LECTURE ABSTRACT

This lecture will provide an overview of research activities in the area of nanostructured carbon and carbide materials used for capacitive storage of electrical energy. Electrochemical capacitors or “supercapacitors” are devices that store electrical energy electrostatically and are used in applications where batteries cannot provide sufficient power or charge/discharge rates, or when a long service life (up to 1 million cycles) is needed. Until now, their higher cost, compared to batteries, has been limiting the use of supercapacitors in household, automotive and other cost-sensitive applications. We describe the materials aspects of supercapacitor development, address unresolved issues and outline future research directions.

High surface area carbon materials are widely used as supercapacitor electrodes. Graphene, nanotubes, activated carbons, template carbons, carbon onions and carbon black are among many materials being used in supercapacitors. Extraction of metals from carbides can generate a broad range of potentially important carbon nanostructures, which range from porous carbon networks to onions and nanotubes. They are known as Carbide-Derived Carbons (CDC). The CDC structure depends on the crystal structure of the carbide precursor as well as process parameters including temperature, time and environment. 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 specific surface area up to 3000 m^2/g. CDC technology allows the control of carbon growth on the atomic level, monolayer by monolayer, with a high accuracy. It will be shown that the pore size to ion size ratio determines the efficiency of electrochemical energy storage systems. Design of supercapacitor electrodes using nanoporous carbons (3-D), graphene (2-D), carbon nanotubes (1-D) and carbon onions (0-D) will be addressed. Also, recently discovered 2-D carbides and carbonitrides known as MXenes (Ti_3C_2, Ti_2C and others) will be described.

SCHEDULE

3:30–4:00 PM, CP-137
Reception for Dr. Gogotsi
Enjoy refreshments and informal conversation with our speaker.

4:00 PM, CP-139
Introduction of our speaker by Professor John P. Selegue.

4:00–5:00 PM, CP-139
Zero- to Three-Dimensional Carbon-Based Materials for Energy Storage

Yury Gogotsi
Professor of Materials Science and Engineering,
Drexel University, Philadelphia
Director, A.J. Drexel Nanotechnology Institute

The Department of Chemistry wishes to acknowledge the generous support of the Lyle Ramsay Dawson Lecture Series by Venita Dawson Curry.

All events are being held in the University of Kentucky’s Chemistry-Physics Building.

Maps of the campus and parking information are available on the web at:
www.uky.edu/CampusGuide

For more information on the Dawson Lecture Series visit our web site at:
http://chem.as.uky.edu/lyle-dawson-lecture-series

Questions and comments can be directed to
Prof. John P. Selegue
selegue@uky.edu

COLLEGE OF ARTS & SCIENCES

THE SEVENTEENTH ANNUAL LYLE RAMSAY DAWSON LECTURE

Established in the memory of Lyle Ramsay Dawson
Distinguished Professor and former Head of the Department of Chemistry

ZERO- TO THREE-DIMENSIONAL CARBON-BASED MATERIALS FOR ENERGY STORAGE

Yury Gogotsi
Professor of Materials Science and Engineering, Drexel University
Director, A.J. Drexel Nanotechnology Institute

Friday, October 25, 2013
4:00 PM
Chemistry-Physics Building – Room 139
Lexington, KY

UK
UNIVERSITY OF KENTUCKY
College of Arts & Sciences
Department of Chemistry

Lyle Ramsay Dawson was a native of Illinois and received his undergraduate degree from the University of Illinois in 1932. He received his Ph.D. degree in 1935 from the University of Iowa.

Dr. Dawson served in several academic positions in Illinois, Wisconsin, Nebraska and Louisiana and also worked on the Manhattan Project as a Research Chemist and Group Leader in the Metallurgical Laboratory at the University of Chicago. In 1946, he was awarded the War Department's Certificate of Merit and a U.S. Patent for his efforts on the Manhattan Project, which led to the discovery of a fundamental process for the extraction and purification of the elements plutonium and neptunium. He was a member of the committee that organized the Oak Ridge Institute of Nuclear Studies and was a council member of the Institute.

Professor Dawson came to the University of Kentucky in 1945 as Head of the Department of Chemistry. He provided key leadership in initiating and building the doctoral program in Chemistry at the University. For example, in his first decade in the department, he individually obtained the major portion of extramural research support. During his twenty-five years with the Department, he held contracts for fundamental chemical research with the U.S. Army, the National Science Foundation and the Atomic Energy Commission.

He directed or co-directed seventeen Ph.D. dissertations and nine M.S. theses. He was a talented research director and had a special ability to imbue his students with a concise, clear and complete scientific writing style. He published more than fifty research papers dealing with the chemistry of nonaqueous solutions and coauthored a reference book on the subject.

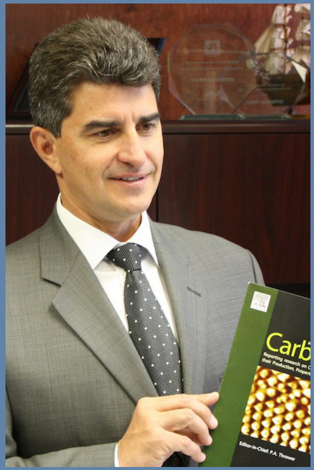
Dr. Dawson was a master teacher both in the classroom and in less formal conferences and discussions. His leadership and mentoring led many graduate teaching assistants and junior faculty members to become more effective teachers. His uncompromising devotion to high achievement standards in course-work, research, education and training set the tone for our department for years to come.

Another significant contribution to the Department was Professor Dawson's indefatigable advocacy for a new chemistry building. His leadership in soliciting and designing a replacement for the former chemistry building, Kastle Hall, culminated in the opening of the current Chemistry-Physics Building in 1963.

He also served the campus community in other ways. Dr. Dawson was elected a Distinguished Professor in the College of Arts and Sciences in 1954–1955, and was appointed to the rank of Distinguished Professor in the field of Physical Chemistry by the University of Kentucky Board of Trustees in 1956. He served as Acting Dean of the Graduate School in 1954–1955, 1956 and 1960–1961.

Dr. Dawson's contributions outside the University were well recognized. He was a Fellow of both the American Institute of Chemists and the American Association for the Advancement of Science. He was a member of the American Chemical Society, Electrochemical Society, Sigma Xi, Omicron Delta Kappa, Alpha Chi Sigma and Kappa Delta Pi, serving leadership roles in each of these organizations. He served several times as a Tour Lecturer and Visiting Scientist under the sponsorship of the American Chemical Society. He was also active in a variety of other nonacademic organizations.

Dr. Dawson's twenty-five years in the department represent a truly outstanding combination and balance of administrative leadership, teaching, research and service. Although Dr. Dawson passed away in 1976, his impact on the department continues to this day as we continue our evolution into a top-twenty research institution. The endowment of the Lyle Ramsay Dawson Lecture Series by his beloved daughter, Venita Dawson Curry, permits us to rejoice in this legacy and to continue our tradition of world-class chemical research.



Dr. Yury Gogotsi is Distinguished University Professor and Trustee Chair in the Department of Materials Science and Engineering at Drexel University. He also holds courtesy appointments in the Departments of Chemistry and Mechanical Engineering and Mechanics at Drexel University, and serves as Director of the A.J. Drexel Nanotechnology Institute. He served as Associate Dean of the College of Engineering from 2003 to 2007. He received his MS (1984) and PhD (1986) degrees from Kiev Polytechnic and a DSc degree from the Ukrainian Academy of Science in 1995. He has co-authored 2 books, edited 13 books, obtained more than 40 patents and authored more than 350 peer-reviewed papers, including more than 10 papers in Science and Nature family journals. His research has been recognized with the Chang Jiang Scholar Award, European Carbon Association Award, S. Somiya Award from the International Union of Materials Research Societies, G.C. Kuczynski Prize from the International Institute for the Science of Sintering, Ross Coffin Purdy and Roland Snow Awards from the American Ceramic Society, NANOSMAT Prize, I.N. Frantsevich Prize from the Ukrainian Academy of Science, R&D 100 Award from R&D Magazine (twice) and two Nano 50TM Awards from NASA Nanotech Briefs. He has been elected a Fellow of the AAAS, Materials Research Society, American Ceramic Society, The Electrochemical Society, as well as Academician of the World Academy of Ceramics and Full Member of the International Institute for the Science of Sintering.