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Modulating the surfactant structure around single wall carbon nanotubes for single chirality separations

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The post synthesis separation of single wall carbon nanotubes (SWCNTs) is needed for their inclusion in novel electronic devices. For example, semiconducting SWCNTs have unique optoelectronic properties that can be utilized in photovoltaics and biosensors. 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 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. SWCNT interfaces are often altered with surfactants to improve their dispersion in aqueous suspensions. Understanding and ultimately controlling these surface layers is important because of its influence on reactivity, adsorption of pollutants and interaction with materials. Our group has focused on characterizing and controlling SWCNT interfaces for high-fidelity separations of semiconducting SWCNTs by the n, m type. Here we report the high-fidelity desorption of single-chirality SWCNTs from hydrogels through surfactant structure modulation. High-purity fractions of (n, m) SWCNTs are obtained with high yield once a specific ratio of sodium dodecyl sulfate (SDS)/sodium deoxycholate (DOC) co-surfactant solution is used as the eluent. The elution of only one n, m type at a specific co-surfactant ratio while other types are exposed to more surfactant suggests that each n, m type forms a thermodynamically-stable surfactant structure in the co-surfactant solution.

Biography

Kirk J Ziegler has joined the Chemical Engineering Department at the University of Florida in 2005. His work on SWCNTs has focused on understanding the effect of surfactant-nanotube interactions on dispersion and separation processes. His work on nanowire arrays has applications in energy-related devices, which require high surface area to maximize energy generation or storage.

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