# Carbide-Derived Carbons for Energy-Related and Biomedical Applications

Yury Gogotsi
*Department of Materials Science and Engineering and A.J. Drexel Nanotechnology Institute*
*Drexel University, Philadelphia, PA 19104*
*Gogotsi@drexel.edu*
*http://nano.materials.drexel.edu*

***Abstract:*** Carbon nanomaterials show a great promise for energy, biomedical, structural and other applications.[1] This presentation describes a variety of carbon nanomaterials, including nanotubes and porous carbide derived carbons, which are produced by extraction of metals from carbides. This method can generate a broad range of potentially important carbon nanostructures, which range from diamond to carbon onions and nanotubes. They are known as Carbide-Derived Carbons (CDC). For example, heating of silicon carbide in vacuum results in ordered graphite films just a few graphene layers in thickness or aligned nanotubes, depending on the crystal face of SiC and temperature. CDC coatings on SiC can be used for a variety of electronic and tribological applications. Extraction of silicon, boron, aluminum, zirconium or titanium from their respective carbides by chlorine at 200-1200°C results in the formation of micro- and mesoporous carbons with the specific surface area up to 2000 $m^2/g$. Porous graphitic carbon (charcoal) has been used in medicine starting from ancient time and is widely used in numerous applications nowadays. However, only recently we have learnt how to tailor the pore structure in carbons to optimize them for sorption of various species, ranging from small gas molecules, such as hydrogen, to fairly large proteins, such as cytokines. CDC technology allows the control of carbon growth on the atomic level, monolayer by monolayer, with high accuracy. The CDC structure depends on the crystal structure of the carbide precursor as well as process parameters including temperature, time and environment. Design of carbon nanomaterials for energy related (hydrogen sorption and supercapacitors) and biomedical (blood cleansing) applications will be particularly addressed in this presentation.

[1]Y. Gogotsi, *Nanomaterials Handbook*, CRC Press, Boca Raton, FL, 2006, 800 pp.

**Dr. Yury Gogotsi** is Professor of Materials Science and Engineering at Drexel University. He also holds a courtesy appointment in the Department of Mechanical Engineering and Mechanics at Drexel University and serves as Director of the A.J. Drexel Nanotechnology Institute and Associate Dean of the College of Engineering. He received his MS (1984) and PhD (1986) degrees from Kiev Polytechnic and a DSc degree from the Ukrainian Academy of Science in 1995. His research group works on nanostructured carbons, nanofluidics, and pressure-induced phase transformations in ceramics and semiconductors. He has co-authored two books, edited ten books, obtained more than 20 patents and authored about 250 research papers.

He has received several awards for his research including I.N. Frantsevich Prize from the Ukrainian Academy of Science, S. Somiya Award from the International Union of Materials Research Societies, G.C. Kuczynski Prize from the International Institute for the Science of Sintering, R. Snow Award from the American Ceramic Society (twice), R&D 100 Award from R&D Magazine and two Nano 50 Awards from NASA Nanotech Briefs. He has been elected a Fellow of the American Ceramic Society, Academician of the World Academy of Ceramics and Full Member of the International Institute for the Science of Sintering.