HL 20: Innovative Materials

Time: Monday 14:30–15:45 Location: POT 06

HL 20.1 Mon 14:30 POT 06

Synthesis of functional nano-micro structural materials by a simple flame transport approach — •Yogendra Kumar Mishra, Sören Kaps, Xin Jin, Dawit Gedamu, Ingo Paulowicz, Arnim Schuchardt, Sebastian Wille, and Rainer Adelung — Functional Nanomaterials, Institute for Materials Science, Faculty of Engineering, Christian-Albrechts-University, Kaiserstrasse 2, 24143 Kiel, Germany

Recent studies on the growth of semiconductor and ceramic nanostructures ranging from 1D arrays to 3D networks, have attracted immense research motivation due to their multi-functional properties which offer a huge amount of applications like nanoelectronics, sensors and mainly biological engineering. However mass scale synthesis of nanostructures or synthesis of hyperbranched interconnected extremely large networked nanostructures is still an open challenge. The vapour liquid solid (VLS) process is the most used technique but according to the recent demands in nanotechnology the VLS process needed further simplification or development of new techniques. The present work demonstrates a very simple flame transport synthesis (FTS) approach which offers synthesis of desired semiconductor and ceramic nanostructures. A complete overview of the family of ZnO nano-micro structures along with the glimpses of SnO2, Fe2O3, Bi2O3 and Al2O3 nanostructures synthesized by FTS approach will be presented and the role of different growth parameters will be discussed. Preliminary results of the corresponding current-voltage response, elastic modulus as well as possible applications in biomedical engineering will be presented.

HL 20.2 Mon 14:45 POT 06

Self assembly of 1D-nanoparticles at interfaces using external fields — •Anindya Majumder[1,3], Oliver Jost[2], Jörg Opitz[3,4], Gianaurelio Cuniberti[3], and Eckhard Beyer[1,2] — [1]Institute of Surface and Manufacturing Technology, Dresden University of Technology, 01062 Dresden, Germany — [2]Fraunhofer IWS, Winterbergstraße 28, 01277 Dresden, Germany — [3]Institute for Materials Science and Max Bergmann Center of Biomaterials, Dresden University of Technology, 01062 Dresden, Germany — [4]Fraunhofer IZFP, Maria-Reiche-Str. 2, 01219 Dresden, Germany

Self-assembly of nanoparticles has promising technological applications since it provides efficient building blocks for physical, chemical, and biological systems. Localization of nanoparticles at liquid-liquid interfaces by manipulating the particle surface energy is an upcoming area with great potential for applied and fundamental research. Apart from regular technological applications, such tailor made assembly opens a window to fabricate self assembled interfacial structured hybrid materials with unique properties. Carbon nanotubes (CNTs) represent an anisotropic and perfectly one-dimensional class of nanoparticles with extraordinary properties. CNTs were functionalized by various surfactants to prevent its agglomeration due to van-der-Waals forces. This dispersion was added to an immiscible solvent and CNTs were self assembled with the aid of electric field via dielectrophoresis between pre-fabricated inter-digitated electrodes on silicon substrates. A potential drop across the interface may provide sufficiently deep potential wells for self assembly at the interface.

HL 20.3 Mon 15:00 POT 06

Properties of annealed RF-sputtered Cu_2O thin films — •Daniel Reppin, Andreas Laufer, Angelika Polity, Detlev M. Hofmann, and Bruno K. Meyer — I. Physikalisches Institut, Justus-Liebig-Universität Giessen, Heinrich-Buff-Ring 16, 35392 Giessen

Cuprous oxide is a p-type semiconductor with a band gap in the visible spectral range, it is sustainable, non-toxic and cheap in production and therefore an interesting material for photovoltaic applications.

Cu_2O thin films were sputtered from a copper and a Cu_2O composite target in a RF sputtering chamber under different oxygen flows. Afterwards the films were annealed under nitrogen flow in the range of 400 to 930 °C for ten minutes. The effect of the annealing time was also investigated. Subsequently the optical and electrical properties of the annealed films were compared to the 'as-deposited' films. After the annealing procedure the films sputtered from the Cu-target show a reduced carrier concentration by a factor of 100 ($2.5 \cdot 10^{17}$ -> $2.5 \cdot 10^{15}$ cm^{-3}) while the mobility increases from 0.37 to 35 cm^2/Vs. The band gap of the films changed from 2.10 to 2.53 eV. These effects are related to a better crystalline quality and therefore a reduction of defects in the crystal structure of the Cu_2O. The results using the Cu_2O-target will be discussed at the conference.

HL 20.4 Mon 15:15 POT 06

Rb_4O_6: strongly correlated 2p shell system under pressure — •shahab naghavi, stanislav chadov, gerhard h. fecher, and claudia felser — institut für anorganische chemie und analytische chemie, Johannes gutenberg universtität mainz

the strongly correlated 2p open-shell of Rb_4O_6 exhibits a variety of interesting physical phenomena at high pressures. In this compound, there are two different kinds of anionic oxygen molecules in the solid simultaneously, hyperoxide and peroxide. By mean of the first-principle electronic structure calculation, we study the Rb_4O_6 system under pressure. Its peculiar feature is the strongly correlated p electrons of the hyperoxide molecules (O_2^{2-}). Around 75 GPa a transition from an insulating antiferromagnetic phase to a half-metallic ferromagnetic phase takes place. At pressures higher than 75 GPa, all anionic oxygen molecules (peroxide and hyperoxide) carry magnetic moments. Finally, above 160 GPa a metallic phase appears, where all oxygen molecules show the same bond lengths without magnetic moment.

HL 20.5 Mon 15:30 POT 06

Molecular beam epitaxy of Heusler alloys on InAs heterostructures — •Boris Landgraf, Sascha Bohse, Christian Heyn, and Wolfgang Hansen — Institut für Angewandte Physik, Universität Hamburg, 20355 Hamburg, Germany

The injection of highly spin-polarized electrons from ferromagnets into low-dimensional semiconductor systems is important for spintronic applications. The main problem encountered when building such spintronic devices is that spin-polarization of electrons gets lost at the metal/semiconductor interface. We investigate epitaxial growth as well as structural, magnetical, and electrical properties of Heusler/semiconductor hybrid systems. In particular, we focus on Ni_2MnIn Heusler grown on InAs(001) as well as on modulation-doped InGaAs/InAs/InGaAs heterostructures. One previous finding [1] with this hybrid system reveals that As diffuses from InAs into the Heusler film and forms a significant intermixing layer. We pursue two possibilities to overcome this problem. One is the growth of a MgO diffusion-barrier to avoid intermixing at the interface. Corresponding data will be discussed. Another solution is the use of other Heusler candidates. For that reason, we run a new metal molecular beam epitaxy (MBE) chamber in our laboratory, which is connected with a commercial III/V semiconductor MBE via an in-vacuo transfer system. This MBE chamber enables the growth of MgO as well as of different Heusler alloys.

[1] A. Zolotaryov et al., *J. Cryst. Growth* 2397–2404, 311 (2009)