MXenes: A New Family of Two-Dimensional Solid Crystals

Brief Overview

Researchers at Drexel University have created a new class of two-dimensional (2D) early transition metal carbide and carbonitride compounds known as MXenes. 2D solids, among them most notably graphene, have generated recent interest because of their outstanding electronic properties which can be exploited for innumerable industrial and biomedical applications. Multilayer MXenes are conductively similar to multilayer graphene. However, unlike graphene, MXenes can be easily dispersed in aqueous solutions because of their hydrophilic properties. MXenes are generated from a large class (>60) of parent compounds known as MAX phases. The electrochemical optical, electronic and mechanical properties of MXenes can be optimized by selection of parent compound, surface chemistry, and intercalating organic compounds to produce a wide array of novel materials with applications that range from electronic devices, sensors, reinforcement for composites, energy storage materials and conductive transparent electrodes.

Applications

- Energy storage, e.g. Li-ion batteries and Li-ion capacitors
- Electrochemical capacitors
- Electrocatalysts and photocatalysts
- Conductors and semi-conductors
- Conductive transparent electrodes
- Reinforcement for composites

Advantages

- Electronically conducting AND hydrophilic 2D nanomaterials
- Versatile class of compounds which can be optimized for specific application by selection of parent compound, surface chemistry, and intercalating compounds
- Manufacturing process is simple, readily scalable, with high yields

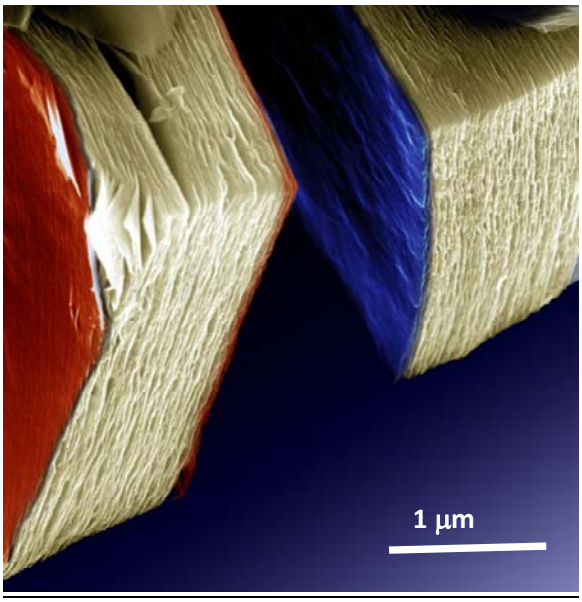

Figure: SEM image of layered MXene. Synthesis: C.E. Ren; SEM: M.R. Lukatskaya; Coloring: Y. Dall'Agnese

Intellectual Property and Development Status

PCT and U.S. Utility patent applications cover composition of matter and applications. Sample materials may be made available under a material transfer agreement.

Commercialization Opportunities

Drexel is currently seeking commercial partners to license and/or sponsor research to further develop this technology.

Inventors

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Web Site

http://nano.materials.drexel.edu

http://max.materials.drexel.edu

References

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