Anisotropic charge transport in few-layer 2D crystals: the case of $Ti_3C_2T_x$ MXenes

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Supplementary information

I) Film characterization

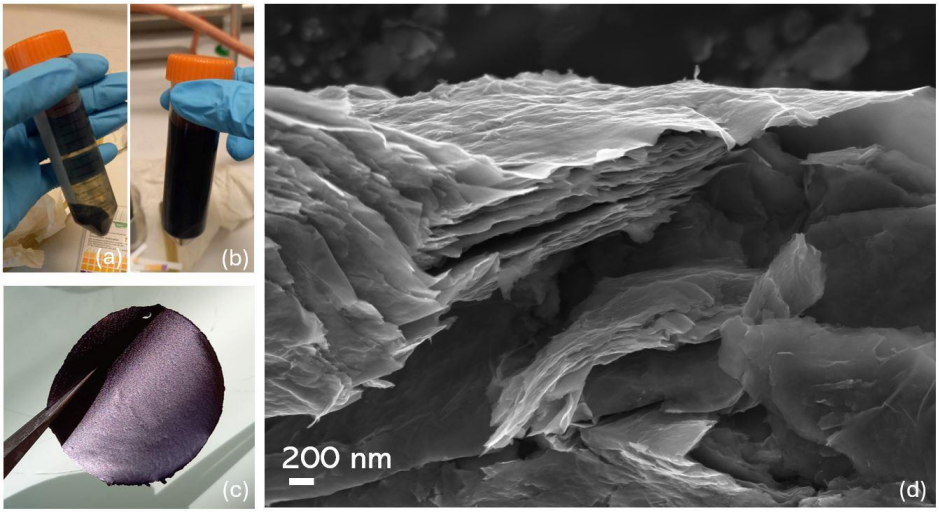

Figure S1: (a) Before and (b) after delamination of the MXenes. (c) Vacuum-dried film of $Ti_3C_2T_x$. (d) SEM image of the $Ti_3C_2T_x$ films.

II) Sample preparation

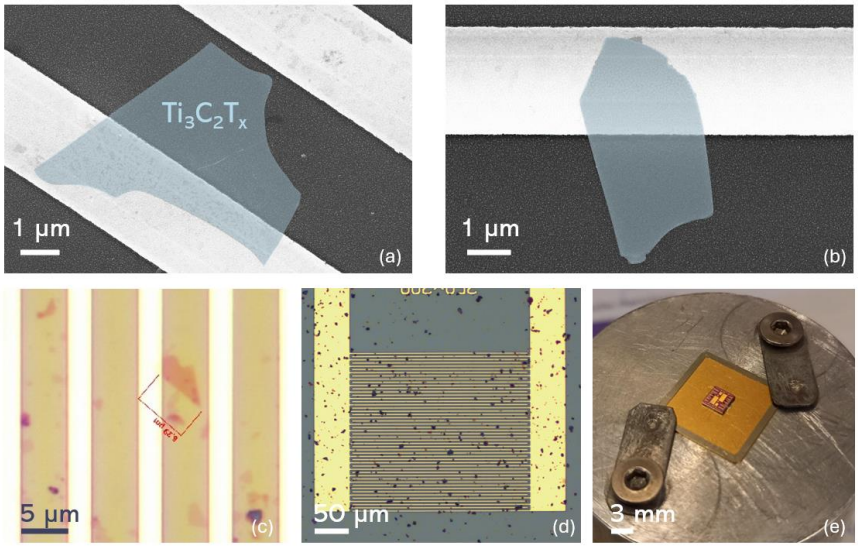

Figure S2: (a-b) SEM images of $Ti_3C_2T_x$ flakes overlapping a gold electrode and the SiO_2 substrate. (c-d) Optical microscope images of $Ti_3C_2T_x$ flakes drop cast on interdigitated electrodes. (e) Image of the sample after bonding on conductive plate.

III) FEM Simulations

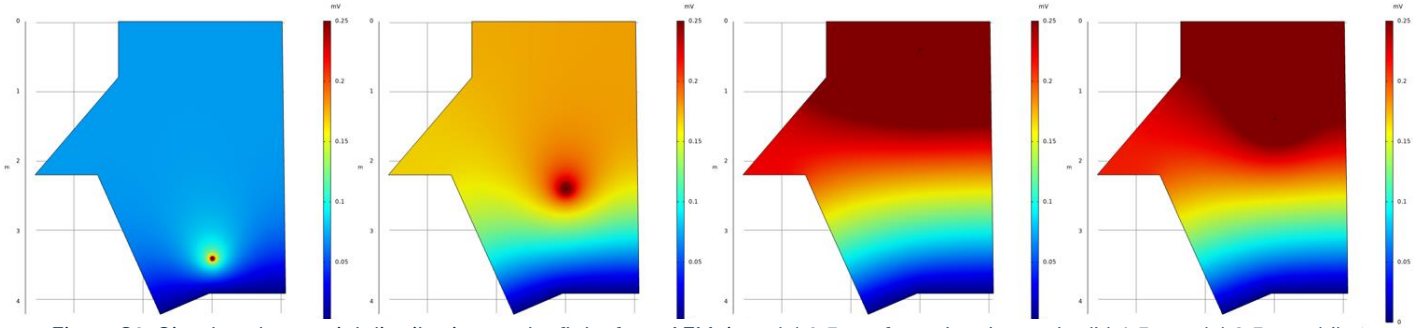

Figure S3: Simulated potential distribution on the flake for c-AFM tip at (a) 0.5 µm from the electrode, (b) 1.5 µm, (c) 2.5 µm, (d) and 3.5 µm.

IV) C-AFM

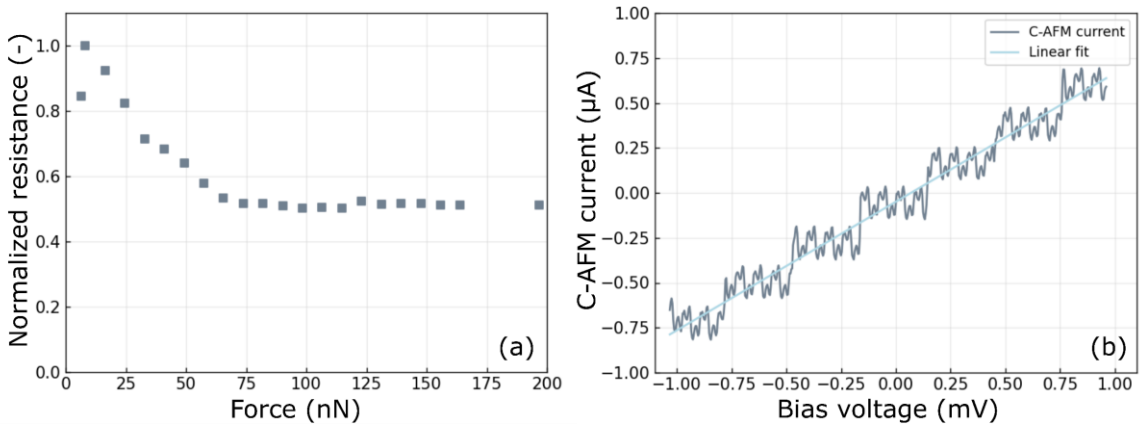

Figure S4: (a) Normalized resistance measured with C-AFM on $Ti_3C_2T_x$ as a function of the normal force applied on the tip. (b) C-AFM I-V characteristic on a gold electrode, where the steps corresponds to the resolution of the instrument in bias voltage.

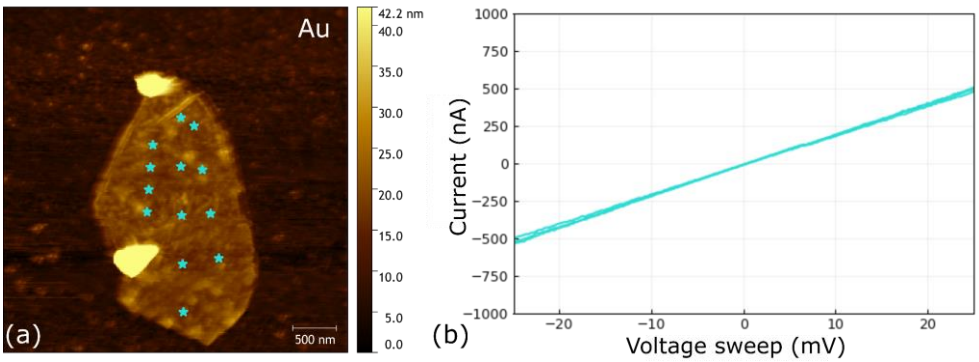

Figure S5: (a) AFM topography image obtained during a C-AFM measurement on a $Ti_3C_2T_x$ flake deposited on a gold substrate. (b) I-V characteristics acquired at each location represented by a colored star on the topography image in (a).

V) Ab initio simulation

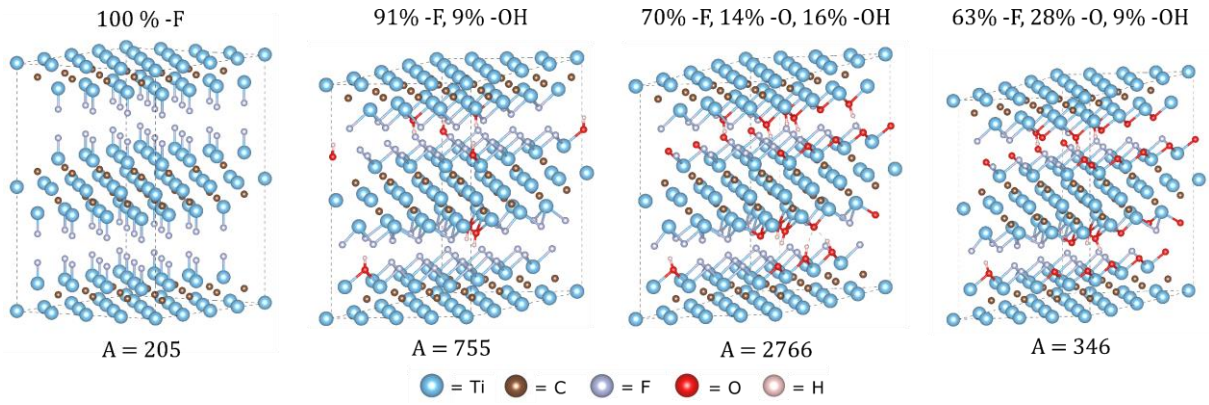

Figure S6: Structurally-optimized atomistic models of $Ti_3C_2T_x$ supercells incorporating various functional groups (-F, -OH, -O) with different concentrations and their resistivity anisotropy.