Development of novel methods for the chemical functionalization of carbon-based nanostructured materials

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The aim of this dissertation was the development of a new methodology for chemical functionalization of carbon based nanostructured materials (Single- and Multi-Walled Carbon Nanotubes (CNTs), Carbon Nanodisks, Fullerenes) for use in various technological applications (e.g. catalysis, biomedicine, nanocomposites).

Initially, Single- and Multi-Walled Carbon Nanotubes were covalent functionalized via 1.3-Dipolar Cycloaddition. CNTs were functionalized with phenol groups, providing stable dispersions in a range of polar solvents, including water. Functionalized CNTs were further modified through silanization reactions. Additionally, functionalized SWCNTs combined with layered aluminosilicate clay minerals were used for the formation of highly ordered thin films through a modified Langmuir-Blodgett method. Furthermore, chemical functionalization of carbon nanodisks was achieved through oxidation reactions already used for other carbon nanostructures (oxidation of graphite). Modification of carbon nanodisks improves their dispersibility in organic solvents and water and makes them more compatible with other materials, facilitating the preparation of composites. Finally, fullerenes poly-adducts were prepared through oxidation, bromidation and hydroxylation reactions and tested in biomedical applications (cytostatic agents).

All the above materials were characterized by a combination of experimental techniques including X-ray diffraction, infrared, μ-Raman and X-ray photoelectron spectroscopies, thermal analysis, and atomicforce microscopy. The characterization techniques gave insight into the formation process and structural details of the produced hybrid nanostructures.