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The structure of a natural bone has well oriented hydroxyapatite crystals and fibrous collagens. Although very different materials have been used for bone replacement and substitutes, mechanical and biological performances of these substances still are not very close to those of natural bones. Scientific researches about this subject have been going on with increasing interests [1].
The aim of this study is to prepare novel biocompatible bone nanocomposites to use in veterinary orthopedic surgery and bone tissue engineering as bone filling materials. Sprague Dawley / Wistar Rats and New Zealand White Rabbits' femur, tibia and calvairum bone samples were used after sterilization and autoclave application and turned into micropowder forms by using a grinder. Molecular structure of hydroxyapatite has been confirmed and controlled and then the crystallite sizes, crystallite morphologies and distributions in the micropowder contents were investigated by FTIR and SWAXS methods. Moreover, titanium and zirconium oxide nanopowders that can modify cell response and dental restorative Eco-Flow (Ivoclar Vivadent AG) were systematically mixed with micropowders and stirred for 20 minutes and then the prepared forms have been poured into a special matrix having four cells. Hardening of the samples was also completed by using visible light. FTIR and SWAXS measurements have been also carried out to characterize the shapes, sizes, distributions and molecular contents of the nanostructured aggregations. Mechanical testing of the samples was also carried out to compare mechanical properties of the composites including different bones and metallic nanopowders.

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[1] R. Murugan, S. Ramakrishna, *Composites Science and Technology*, **2005**, 65, 15-16, 2385-2406.

Keywords: bone nanocomposites; FTIR; SWAXS; natural bones

FA5-MS06-P04

Structure Investigation of Individual GaAs Nanorods by X-ray Coherent Diffraction Imaging

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Semiconductor 1D nano structures are very promising for future manufacturing of semi-conductor devices such as different kind of diodes or devices for high speed electronics. Up to now the most common way to grow such so called nanorods is the vapor-liquid-solid method (VLS), Typically the NR grow onto 111 planes of zinc-blende structure compounds. Unfortunately in this method positions and size of nanorods are defined by the position and size of catalyst droplets. Therefore it is not possible to grow nanorods with uniform size and uniform contribution onto the substrate. An alternative to overcome this drawback is the growth of nanorods without the use of a catalyst onto a pre-patterned substrate. Here NR only grow on certain position and with nearly uniform size [1,2]. However, the MOVPE growth process is not well understood so far.

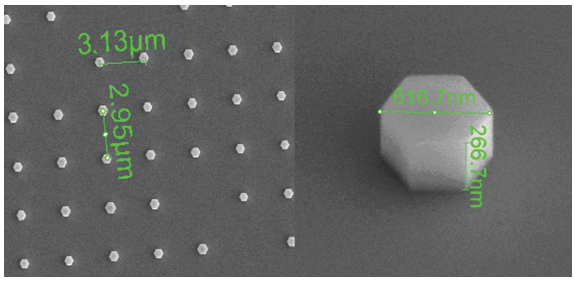

Fig 1. NR -STEM picture of single NR and array of NR's

The aim of this work was structural X-ray analysis [3] of single rods grown by MOVPE. To do this we have measured a sample with GaAs NR's grown on GaAs (111) B substrate with inter-rod distance of 3µm (Fig.1) grown at 750C^0 with III-V ratio of 80 using SiN_x layer. The sample was inspected using the microfocus setups at ID1 of ESRF. Using Fresnel Zone Plates the spot size of x-ray beam was reduced to 200x 600nm which is small enough to select a single nanorod with diameter of 600nm.

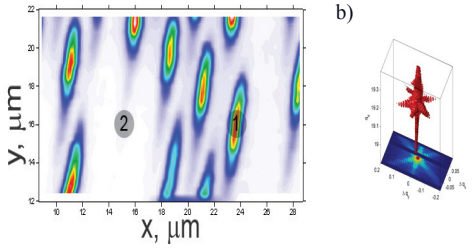

Fig. 2. Experemental RSM: a) Scaning area; b3D image of single rod in RS

Using the 111 position of GaAs nanorod which was slightly mismatch with respect to the substrate we recorded an intensity map of the whole nanorods array. At the position of a single rod (Fig. 2a) we were able to record a 3D image using Coherent Diffraction Imaging (Fig. 2b). Cut in (q_x,q_y) plane shows the picture with CTR in six directions corresponding to side planes of single nanorod with regular hexagon shape (Fig.3).

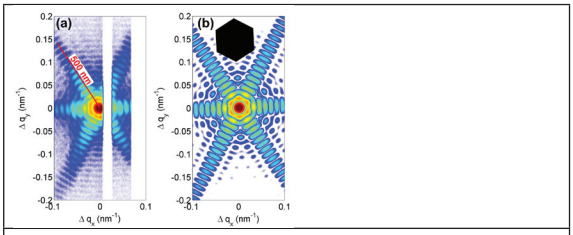

Fig.3 RSM of single rod and FFT of hexagon shape object

We report on X-ray characterization of single GaAs NRs grown by selective-area MOVPE on GaAs[111]B. We show that one is able to separate individual NR´s within a regular NR array using a micro-beam setup. Using Fourier transform of experimental data we are able to reconstruct the hexagonal shape of the nanorod shown in Fig. 3.

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Keywords: nanocrystals; XRD

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High Efficiency Core-shell Nanowires and Their Characterisation by X-ray Diffraction. Özgül Kurtuluş[a], Ullrich Pietsch[b]. [a]*Division of Physics, Doğuş University.* [b]*University of Siegen, Siegen, Germany.*
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The controlled organisation of nano-materials in arrays of confinements with regular spacings is a key issue in fabricating functional nanodevices. Structural characterisation of these materials is essential for understanding their physical properties and evaluating their future applications in nano-electronics. The performance of nanodevices can be improved by effective surface passivation. The best passivation to date is the creation of core-shell heterostructures. In order to protect the electronic performance, both core and shell materials have to have a lattice mismatch as low as possible. For II-VI semiconductor nanomaterial systems, CdSe/CdS, CdSe/ZnS, and CdSe/ZnSe core-shell structures are under investigation up to now, but there is no report on the preparation and applications of uniform core-shell nanowires prepared by the succesive ion layer adsorption and reaction (SILAR) technique which improves the nanowire photostability. Cadmium chalcogen nanowires and corresponding core-shell nanowires could serve as a solution for high efficiency and low cost solar cells. The aim of this work is to produce uniform core-shell CdSe/CdS, CdSe/ZnS, CdSe/CdS-ZnS nanowires with SILAR technique and to determine the crystalline structure, the aspect ratios and the strain acting parallel and perpendicular with respect to nanowire axis by using transmission electron microscope (TEM) and synchrotron x-ray diffraction (XRD). In this study, the diameter of the nanowires is determined by TEM and XRD around 10 to 20nm. The lengths are determined by TEM in the order of μms, while the coherence length along the growing direction is obtained around a few tens of nms. These two parameters basically affect the optical and electrical properties of nanowires, which will influence ttheir efficiency The nanowire crystalline structure is determined by XRD and high resolution TEM. The nanowires are found to be randomly oriented and each of them exhibiting the admixture of wurtzite and zinc blende structure separated by stacking faults which is common in CdSe nanomaterials. For the first time, the ratio between wurtzite (W) and zinc-blende (ZB) structure in nanowires is quantified as less than 10% through XRD. This crystalline admixture has significant effects on the optical properties of nanowires and explains the observation of optical heterogeneity in individual cadmium chalcogen nanowires.

Keywords: nanostructures; chalcogenides; powder x-ray diffraction

FA5-MS06-P06

Preparation of the Noble Metals Nanoalloys Using Single-Source Precursors. Yuri Shubin[a], Sergey Korenev[a], Andrey Zadesenez[a], Pavel Plusnin[a], Evgeny Filatov[a]. [a]*Nikolaev Institute of Inorganic Chemistry of SB RAS, Novosibirsk, Russia.*
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In the most of chemical methods of nanoalloys preparation are used mixtures of individual precursors. Reduction of different metallic atom occurs no simultaneously. It results in two-phase mixture of different kinds of metals or core-shell particles. Using single-source complex precursors containing both alloy components ensures simultaneous reduction and preparing particles with homogeneous distribution of atoms.
The thermolysis of double complex salts at relatively low temperature (200-400ºC) gives nanoalloy powders. Depending on the phase diagram of the respective bimetallic system and temperature conditions its can be single phase or multiphase products. For example, the reduction of $[Pd(NH_3)_4][AuCl_4]_2$, $[Pd(NH_3)_4][IrCl_6]$, $[Rh(NH_3)_5Cl](ReO_4)_2$ under H_2 atmosphere produces nanoalloys $Au_{0.67}Pd_{0.33}$, $Pd_{0.50}Ir_{0.50}$ and $Rh_{0.33}Re_{0.67}$ respectively. Disordered $Pt_{0.50}Ni_{0.50}$ was obtained from $[Pt(NH_3)_4][Ni(Ox)_2(H_2O)_2]\bullet 2H_2O$ in He atmosphere while in H_2 atmosphere – a two-phase mixture of disordered $Pt_{0.50}Ni_{0.50}$ and ordered PtNi. In all cases crystallite sizes of bimetallic particles varied within 5–25 nm. The main parameters influenced on the phase composition and crystal structure of powder are thermal and chemical properties of precursor and the conditions of the experiment.
Structural and interphase transformations of bimetallic particles were investigated. The new results concerning equilibrium solid state solubility in the Rh-Re and Ir-Re systems are represented and discussed.
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Keywords: nanocrystallites; noble metals; binary alloys