MM 25: Topical Session: TEM-Symposium - Structure-Property

Time: Tuesday 15:00–16:00 Location: H4

Topical Talk MM 25.1 Tue 15:00 H4

Modern Transmission Electron Microscopy in Energy Materials Research — •Erdmann Spiecker — Center for Nanoanalysis and Electron Microscopy (CENEM), Department Werkstoffwissenschaften, Universität Erlangen-Nürnberg

Energy is an area where materials technology will play an important role in meeting the needs of the future. Due to the growing importance of environmental issues energy generation, conservation and storage will continue to be major drivers for materials technology. Increasing the efficiencies of energy systems, like solar cells, fuel cells, gas turbines and batteries generally requires the development of new or the improvement of existing materials. Modern transmission electron microscopy (TEM) plays an imporatant role in this process since it provides powerful techniques for investigating the structure, chemistry and defects of materials from the microscale down to the atomic scale and for revealing local structure-property relations. In this presentation examples of the use of modern TEM techniques in energy materials research will be highlighted, including microscopic studies on single-crystal superalloys for turbine engines, transparent electrodes for organic solar cells, porous materials for catalytic gas reactions, and nanoparticle-filled polymers for high voltage electrical isolation.

MM 25.2 Tue 15:30 H4

High-resolution TEM study on carbon nanotubes grown from $Fe_{20}Ni_{80}$ nanoparticles — •Anja Kiessling[1,2], Darius Pohl[1,2], Christine Täschner[1], Mark Hermann Rümmeli[1], Rolf Erni[3], Ludwig Schultz[1,2], and Bernd Rellinghaus[1] — [1]IFW Dresden, D-01069 Dresden, Germany — [2]TU Dresden, Department of Physics, D-01062 Dresden, Germany — [3]Electron Microscopy Center, Swiss Federal Laboratories for Materials Testing and Research (Empa), CH-8600 Dübendorf, Switzerland

With the aim of studying the interface between the catalyst nanoparticle (NP) and the graphene layers, Carbon Nanotubes (CNT) were grown from $Fe_{20}Ni_{80}$ ("permalloy") NP on silicon substrates. Aberration-corrected high resolution transmission electron microscopy (FEI TITAN^3 80-300) was used to characterize the as-grown CNT.

Recent results obtained with CNT grown from FePt catalyst NP showed an energetically favoured facet for the release of carbon [1]. For the CNT grown from permalloy NP a similar behaviour is predicted from MD simulations and preliminary experimental results are in accord with that. Furthermore, by changing the growth parameters we were able to produce CNT filled with SiC nanowires. These CNT show a strongly distorted lattice. Within a model this behaviour can be explained.

[1] Pohl et al., PRL 107 (2011), 185501.

MM 25.3 Tue 15:45 H4

Electron tomography and HRTEM investigation of PbSe/carbon nanotube hybrid structures for near-infrared photodetectors — •Benjamin Winter[1], Julia Schornbaum[2], Benjamin Butz[1], Jana Zaumseil[2], and Erdmann Spiecker[1] — [1]Center for Nanoanalysis and Electron Microscopy (CENEM), Materials Science Department VII, University of Erlangen-Nuremberg, 91058 Erlangen, Germany — [2]Nanomaterials for Optoelectronics Group, Materials Science Department V, University of Erlangen-Nuremberg, 91058 Erlangen, Germany

Hybrids of single-walled carbon nanotubes (SWNTs) with high charge carrier mobilities and semiconductor quantum dots (QDs) with size-tunable absorption are ideal building blocks for optoelectronic devices. Coupling near-infrared absorbing PbSe QDs to SWNTs transforms the photoexcited states of the QDs into charge separated states. Due to the fast charge transport in SWNTs a dramatic increase of photosensitivity is expected. After the synthesis of the PbSe/SWNT hybrids, Raman spectroscopy indicates that the sp2-carbon lattice of the SWNTs is not chemically modified by the PbSe QDs. This implies that the QDs are attached to the SWNTs without molecular linker and charge transport along the SWNT is not affected. Scanning transmission electron microscopy (STEM) tomography and high-resolution TEM (HRTEM) carried out at 80 kV with an aberration-corrected FEI Titan3 80-300 reveal that the well-defined PbSe QDs partially grow around the SWNT bundles and have a preferred orientation of the {002} lattice planes perpendicular to the longitudinal axis of the SWNT bundles.