MM 40 Nanostructured Materials III

Time: Friday 11:00–12:00 Room: IFW D

MM 40.1 Fri 11:00 IFW D

Compaction of Amorphous and Partially Crystallised Al-Ni-La Alloys — •Jens Vierke, Markus Wollgarten, and John Banhart — Hahn-Meitner-Institute, Materials Dep., Glienicker Str. 100, D-14109 Berlin, Germany

Morphology, microstructure and crystallisation behaviour of Argon (Ar) and Helium (He) atomised $Al_{87}Ni_8La_5$ and $Al_{85}Ni_{10}La_5$ alloy powders were studied by scanning and transmission electron microscopy, X-ray diffraction (XRD) and differential scanning calorimetry. XRD measurements of He-atomised $Al_{85}Ni_{10}La_5$ powders show a complete X-ray-amorphous structure. Ar-atomised powders of the same alloy exhibit fcc-Aluminium crystals in an amorphous matrix. In the case of $Al_{87}Ni_8La_5$, the microstructure consists of an amorphous phase, fcc-Aluminium as well as intermetallic phases. DSC measurements reveal that the amorphous phase of all alloys is stable up to a temperature of about 170°C, applying a heating rate of 20 K/min. The powders were compacted by uniaxial pressing, direct extrusion and equal channel angular pressing. Different compaction temperatures were applied with regard to the conservation of the amorphous phase. First results of the study will be presented. The support of the Institute of Materials and Machine Mechanics of the Slovak Academy of Sciences is gratefully acknowledged.

MM 40.2 Fri 11:15 IFW D

Aerosol synthesis of magnetic iron oxide nanoparticles — •Markus Ames, Andreas Tschöpe, and Rainer Birringer — Universität des Saarlandes, FR 7.3 Technische Physik, Postfach 151150, 66041 Saarbrücken

The metal-organic compound $[Fe(O^tBu)_3]_2$ is used as precursor in CVD processes to deposit thin films of iron oxide on a substrate. Depending on substrate temperature, three different modifications were observed: Haematite ($\alpha - Fe_2O_3$), Maghemite ($\gamma - Fe_2O_3$) and Magnetite (Fe_3O_4). The purpose of the present study was to evaluate this particular precursor for aerosol synthesis of nanocrystalline iron oxide particles. The reaction temperature in a hot-wall reactor was varied between 300°C and 800°C. The produced materials were characterized by X-ray diffraction, magnetization measurements and transmission electron microscopy. At temperatures below 400°C the yield of material was too low to allow further examination. The X-ray diffraction analysis revealed that Haematite was not produced and only Maghemite or Magnetite was found at all temperatures. The latter phases could not be distinguished by XRD due to their similar diffraction patterns. From magnetization measurements a saturation magnetization between 40 and 50 emu/g was obtained.

MM 40.3 Fri 11:30 IFW D

Elastic Properties of nanocrystalline palladium — •Markus Thirion and Rainer Birringer — Universität des Saarlandes, FR 7.3 Technische Physik, Postfach 151150, 66041 Saarbrücken

We investigate the elastic properties of nanocrystalline palladium by means of velocity of sound measurements. The samples are prepared by inert-gas condensation and compaction and have grain sizes ranging from 10 to 25 nm. Due to an unavoidable residual porosity, the specimen densities lie in the range between 90 and 95% of the bulk density of coarse-grained palladium. From the velocities of longitudinal and transversal polarized ultrasonic waves, the elastic moduli (Young's, shear and bulk) can be determined. In the low porosity regime (<10%), we find a linear dependence of moduli versus porosity, allowing to extrapolate the moduli of the pore-free material state. The extrapolation reveals slightly enhanced effective moduli of the nanocrystalline palladium (pore-free), as compared to the coarse-grained reference material. This enhancement will be discussed in terms of a rule of mixture approach for a two-phase system made up of crystalline grains and grain boundaries.

MM 40.4 Fri 11:45 IFW D

Structure and conductance in metal nanosystems — •Tammo Block[1], Jan Rönspies[1], Svend Vagt[1], Volkmar Zielasek[2], and Herbert Pfnür[1] — [1]Institut für Festkörperphysik, Universität Hannover — [2]Institut für Angewandte und Physikalische Chemie, Universität Bremen

Recently the Pb/Si(557) system has been demonstrated to exhibit a high quasi one-dimensional conductance along the Si(557) step direction on a macroscopic scale, associated with a metal-semiconductor phase transition [1]. Here we describe how to bring this system one step further, by using a lithographical method to perform measurements on only a few of these wires selected out of the 'wire array' of the Pb/Si(557) system. We employ electron-beam stimulated thermal desorption of oxygen (EBSTD) in UHV from ultrathin SiO_2 layers on a Si(557) surface to generate windows of clean Si in a SiO_2 mask, usually in the form of narrow (≤20nm) lines along the 557-step direction. Subsequent deposition of Pb and annealing to 640 K forms the 1D conducting system descibed above. TiSi contacts, produced previously ex-situ with conventional e-beam lithography, and the tip of a STM are used to connect these wires for conductivity measurements.The influence of various kinds of defects on electrical transport in the structures will be discussed.

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