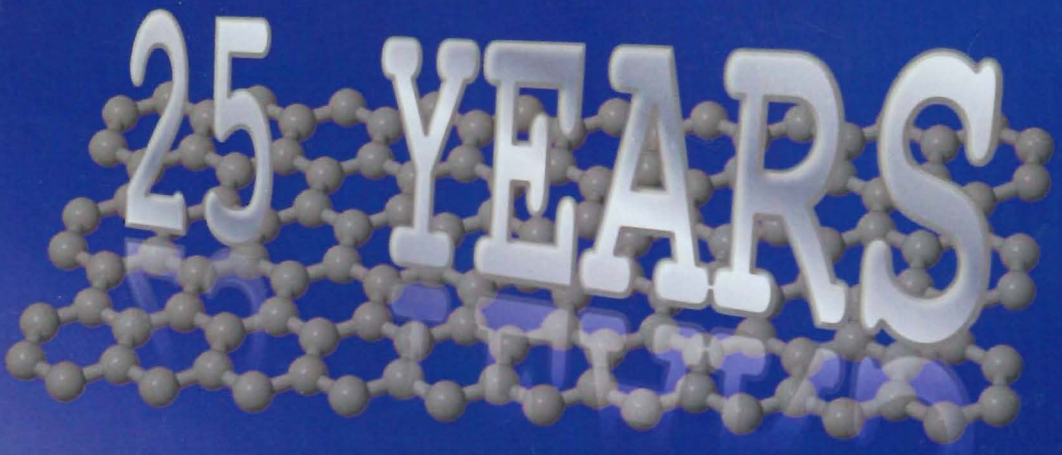
International Winterschool on Electronic Properties of Novel Materials

Molecular Nanostructures



Program

Hotel Sonnalp
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Name A. HUCZKO

TUE 11
Synthesis of Nb1-xWxS2 Graphene-Like Sheets

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Along with carbon 2D material graphene, stable graphene-like structures of transition-metal chalcogenides have sparked new discoveries in condensed-matter physics and electronics. In fact, the miniaturization of 2D structures by lateral confinements, makes them potential candidates not only for modulation of electron-transport phenomena, but also enhances their host capabilities arising from the enlarged surface area and improved diffusion properties upon the intercalation of guest molecules due to the finite lateral size and enhanced open-edge morphology of the 2D nanosheets. Herein, we demonstrated the formation of Nb0.33W0.66S2 flying carpets, i.e. stacks of one to five layers, by lithiation and exfoliation of stacked niobium tungsten sulfide Coin-Roll Nanowires. The flying carpets can be successfully functionalised with ZnO colloids, demonstrating the reactivity of the sulphur atoms at the surface. We will present detailed investigations TEM investigations on the defect structure and transport properties by means of conductive-AFM studies.

TUE 12
Ultra-fast efficient synthesis of one-dimensional nanostructures

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Using the thermal-explosion mode of the redox reaction between the strong reducing agent and oxidant within a fraction of a second the process is terminated. A careful selection of powdered reactants, which are very basic chemicals, can result in the efficient formation of novel nanostructures. Different starting mixtures of magnesium powder with various carbonates (such as Na2CO3, CaCO3, FeCO3) were tried while the autothermal reaction was carried out under both reactive (air) and neutral atmosphere (argon) with an initial pressure of 1 or 10 atm, respectively. Spectral diagnostics was carried out to determine the combustion temperature (around 1900 K). Under those conditions the deep decomposition of carbonates was confirmed. The morphology of the products was studied using XRD, SEM, TEM and Raman spectroscopy. Both micro- and nanosized one-dimensional structures were efficiently formed. The morphology of some of the latter ones resembles multi-walled carbon nanotubes.

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TUE 13
Ionic doping of carbon nanotubes – a Raman scattering and electric conductivity study

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In our contribution, we present results on doped single-wall carbon nanotubes. Combining Raman spectroscopy with measurements of electrical conductivity and the Hall coefficient, the influence of various stages of doping on Raman features is investigated. In particular, it is shown that for a proper characterisation of Breit-Wigner-Fano line of metallic nanotubes both a broader part of the Raman spectrum than usually used, and the spectrum background ("dark counts") have to be taken into account. Furthermore, a characteristic energy for ionic doping in order of few tens of meV was obtained from thermal annealing experiments. We also focus on possible signatures of electronic Raman scattering in carbon nanotubes. For that, the basic parameters like screening length, plasma frequency, single-particle energy, etc. and their dependence on the charge carrier concentration are discussed.

TUE 14
Investigating the effect of heat pre-treatment and catalyst mixtures on the yield of epitaxially horizontally aligned carbon nanotubes grown over st-cut quartz

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Single-walled carbon nanotubes (SWNT) are a promising material for nanoelectronics because of their physical and electrical properties. To this end, they should be synthesized with controlled orientation, alignment, yield and electronic type. Chemical vapor deposition (CVD) is widely used method for growing horizontally aligned SWCNT on selectively cut single crystal substrates such as ST-cut quartz. Thermal annealing of the substrates prior the CVD process is an often implemented step to improve yield. Nevertheless, the role of the annealing step has not been fully investigated. Here, we systematically investigate the effect of the annealing step on the morphology of the ST-cut quartz substrates, in order to provide excellent conditions for high nucleation yields and growth of long tubes (longer than 100