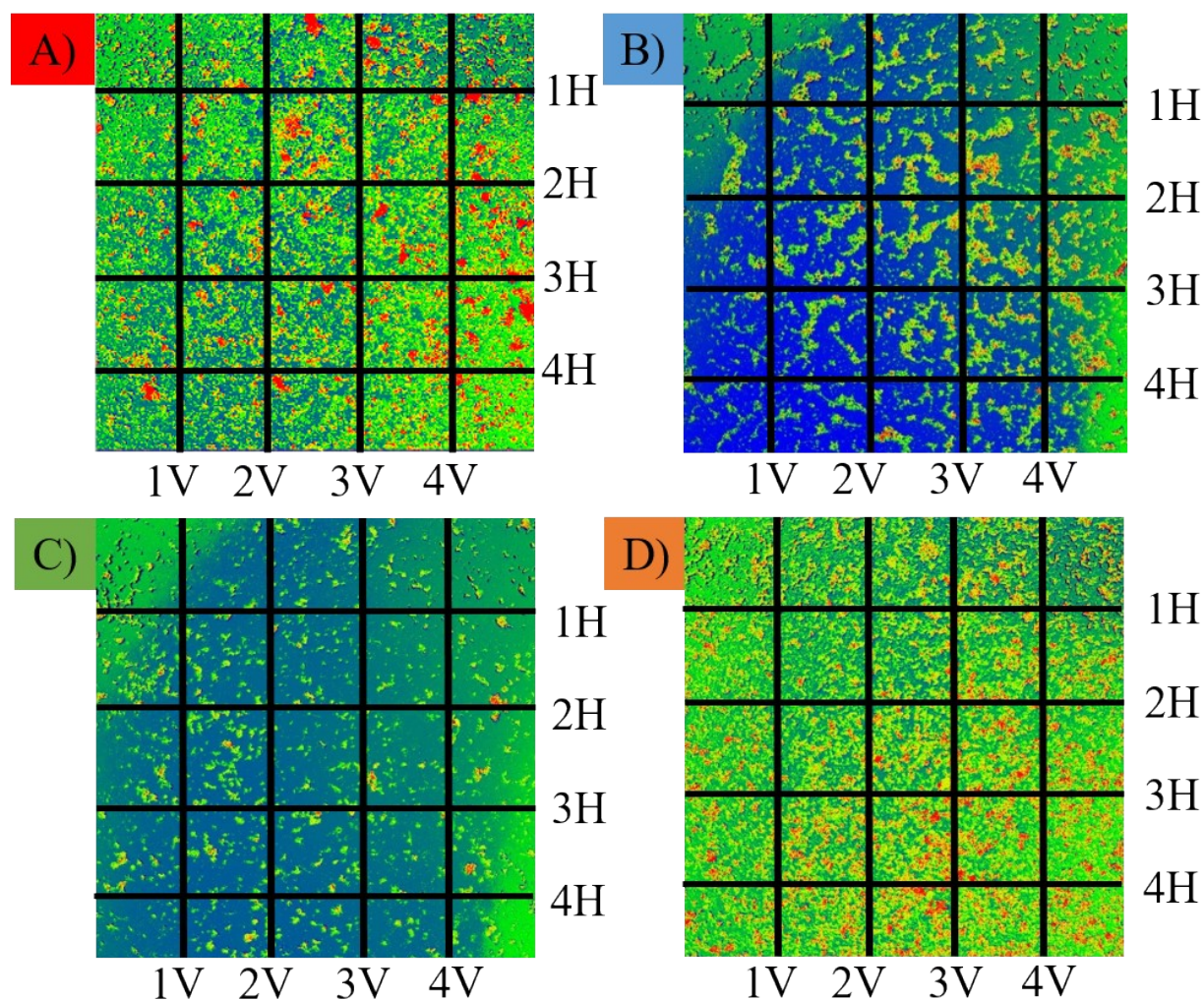


**Figure S2.** Tafel analysis of the  $Ti_3C_2T_x$  MXene samples. (A) Tafel slopes for the MXene samples prepared from the fresh and (B) aged suspensions.

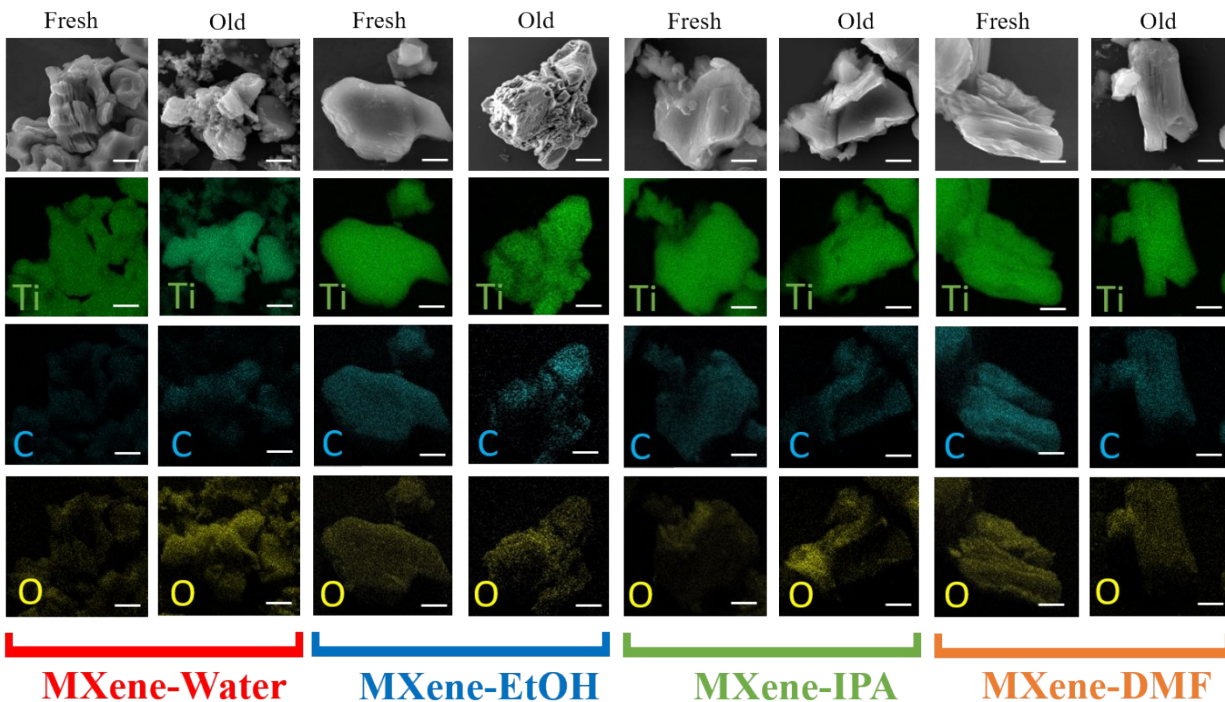
**Table S1.** Table showing the properties of water, EtOH, IPA, and DMF.

| Solvent | Boiling point / °C | Viscosity / mPa s (at 25 °C) | Dielectric constant | *Density / g ml <sup>-1</sup> | Electrical conductivity / μS cm <sup>-1</sup> | Ref.     |
|---------|--------------------|------------------------------|---------------------|-------------------------------|---|----------|
| Water   | 100.0              | 1.00                         | 8.0                 | 1.00                          | 0.05  | [1], [2] |
| EtOH    | 78.5               | 1.04                         | 24.55               | 0.78                          | 0.50  | [1], [2] |
| IPA     | 82.4               | 2.05                         | 18                  | 0.78                          | 0.06  | [1], [2] |
| DMF     | 153.0              | 0.92                         | 38                  | 0.94                          | 1.60  | [3], [4] |

\*Data is taken from the safety data sheet provided by solvent producer



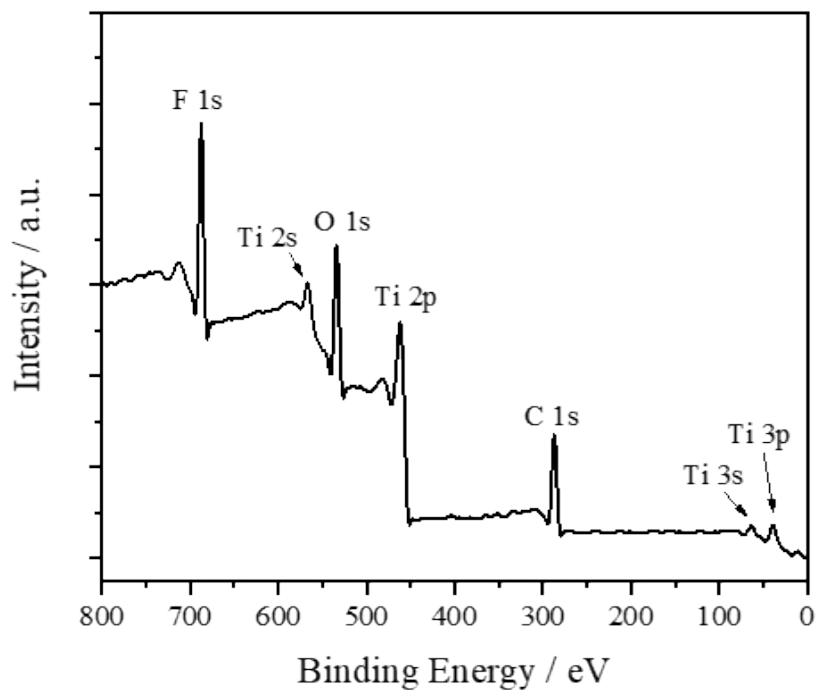
**Figure S3.** Optical characterization of the surface roughness of the  $Ti_3C_2T_x$  MXene samples by confocal laser scanning microscopy (CLSM) with 20x lenses. The false-color CLSM images with indicated line roughness measurements (black lines) of V-vertical and H-horizontal lines on (A) water, (B) EtOH, (C) IPA, and (D) DMF  $Ti_3C_2T_x$  MXene samples.



**Figure S4.** Scanning electron micrographs (black & white) and EDS maps for the elemental distribution of Ti, C and O on the  $Ti_3C_2T_x$  MXene samples prepared from fresh and aged water, EtOH, IPA, and DMF suspensions. The scale is 2  $\mu m$ .

**Table S2.** Table showing the EDS atomic percentages in the  $Ti_3C_2T_x$  MXene samples prepared from the fresh and aged water, EtOH, IPA, and DMF suspensions.

|           | <b>MXene-Water</b> |             | <b>MXene-EtOH</b> |             | <b>MXene-IPA</b> |             | <b>MXene-DMF</b> |             |
|-----------|--------------------|-------------|-------------------|-------------|------------------|-------------|------------------|-------------|
|           | <b>fresh</b>       | <b>aged</b> | <b>fresh</b>      | <b>aged</b> | <b>fresh</b>     | <b>aged</b> | <b>fresh</b>     | <b>aged</b> |
| <b>Ti</b> | 24.2               | 9.5         | 9.9               | 17.3        | 12.8             | 12.1        | 10.7             | 7.4         |
| <b>C</b>  | 23.0               | 18.0        | 33.8              | 31.8        | 27.6             | 26.2        | 33.6             | 32.7        |
| <b>O</b>  | 24.4               | 26.3        | 8.1               | 18.0        | 9.4              | 11.8        | 9.7              | 6.5         |
| <b>F</b>  | 26.4               | 4.5         | 6.1               | 16.4        | 11.5             | 12.5        | 10.3             | 5.1         |



**Figure S5.** X-ray photoelectron spectroscopy (XPS) study of the survey spectra of the  $\text{Ti}_3\text{C}_2\text{T}_x$  MXene powder with the atomic percentages of the constructed elements of Ti, C, O and F.

**Table S3.** Table showing the XPS atomic percentages in the Water, EtOH, IPA and DMF  $\text{Ti}_3\text{C}_2\text{T}_x$  MXene samples.

|              | Water |       | EtOH  |       | IPA   |       | DMF   |       |
|--------------|-------|-------|-------|-------|-------|-------|-------|-------|
|              | fresh | aged  | fresh | aged  | fresh | aged  | fresh | aged  |
| <b>O 1s</b>  | 28.41 | 40.27 | 22.61 | 22.94 | 20.70 | 20.67 | 24.09 | 20.38 |
| <b>Ti 2p</b> | 16.16 | 16.94 | 18.15 | 18.95 | 19.36 | 17.24 | 18.88 | 19.56 |
| <b>C 1s</b>  | 45.50 | 36.81 | 41.67 | 42.16 | 42.54 | 47.96 | 35.69 | 46.07 |
| <b>F 1s</b>  | 9.93  | 5.98  | 17.57 | 15.95 | 17.40 | 14.13 | 20.17 | 12.78 |
| <b>N 1s</b>  | /     | /     | /     | /     | /     | /     | 1.17  | 1.21  |

## References:

1. P. Atkins, J. de Paula, Atkin`s Physical Chemistry, 10<sup>th</sup> Edition, Oxford University Press 2014.
2. T. Dong, E. P. Knoshaug, P.T. Pienkos and L. M. L. Laurens, Lipid Recovery from Wet Oleaginous Microbial Biomass for Biofuel Production: A Critical Review, *Applied Energy* 2016, 177, 879-895.
3. B. Shi, X. X. He, W.Wu, C. L. Hsien, Economic and Risk Analyses of an Industrial N,N-Dimethylformide Recovery Process, *Chem. Ing. Technol.* 2019, 42, 5, 1-12.
4. W. A. Hammad, N. H. El-Hammamy, M. H. Morshidy, Kholood Alkamis, M. A. Darweesh, Electrical conductivity and thermodynamic studies on sodium dimethyldithiocarbamate in non-aqueous solvents dimethylformamide (DMF), at different temperatures, *Scientific Reports* **2022**, 12, 15634.