Infrared spectroscopic investigation on non-covalently functionalized single walled carbon nanotubes

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Hybrid materials formed by adsorption of organic molecules on the surface of carbon nanotubes form an important class of nanotube chemistry. This importance originates in the possibility of combining special (optical, electric or dispersive) properties of the added molecules with the mechanical stability of carbon nanotubes (CNTs). Functionalization of CNTs by polymers or aromatic systems is not only relevant from the functional groups' point of view, but the easier applicability of host nanostructure also plays an essential role.

The key to all applications is a method to study the qualitative properties of interaction (strength, bond type, etc.) between nanotubes and the associated species. We use infrared (IR) transmission and attenuated total reflection (ATR) spectroscopy to understand how these compounds are adsorbed or attached to the surface of the nanotube. Aromatic systems tend to adsorb by π-π stacking, which causes surface-attenuated infrared absorption (SAIRA) and thus peculiar vibrations of the added molecules can be investigated through the interaction of the evanescent field on the surface of the nanotube with the vibrations of the adsorbed species. We have studied these effects on pyrene-based systems and on luminescent rare-earth complexes.