Scientists develop solution for preparing macroscopic 2-D MXenes

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Recently, Chinese scientists in Institute of Solid State Physics (ISSP), Hefei Institutes of Physical Science reported that they have obtained the macroscopic $V_4C_3T_x$ MXene by wet-chemical method.

MXene is a new kind of two-dimensional (2-D) material, which are synthesized by chemical etching the "A" layers of MAX phase compounds.

MXenes have shown promises in electrochemical energy storage, electromagnetic interference shielding, sensor, catalysis and so on. Besides, they also have exhibited outstanding performances in electronic and photonic applications based on their metallic conductivity, tunable work function, and adjustable band gap, which is a fast-emerging field of MXene research with huge potential.

In general, the obtained MXenes are micron size or even smaller because they are usually produced by etching MAX phase polycrystalline powders with the size of micron (

Such a small size of MXene materials limits their applications in electronic and photonic devices. How to obtain 2-D MXene materials with large size or even macroscopic size has become an urgent problem to be solved.

For this purpose, the researchers in ISSP firstly grew millimeter-scale V_4AlC_3 single crystals by high-temperature flux method. And then,

V4AlC3 single crystals were immersed in hydrofluoric acid at room temperature for 40 days.

As a result, the Al layers of V_4AlC_3 single crystals were selectively etched, resulting in the formation of macro-sized $V_4C_3T_x$ MXene (as shown in Fig. 1).

Obtaining of macroscopic $V_4C_3T_x$ MXene will not only provide the possible to probe its application in electronic and photonic devices but also stimulate the preparation and applications of other macroscopic MXene materials.

More information: Dong Wang et al. Achieving Macroscopic $V_4C_3T_x$ MXene by Selectively Etching Al from V_4AlC_3 Single Crystals, *Inorganic Chemistry* (2020). DOI: 10.1021/acs.inorgchem.9b03625

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