Visible light induced charge transfer and gating in low dimension carbon hybrids

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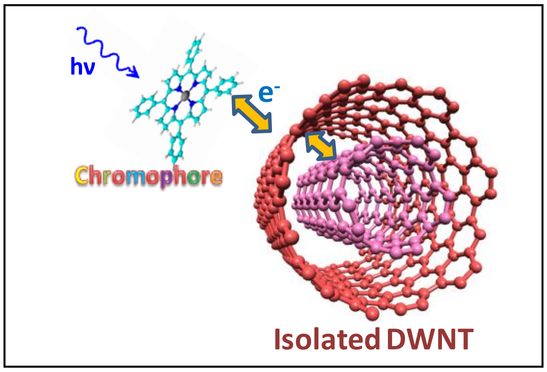

Nanotube/chromophore hybrids

Graphene and carbon nanotubes (CNTs) are promising platforms for realizing new functional devices such as ultrasensitive gas detectors, molecular scale logics and quantum devices. Particularly, double walled nanotubes (DWNTs) consisting of two concentric single walled CNTs, can be treated as structures of two twisted and stretched graphene bilayers that exhibit peculiar electronic properties, visible using molecule grafting on the outer wall [1]. Photo active molecules such as porphyrin molecules and terpyridine complex have the ability to reversibly switch between two or more stable states in response to external stimuli such as light, temperature or an electrical current, and can thus find application in molecular optoelectronics [2].

A few studies have already demonstrated the efficient photo induced charge transfer in CNT/porphyrin hybrid systems by using electrochemical methods, photoluminescence excitation experiments [3] as well as absorption spectra. Here we use Raman spectroscopy as a powerful tool both for the investigation of isolated DWNT and graphene and to study the charge transfer between the chemical dopants and sp2 carbon. We demonstrate optical gating in field effect transistors based on isolated DWNT or graphene, and functionalized with photo active molecules probed with combined Raman spectroscopy and electrical transport measurements. The role of light in the control of the state of the hybrid down to low temperature will be manifested and elucidated in terms of photo-induced charge transfer.

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