東京大学グローバルCOEプログラム　機械システム・イノベーション国際拠点

東京大学 THE UNIVERSITY OF TOKYO

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Tailoring the electronic properties of low dimensional carbon hybrids

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日時：2012年10月5日（金）　14:00-15:00

会場：東京大学工学部2号館3F 231講義室

The presentation will give an overview on our current research focus on the electronic properties of carbon based low dimensional hybrid structures. These properties are strongly influenced by basic correlation effects and have a broad and promising application potential. Archetypical examples of these systems are functionalized graphene, graphite and single wall carbon nanotubes (SWCNT) which are determined by the local arrangement of their sp^2 hybridised carbon atoms, such that their character is either a zero gap semiconductor, semi-metallic, insulating, semiconducting or metallic. Examples of our recent work on how one can unravel the underlying electronic structure using high energy spectroscopy (electron energy-loss, (resonant) photoemission and x-ray absorption spectroscopy) and optical spectroscopy (resonant Raman and Photoluminescence) as a probe will be presented. Special emphasis will be given to the influence of basic correlation effects and local field corrections on the electronic and optical properties of graphite, graphite intercalation compounds and functionalized SWCNT hybrids. The latter include examples for the three alternative doping routes, namely, substitution and side wall functionalization (e.g. via the chemisorption of reactive gases like nitroxides), intercalation and endohedral doping (e.g. by filling with fullerenes and metallocenes) as well as examples for the growth of defined inner tubes from the different precursors via a nanochemical reaction. Different pathways to tailor these carbon hybrids regarding the complex interplay between charge transfer and hybridisation towards optimized optical quantum yield and defined conductivity will be emphasized.

In addition for metallic tubes, exhibiting a Luttinger liquid behavior, changes in basic correlation effects, will be discussed in the framework of a dimensionality crossover which causes a change from a one-dimensional metal to a normal Fermi liquid for functionalized SWCNT hybrids.

The detailed understanding of these fundamental electronic properties of functionalised graphite/graphene and SWCNT hybrids is the key to their future success in for instance nanoelectronic and different transport/optical based sensor applications.

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