Properties of 2-Dimensional MXene Layers

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Objective:
Synthesis of larger MXene flakes than those produced to date, isolation of larger flakes on a substrate, and testing of single large flakes to determine their properties, particularly mechanical properties relevant to manufacture/processing and electrical properties relevant to use in batteries and other areas.

Approach:
Starting from MAX phases, exfoliate, intercalate, and delaminate to synthesize large MXene flakes; XRD, SEM, Raman, and optical microscopy for analysis of flake size, quality and composition. Test properties using nanoindenter, four-point probe, and other methods.

Motivation:
MXenes were first synthesized c. 2010, and relatively little is known about them, including the properties of a single flake. Knowing such properties is one of the pivotal steps needed to continue to advance MXene research towards the ultimate goal of having sufficient information about the properties of all MXenes to properly apply them. From what is known, MXenes exhibit high electrical and thermal conductivity, very high specific surface area, and other qualities that make them excellent candidates as a new anodic material in lithium-ion and similar rechargeable batteries. MXenes can also be made into conductive films so thin as to be transparent to visible light, which could have applications in fields such as optics and electronics.

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