Graphenated Carbon Nanotubes in Electrode Applications: from micro-mass spectrometers to supercapacitors

Jeffrey T Glass, PhD, MBA
Professor, Department of Electrical and Computer Engineering
Professor, Department of Mechanical Engineering and Materials Science
Hogg Family Director of Engineering Management and Entrepreneurship
Duke University, Durham, NC 27708

Abstract - This presentation will start with a brief review of research in the presenter's laboratory. This will include research on carbon nanotube and graphenated carbon nanotube growth, characterization and electrode development for applications in supercapacitors, neural probes and miniature mass spectrometers. The development of solar fuel electrodes using ultrathin films deposited by atomic layer deposition onto nanoparticle scaffolds will also be discussed. The talk will then focus on graphenated carbon nanotubes for supercapacitor applications. Graphene and carbon nanotubes (CNTs) are fascinating materials due to their exceptional properties and potential use in applications ranging from high frequency electronics to energy storage devices. A hybrid structure consisting of graphene foliates protruding from the sidewalls of aligned multi-walled CNTs has been developed in the presenter's labs. The graphenated-CNT (g-CNT) structures were deposited via microwave plasma enhanced chemical vapor deposition and characterized using electron microscopy, Raman spectroscopy, and electrochemical techniques. These structures have enhanced capacitive properties due to the density of exposed graphene edges in a three dimensional framework. Electrochemical impedance spectroscopy indicated that the weight specific capacitance for the g-CNTs was 5.4x that of similar CNTs without the graphene foliates. Pulsed charge injection measurements demonstrated a 7.3x increase in capacitance per unit area. Time allowing, to help explain the properties of this CNT-graphene integrated structure, this presentation will outline a microstructural classification for sp^2 bonded carbon nanostructures in the context of their edge vs. basal plane exposure and whether they are predominantly planar or three dimensional.

Biosketch - Jeffrey T. Glass is a Professor in the Department of Electrical and Computer Engineering and the Department of Mechanical Engineering and Materials Science, in the Pratt School of Engineering at Duke University. He is also holds the Hogg Family endowed chair in Engineering Management and Entrepreneurship. Jeff's research has focused on the growth and characterization of thin films for electronic applications with a focus on carbon-based materials, including carbon nanotubes, diamond, diamond-like carbon and silicon carbide. Jeff has published over 160 papers and book chapters, edited six books, is a co-inventor on 15 patents and is an ISI Highly Cited researcher. He has been a short course instructor for several professional societies and companies and has organized numerous conferences. He has given over 70 invited presentations in 12 different countries. He served as a member of a Presidential Science Advisor's committee for the assessment of diamond technology in Japan and has received two teaching awards and the National Science Foundation Presidential Young Investigator award. Jeff received his Bachelors and Masters degrees from Johns Hopkins University, and a Ph.D. in Materials Science and Engineering from the University of Virginia. He also holds a Global Executive MBA from the Fuqua School of Business at Duke University. He has been an Advisory Board Member for new ventures, consulted for venture capital firms and fortune 500 companies, and has testified as an expert witness in patent litigation.

Innovation, Professionalism and Leadership in the Real World

Jeffrey T Glass, PhD, MBA
Professor, Department of Electrical and Computer Engineering
Professor, Department of Mechanical Engineering and Materials Science
Hogg Family Director of Engineering Management and Entrepreneurship
Duke University, Durham, NC 27708

Abstract - This presentation will discuss a variety of issues related to managing innovation and entrepreneurship in the context of a technology-based organization. It will define some commonly misunderstood terms and describe barriers to innovation in organizations. Accepted best practices and concepts will be discussed to help develop an understanding of innovation management including: i) the processes that relate to innovation management in a technology based firm, ii) how to create a culture of innovation in an organization, iii) the organization and motivation of technical employees to support innovation, iv) the critical role of champions and, time allowing; v) key concepts of innovation strategy. Time allowing, we will also cover some the typical mistakes that early career professionals make when they start a new job. This will include a glimpse into leadership traits and the difference between leadership and management. Misperceptions about what it means to be a leader will also be discussed.

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