UCLA ENGINEERING
Chemical and Biomolecular Engineering

SEMINARS IN CHEMICAL AND BIOMOLECULAR ENGINEERING

Monday, April 16th, 2018 | 2:00PM **8500 Boelter Hall**

Presented by:
Yury Gogotsi
Professor
Department of Materials Science and Engineering
Drexel University

"MXenes – Synthesis, Properties and Applications of Two-Dimensional Carbides and Nitrides, the Largest Family of 2D Materials"

Two-dimensional (2D) materials with a thickness of a few nanometers or less can be used as single sheets, or as building blocks, due to their unique properties and ability to assemble into a variety of structures. Graphene is the best-known example, but several other elemental 2D materials (silicene, borophene, etc.) have been discovered. Numerous compounds, ranging from clays to boron nitride (BN) and transition metal dichalcogenides, have been produced as 2D sheets. By combining various 2D materials, unique combinations of properties can be achieved which are not available in any bulk material. The family of 2D transition metal carbides and nitrides (MXenes) has been expanding rapidly since the discovery of Ti3C2 in 2011. Approximately 30 different MXenes have been synthesized, and the structure and properties of numerous other MXenes have been predicted using density functional theory (DFT) calculations. Moreover, the availability of solid solutions on M and X sites, control of surface terminations, and the discovery of ordered double-M MXenes (e.g., Mo2TiC2) offer the potential for synthesis of dozens of new distinct structures. The versatile chemistry of the MXene family renders their properties tunable for a large variety of applications. They have very high strength, modulus of elasticity and electronic conductivity. Oxygen or hydroxyl- terminated MXenes, such as Ti3C2O2, have been shown to have redox capable transition metals layers on the surface and offer a combination of high electronic conductivity with hydrophilicity, as well as fast ionic transport. This, among many other advantageous properties, makes the material family promising candidates for composites, energy storage and related electrochemical applications, but applications in optoelectronics, plasmonics, electromagnetic interference shielding, electrocatalysis, medicine, sensors, water purification/ desalination and other fields are equally exciting.

Yury Gogotsi is Distinguished University Professor and Bach Endowed Professor of Materials Science and Engineering at Drexel University. He is the founding Director of the A.J. Drexel Nanomaterials Institute and Associate Editor of ACS Nano. He works on nanostructured carbons and two-dimensional carbides for energy related and biomedical applications. His work on selective extraction synthesis of carbon and carbide nanomaterials with tuneable structure and porosity had a strong impact on the field of capacitive energy storage. He has co-authored 2 books, more than 500 journal papers and obtained more than 50 patents. He has received numerous national and international awards for his research. He was recognized as Highly Cited Researcher (Web of Science) in Materials Science and Chemistry fields in 2014-2017, and elected a Fellow of AAAS, MRS, ECS, RSC, ACerS, NANOSMAT Society and a member of the World Academy of Ceramics. He also serves on the MRS Board of Directors.