MM 60: Nanomaterials - Nanoparticles

Time: Thursday 15:45–17:00 Location: H25

MM 60.1 Thu 15:45 H25

Tuning of silver ion release properties of silver-polymer nanocomposites — •Nisreen Alissawi, Vladimir Zaporojtchenko, Thomas Strunskus, and Franz Faupel — Institute for Materials Science - Multicomponent Materials, Faculty of Engineering, Christian-Albrechts-University (CAU) Kiel, Kaiser Str. 2, 24143, Kiel, Germany

The tuning of silver ion release is very important for biomedical applications of silver nanocomposite materials to reduce the potential toxicity effects towards human cells and the environment. In this work a well defined model system consisting of nearly two dimensional silver nanoparticle ensembles deposited on the surface of a polymer matrix was used to study the influence of different parameters on the silver ion release. Samples were prepared by physical vapor deposition (PVD) techniques. The effect on Ag ion release kinetics was investigated in dependence of the composite morphology (Ag nanoparticle size, concentration, and distribution), for nanocomposites containing silver (Ag) and gold (Au) as alloy nanoparticles with different composition, or with a polymer barrier on top of the NPs. Composition and the time-dependent release of silver ions after immersion in water were examined by a combination of techniques. Increasing the gold fraction in Ag-Au alloy NPs leads to a strong improvement of the oxidation resistance of the AgNPs. Moreover, a polymer barrier stabilizes the morphology of the composites and allows controlling the Ag ion release rate.

MM 60.2 Thu 16:00 H25

Role of oxygen on stabilization of TiOx cluster production by gas aggregation cluster source — •Amir Mohammad Ahadi[1], Vladimir Zaporojtchenko[1,3], Alexander Martin Hinz[1], Tilo Peter[1], Oleksandr Polonskyi[2], Thomas Strunkus[1], and Franz Faupel[1] — [1]Faculty of Engineering, Institute for Material Science, Multicomponent Materials, Christian Albrechts University, Kaiserstr. 2, D-24143 Kiel, Germany — [2]Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic — [3]deceased on 31.08.2012

Reactive DC magnetron sputtering from a Ti target combined with a gas aggregation chamber was applied to form TiOx clusters. Continuing previous work [1] the role of oxygen (as a reactive gas) on stabilization of TiOx cluster formation has been investigated. It was observed that at appropriate sputter conditions and by adding a certain oxygen flow, high and stabilized cluster deposition can be achieved. But already small changes of the oxygen flow lead to unstable cluster deposition rates. Further experiments at different magnetron power showed that the required oxygen flow for stabilization of the cluster deposition rate depends strongly on the magnetron power used. Analysis of the escaped oxygen concentration - from aggregation chamber as determined by mass spectrometry- indicates the crucial role of the reactive gas for cluster formation on the one side and poisoning of the target on the other side.

[1] T. Peter, O. Polonskyi, B. Gojdka, A.M. Ahadi, T. Strunskus, V. Zaporojtchenko, H. Biederman, F. Faupel, J. Appl. Phys., accepted(2012).

MM 60.3 Thu 16:15 H25

Magnetic Memory Effect in Chelated Zero Valent Iron Nanoparticles — •Nilotpal Ghosh, Badal Kumar Mandal, and Kesarla Mohan Kumar — School of Advanced Sciences, VIT University, Vellore-632014, Tamilnadu, India

We report the study of non-equilibrium magnetic behaviour of air stable Zero Valent Iron Nanoparticles synthesized in presence of N-cetyl-N,N,N-trimethyl ammonium bromide chelating agent. X-ray photoelectron spectroscopy study has suggested the presence of Iron oxides on nZVI surfaces. Zero-field-cooled and field-cooled magnetization measurements have been carried out at 20-300 K and 100 Oe. For field-cooled measurements with 1hr stops at 200, 100 and 50 K when compared with the warming cycle, we found the signature of magnetic memory effect. A study of magnetic relaxation at same the temperatures shows the existence of two relaxation times.

Reference : N. Ghosh, B.K. Mandal, K. M. Kumar, Journal of Magnetism and Magnetic materials 324 (2012)3839.

MM 60.4 Thu 16:30 H25

Synthesis and characterization of magnetic core-shell nanoparticles — •Marcel Hennes[1], Andriy Lotnyk[1], and Stefan G. Mayr[1,2,3] — [1]Leibniz-Institut für Oberflächenmodifizierung e.V. (IOM), Leipzig, Germany — [2]Translationszentrum für Regenerative Medizin (TRM), Universität Leipzig, Germany — [3]Fakultät für Physik und Geowissenschaften, Universität Leipzig, Germany

Magnetic nanoparticles with an inert functionalizable shell have received increasing attention during the past years, owing to their application potential e.g. in medicine or catalysis. In the present contribution, we report about our approaches to synthesize tailored magnetic core-shell nanoparticles using plasma assisted inert gas condensation (PA-IGC). Employing Cu/Ni as example of a binary alloy with moderate miscibility gap and different surface energies of the constituents, we first address the potential of synthesizing rotationally symmetric core-shell structures by self-organization using a combined Monte-Carlo / Molecular Dynamics computer simulation approach based on different well-established embedded atom method (EAM) potentials. Our results indicate presence of a Cu segregation layer of about one monolayer thickness, but absence of spherically symmetric core-shell particles. Motivated by these findings, an experimental setup with a post-synthesis coating stage is presented, that is capable of producing fine-tuned core-shell magnetic structures, as verified with aberration corrected high resolution transmission electron microscopy.

MM 60.5 Thu 16:45 H25

Size-dependent evolution of the phonon density of states of isolated Fe nanoparticles — Beatriz Roldan Cuenya[1], Luis K. Ono[1], Jason R. Croy[1], Kristof Paredis[1], Abdelkader Kara[1], Jiyong Zhao[2], Ercan E. Alp[2], and •Werner Keune[3,4] — [1]Department of Physics, University of Central Florida, Orlando, FL, USA — [2]Advanced Photon Source, Argonne National Laboratory, Argonne, IL, USA — [3]Faculty of Physics, University of Duisburg-Essen, Duisburg, Germany — [4]Max-Planck Institute of Microstructure Physics, Halle, Germany

The phonon density of states [PDOS, g(E)] of self-assembled isolated 57Fe nanoparticles (NPs) (2-6 nm in size) on SiO2/Si(111) substrates, synthesized by inverse micelle encapsulation, was measured as a function of NP size by nuclear resonant inelastic X-ray scattering (NRIXS) of synchrotron radiation. The NPs were protected by a Ti coating layer. An intriguing behavior was observed: an increase of the low-energy excess PDOS (as compared to bulk bcc Fe) with increasing NP size, combined with Debye behavior [g(E) prop. E^n, with n = 2] for small NPs (2 nm), but non-Debye behavior (n = 1.4) for larger NPs. This unexpected result can be qualitatively explained by the existence of low-coordinated Fe atoms located at grain boundaries and other defects with structural disorder in the interior of the large NPs, but not in the small NPs (2 nm). The PDOS was used to calculate important thermodynamic quantities of Fe nanoparticles, such as the atomic mean-square vibrational displacement, vibrational specific heat and vibrational entropy.