MXenes - Two-Dimensional Materials for Future Technologies

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2D carbides and nitrides, known as MXenes, are among the most recent material families. The field is experiencing very fast growth with the number of papers on MXenes exceeding 1000 per year. Major breakthroughs have been achieved in the past 3-4 years, including the discovery of 2D M_5C_4 carbides with the twinned layers and CVD synthesis of $MoSi_2N_4$, representing a new family of 2D nitrides. Synthesis of dozens of predicted MXenes, demonstration of superconductivity in MXenes with specific surface terminations, stronger interactions with electromagnetic waves compared to metals, metallic conductivity combined with hydrophilicity and redox activity, enable applications in many fields. The scalable synthesis by selective etching allows one to produce substantial amounts of MXenes, opening avenues for large-volume applications. Outstanding mechanical properties of Ti_3C_2, combined with conductivity and strong interfaces, have been used in polymer, ceramic and metal matrix composites. Reversible redox activity of transition metal atoms in the outer layers of MXene flakes combined with high electronic conductivity led to applications in a variety of batteries and electrochemical capacitors. MXenes are promising candidates for energy storage and related electrochemical applications, but applications in optoelectronics, plasmonics, electromagnetic interference shielding, electrocatalysis, medicine, sensors, or water purification are equally exciting, and several of them are on their way to commercialization.

Biography:

Yury Gogotsi is Distinguished University Professor and Charles T. and Ruth M. Bach Professor of Materials Science and Engineering at Drexel University. He also serves as Director of the A.J. Drexel Nanomaterials Institute. His research group works on 2D carbides, nanostructured carbons, and other nanomaterials for energy, water, biomedical and optoelectronic applications. He is recognized as Highly Cited Researcher in Materials Science and Chemistry, and Citations Laureate by Thomson-Reuters/Clarivate Analytics. He has received numerous awards for his research including the ACS Award in the Chemistry of Materials, Gamow Prize, European Carbon Association Award, and S. Somiya Award from IUMRS. He has been elected a Fellow of the World Academy of Ceramics, the European Academy of Sciences, American Association for Advancement of Science, Materials Research Society, American Ceramic Society, the Electrochemical Society, Royal Society of Chemistry, and the International Society of Electrochemistry. He holds honorary doctorates from several Universities in France and Ukraine. He served on the MRS Board of Directors and is acting as Associate Editor of *ACS Nano*.