Supporting Information

MXene/activated carbon hybrid capacitive deionization for permselective ion removal at low and high salinity

Mohammad Torkamanzadeh,[1,2] Lei Wang,[1,2] Yuan Zhang,[1,2]
Öznil Budak,[1,2] Pattarachai Srimuk,[1] Volker Presser,[1,2,*]

[1] *INM - Leibniz Institute for New Materials, D2 2, 66123, Saarbrücken, Germany*

[2] *Department of Materials Science & Engineering, Saarland University, Campus D2 2, 66123, Saarbrücken, Germany*

* Corresponding author's email: presser@presser-group.com

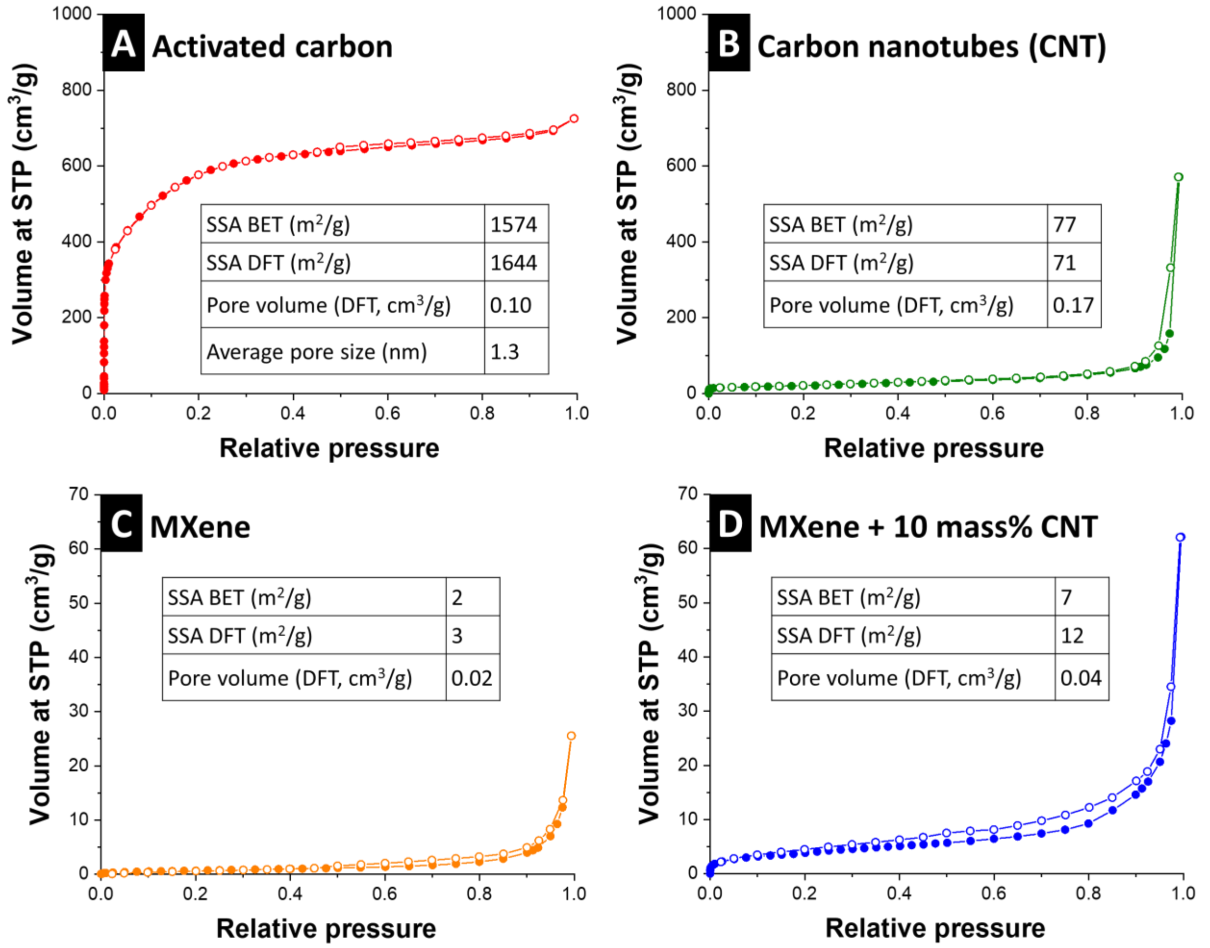

Figure S1: Nitrogen gas sorption isotherm of (A) activated carbon, (B) carbon nanotubes, (C) MXene powder, and (D) MXene/carbon nanotube electrodes recorded at a temperature of -196 °C. STP: standard temperature and pressure.

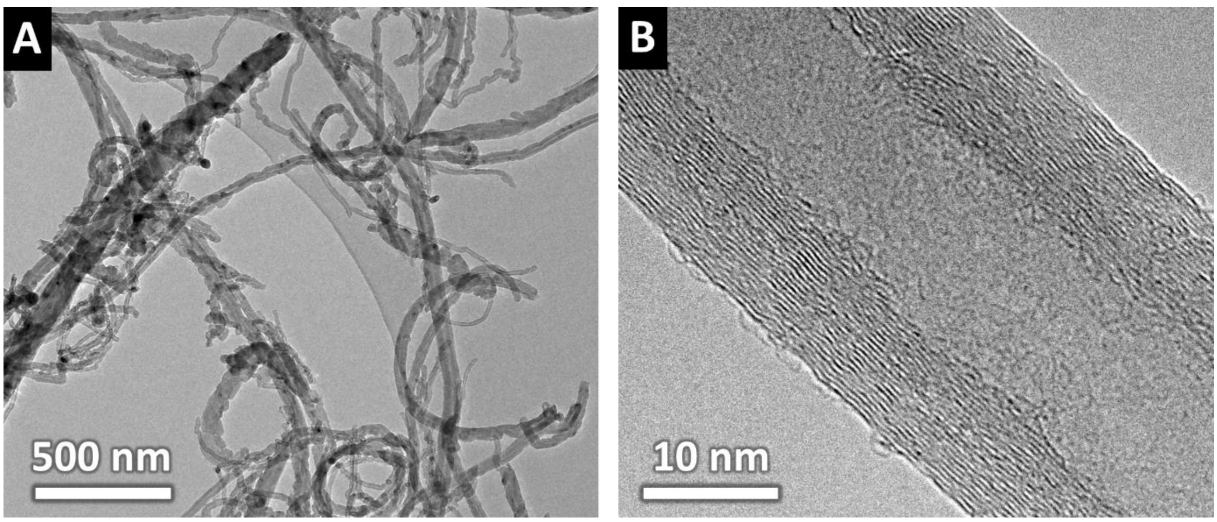

Figure S2: Transmission electron micrographs of the carbon nanotubes.

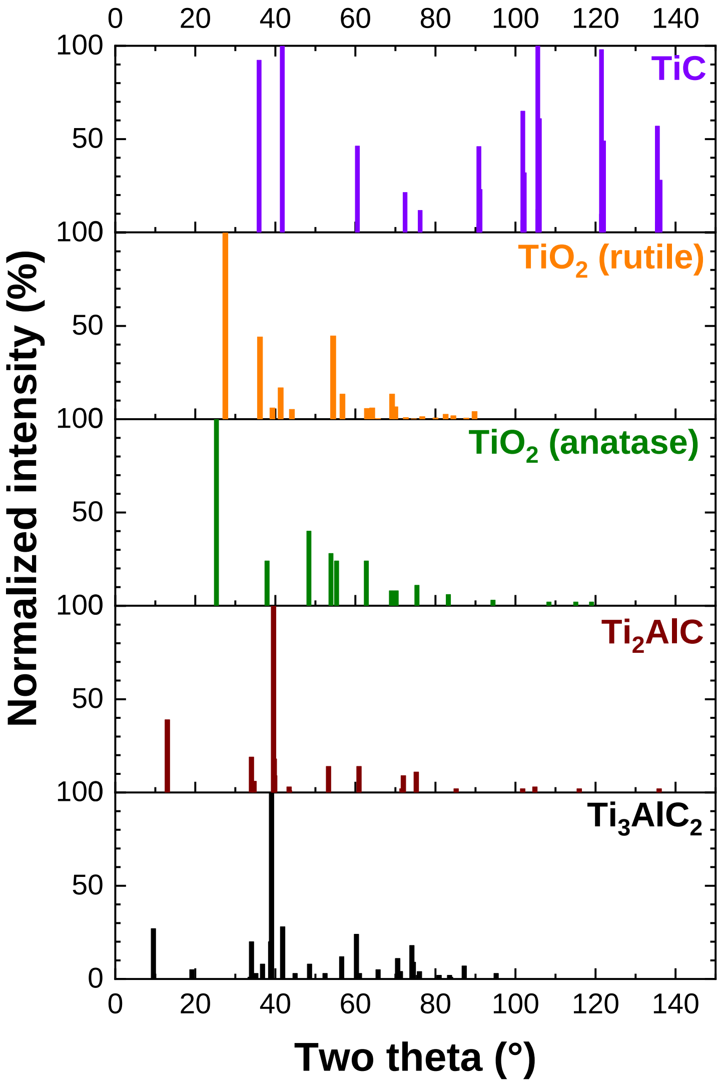

Figure S3: Relative intensities of the reference phases provided in Figure 2D.

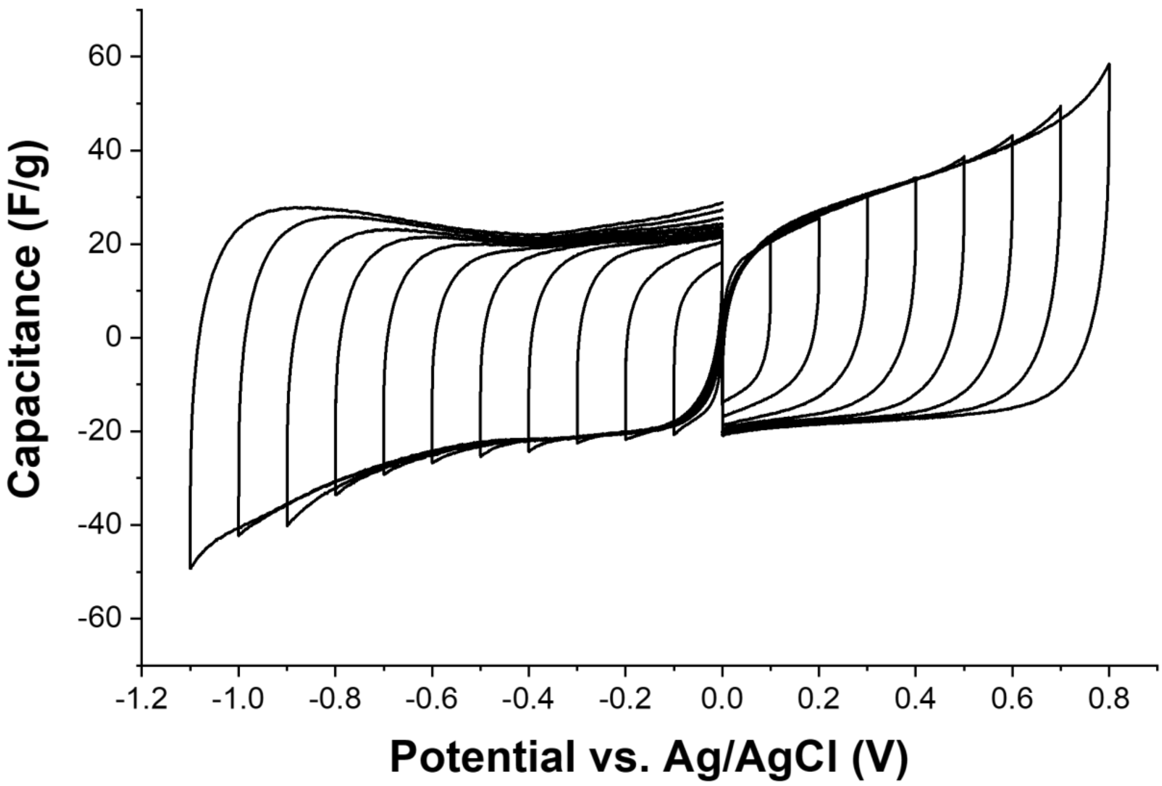

Figure S4: Half-cell window opening cyclic voltammograms of electrodes just composed of CNTs in aqueous 1 M NaCl electrolyte.

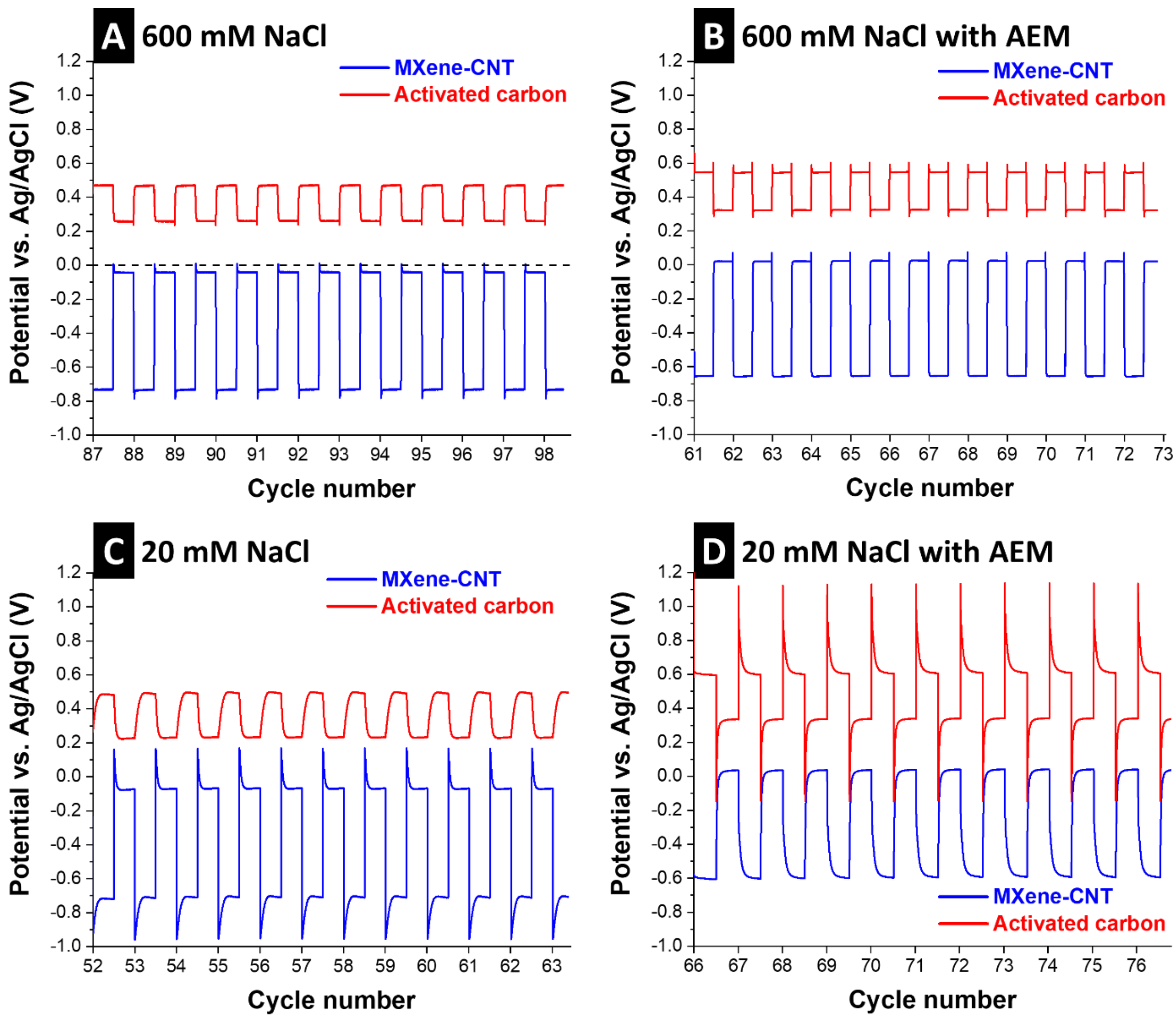

Figure S5: Potential development of individual electrodes upon charging the MXene/AC cell to a cell voltage of 1.2 V and discharging to a cell voltage of 0.3 V. (A-B) aqueous 600 mM NaCl; (C-D) aqueous 20 mM NaCl; (A,C) without an anion-exchange membrane (AEM) placed in front of the activated carbon electrode; (B,D) experiments with an AEM at the activated carbon electrode.

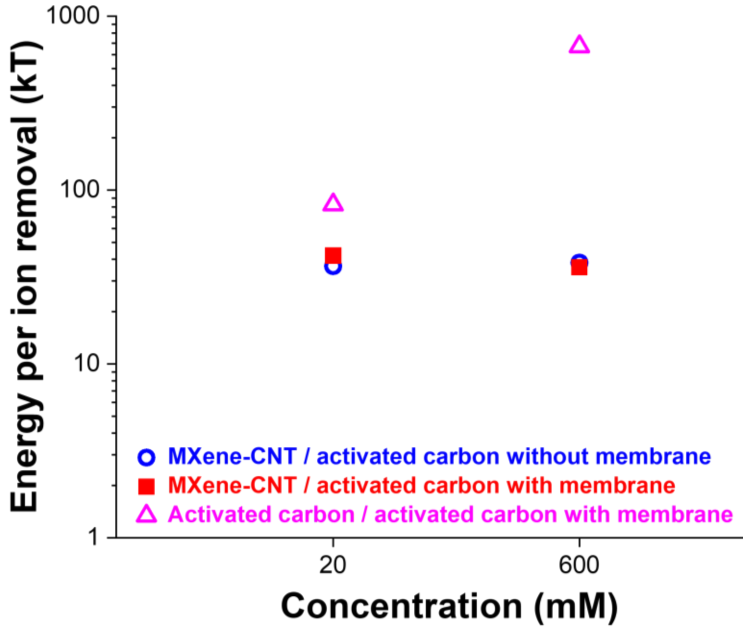

Figure S6: Energy consumption per ion removal.

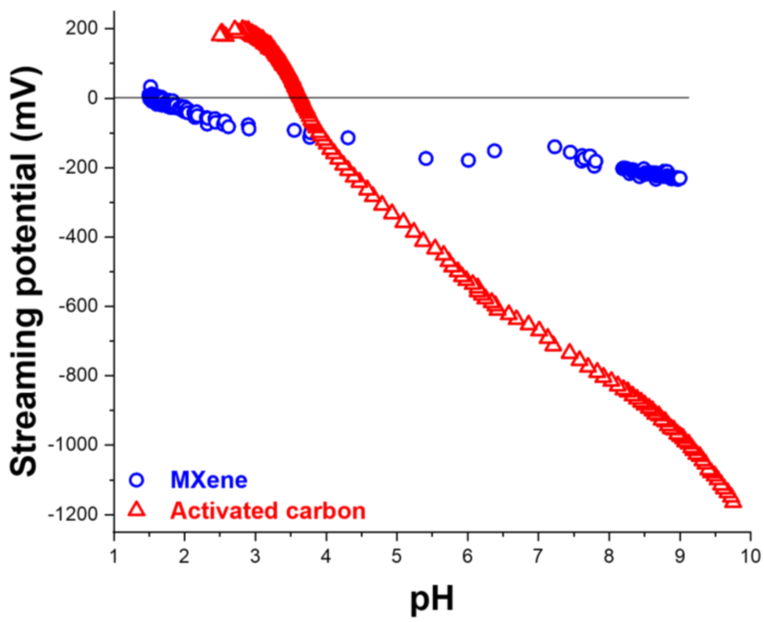

Figure S7: Streaming potential response of MXene and activated carbon in water.

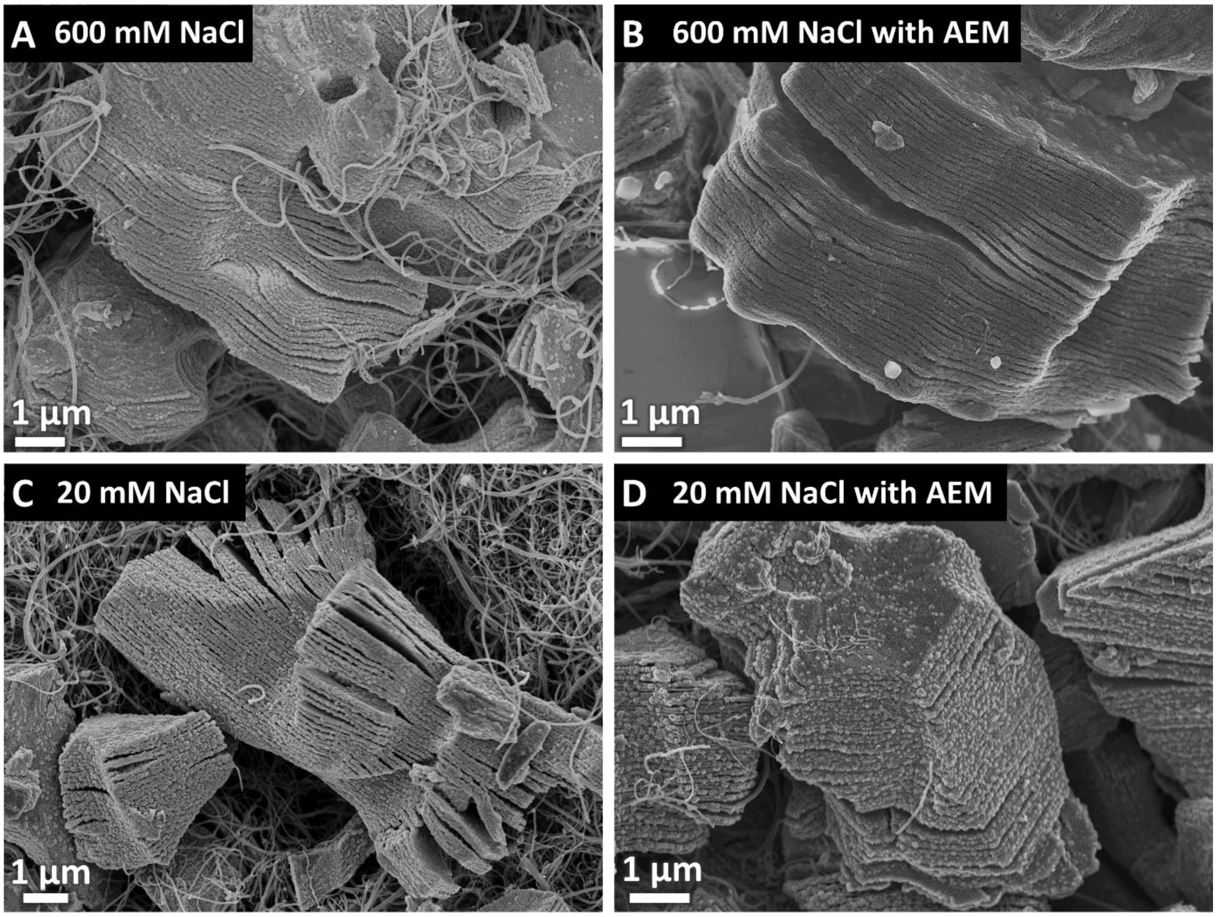

Figure S8: Post mortem scanning electron micrographs of MXene-CNT electrodes.

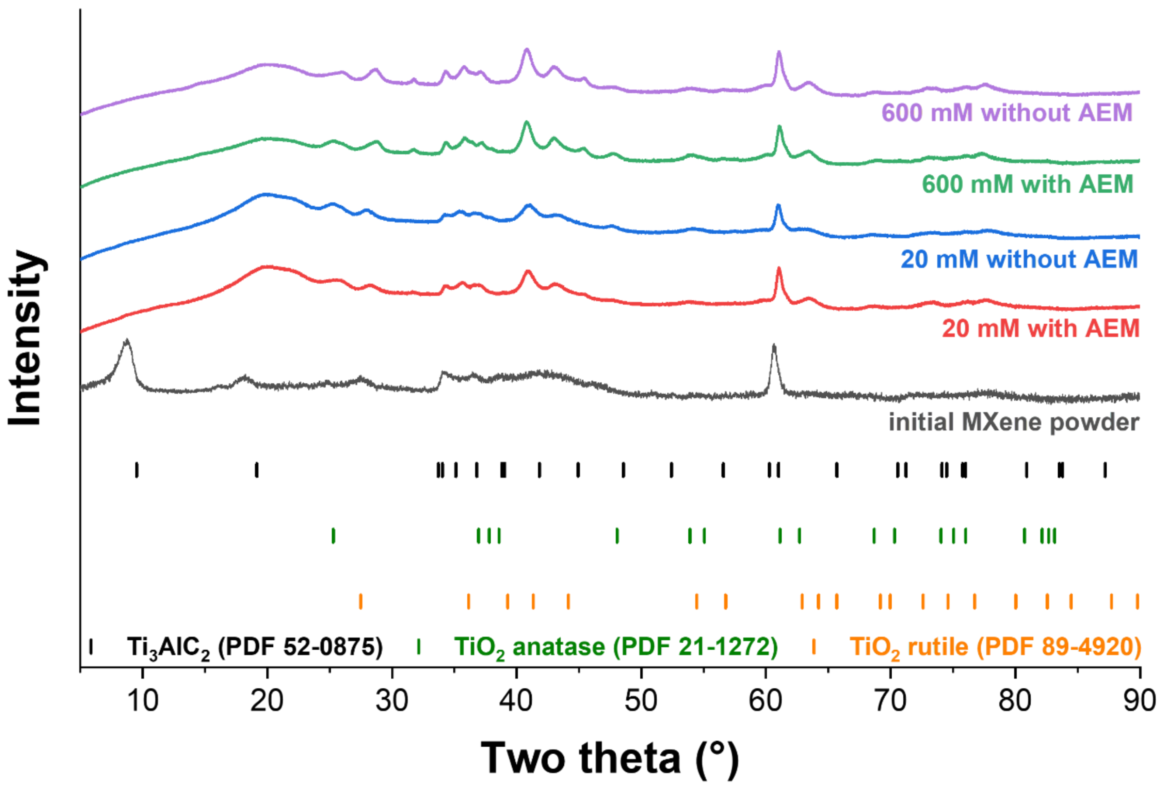

Figure S9: X-ray powder diffraction pattern of the initial MXene powder and after electrochemical operation for desalination (post mortem).