Comparing advanced functionalization routes to tailor 1D and 2D nanocarbons

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In this contribution I will present recent progress on unraveling the influence of charge transfer, local strain and hybridization on the electronic transport properties of single walled carbon nanotubes and graphene with special emphasis on the influence of basic correlation effects on the two particle excitation and the nature of the metallic ground state. In order to tailor their properties I will compare different functionalization routes and use resonance Raman, photoemission and x-ray absorption spectroscopy as probes. I will first briefly discuss recent results on charged and strained 2D graphene layers in graphite intercalation compounds and substitutionally doped graphene as well as intercalated and substituted 1D SWCNT. Then I will present a gas sensing model based on external functionalisation shows how reactive gases like nitric oxides are predominantly physisorbed on ultrapure SWCNT. I will also highlight the pathway how this interaction can be tailored by advanced filling reactions with metallocenes and metalacetylacetonates towards room temperature selectivity and sensitivity. As a last example I will review how such encapsulation inside SWCNT can be used for confined nanochemical reactions to stabilize new hybrid systems with novel electronic and optical properties.

Work supported by FWF and the EU.