OMICS Group Conferences
Accelerating Scientific Discovery

2nd International Conference and Exhibition on
Materials Science & Engineering

October 7-9, 2013 Hampton Inn Tropicana, Las Vegas, USA

Controlling the interfacial properties of carbon nanotubes

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Abstract

The high surface area of nanomaterials dictates that the interface with their surroundings is important in determining their properties or functionality. For example, all atoms in single-walled carbon nanotubes (SWCNTs) exist on the surface and, therefore, have excellent sensing capabilities. The interface of SWCNTs with their surroundings is also important to their application in polymer composites, devices, drug delivery, bioimaging and biosensing. Understanding and ultimately controlling these surface layers is important because of its influence on reactivity, adsorption of pollutants, and interaction with biological materials. SWCNT interfaces are often altered with surfactants to improve their dispersion in aqueous suspensions. While the surfactant surrounding the nanotube provides many benefits, the inability to alter or control this interface often limits the performance or functionality of the nanotube. A lack of information on the effect of the surrounding environment on SWCNT properties further complicates the development of processes to control these interfaces. I will discuss our efforts at characterizing and controlling SWCNT interfaces. I will show that emulsion-like microenvironments surrounding the nanotubes can be used to probe the interaction of molecules with the SWCNTs and coat the nanotubes with thin polymer shells, enabling control over the interfacial properties of the nanotubes. I will show how the ability to control these interfaces changes the retention behavior of SWCNTs onto agarose columns and may alter the toxicity of SWCNTs to various biological materials. Finally, I will show how these systems could provide new avenues for loading drugs within SWCNTs.

Biography

Kirk J Ziegler completed his Ph.D. in Chemical Engineering at the University of Texas at Austin. He then received the Enterprise Ireland Postdoctoral Fellowship and conducted research at University College Cork followed by postdoctoral research at Rice University with Nobel Laureate Richard Smalley. In 2005, Prof. Ziegler joined the faculty in the Chemical Engineering Department at the University of Florida. He has over 50 publications in high impact journals and he currently serves as the chair of the Nanoscale Science and Engineering Forum within the American Institute of Chemical Engineers.