Synthesis, Characterization and Applications of Functionalized Carbon Nanotubes

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Nanometer-scale structures represent a novel and intriguing field, where scientists and engineers manipulate materials at the atomic and molecular levels to produce innovative materials for composites, electronic, sensing, and biomedical applications. Carbon nanomaterials such as carbon nanotubes constitute a relatively new class of materials exhibiting exceptional mechanical and electronic properties and are also promising candidates for gas storage and drug delivery. However, processing of carbon nanotubes is severely limited by a number of inherent problems: purification from a variety of byproducts, difficult manipulation and low solubility in organic solvents and in water are only some of these problems. For these reasons, several strategies have been devised to make nanotubes “easier” materials.

Covalent and supramolecular functionalization of carbon nanostructures are the basic synthetic techniques for solubilization and use in different fields such as donor-acceptor systems or drug delivery.

During this talk, we will discuss the basic concepts for functionalizing carbon nanotubes and for the characterization of the chemically modified materials. We will then highlight the use of functionalized carbon nanotubes in a number of applications, including:

1) CNTs as drug delivery scaffolds and as active substrates for neuronal growth. Nanotubes are compatible with neurons, but especially they play a very interesting role in interneuron communication.

2) In combination with polyoxometalate catalysts carbon nanotubes can successfully be used for the splitting of water molecules to give oxygen, but, especially, molecular hydrogen, ideal for clean energy generation.