MM 56: Biomaterials

Time: Thursday 15:45–16:45 Location: H 0106

MM 56.1 Thu 15:45 H 0106

Performance of biodegradable austenitic Fe-Mn-C-Pd alloys for temporary medical applications — •Michael Schinhammer[1], Isabel Gerber[2], Anja C. Hänzi[1], Jörg F. Löffler[1], and Peter J. Uggowitzer[1] — [1]Laboratory of Metal Physics and Technology, ETH Zurich, Switzerland — [2]Labororatory for Biologically Oriented Materials, ETH Zurich, Switzerland

Biodegradable metals offer great potential for the use as temporary implant material in vascular intervention and osteosynthesis. They may overcome some of the restrictions of permanent devices, such as prolonged physical irritation and chronic inflammation. Iron and its alloys are considered promising candidates for such applications. This study focuses on the performance of a biodegradable austenitic Fe-Mn-C-Pd alloy regarding its mechanical properties and in vitro cytocompatibility. The alloys developed feature high ductility values at moderate strength levels and a pronounced hardening, which makes the alloys especially suitable for stent applications. By means of thermo-mechanical treatments the properties can be adjusted over a wide range. In vitro cell testing indicates good cytocompatibility of the eluates, even with increasing eluate concentrations. In summary the property profile of the newly developed alloys appears promising for the use as degradable medical implant material.

MM 56.2 Thu 16:00 H 0106

Influence of the synthetic polypeptide c25-mms6 on Nanoparticle growth — •Annalena Wolff[1], Katrin Wollschläger[2], Katrin Eckstädt[1], Inga Ennen[3], Patrick Thomas[1], Walid Hetaba[3], Stefan Löffler[3], Marco Wissbrock[2], Nadine Mill[1], Thomas Weiss[1], Peter Schattschneider[3], Norbert Sewald[2], and Andreas Hütten[1] — [1]Universität Bielefeld, Fakultät für Physik, Deutschland — [2]Universität Bielefeld, Fakultät für Chemie, Deutschland — [3]Technische Universität Wien, Institut für Festkörperphysik,Österreich

Bioinspired Nanoparticle syntheses have advanced in recent years. Polypeptides play a key role in the controlled biomineralization process. Their influence on inorganic crystal growth has not yet been understood. A bioinspired synthesis of Cobalt Ferrite nanoparticles was carried out in vitro at room temperature. Here a short synthetic version of the protein MMS6, found to be involved in the biomineralization process within Magnetotactic Bacteria was used to synthesize the magnetic nanoparticles. The influence of this synthetic polypeptide was studied by comparing the obtained Cobalt Ferrite Nanoparticles to those synthesized without polypeptide. Stoichiometric Cobalt Ferrite Nanoparticles were obtained in the polypeptide enhanced synthesis while non-stoichiometric Cobalt Ferrite nanoparticles were found in the control experiment. Our results indicate that the polypeptide influences the microstructure but is not required to obtain particles. On the basis of our results we propose a multistep biomineralization process in which the polypeptide acts as a catalyst.

MM 56.3 Thu 16:15 H 0106

On the role of Mg atoms in calcite crystals: an *ab initio* study — •Pavlína Elstnerová[1], Martin Friák[1], Tilmann Hickel[1], Helge Otto Fabritius[1], Dierk Raabe[1], Andreas Ziegler[2], and Jörg Neugebauer[1] — [1]Max-Planck-Institut für Eisenforschung GmbH, Düsseldorf, Germany — [2]University of Ulm, Ulm, Germany

Nearly 90% of animal species protect themselves with a cuticle: a complex hierarchical biocomposite often containing calcite that acts as a stiffening component. These calcite crystals contain impurities, commonly Mg or P, but the role of these elements is much debated. Here we present results of a parameter-free quantum-mechanical study of the thermodynamic, structural and elastic properties of single calcite crystals containing Mg atoms employing density functional theory (DFT). We calculated the electronic structure of bulk $(Ca_xMg_{x-1})CO_3$ using 30-atomic supercells and studied the impact of Mg substitutions. Our calculations show that replacing Ca by Mg reduces the volume of substituted crystals and increases their bulk modulus as well as uniaxial and biaxial Young's moduli. Our results thus indicate that the role of Mg in calcite crystals is to stiffen the material (for details see Elstnerová *et al.*, *Acta Biomater.* **6** (2010) 4506). We also find significant Mg-induced local distortions of lattice geometries (involving carbonate groups) that are similar to those found at calcite surfaces.

MM 56.4 Thu 16:30 H 0106

How to detect protein fouling and cleaning in heat exchangers using ultrasonic based measurements and classification methods — •Eva Wallhäusser, Mohamed Hussein, and Thomas Becker — TU München. Brau- und Getränketechnologie, (Bio-)Prozesstechnik und Prozessanalyse, Weihenstephaner Steig 21, 85354 Freising

Fouling and cleaning are severe issues in industries using heat exchangers. In particular food and pharmaceutical industry is concerned. Due to fouling unsupervised cleaning takes place which leads to high production costs. A setup was developed to produce and measure dairy protein fouling under realistic conditions. This setup was characterised theoretical using wave equations, port theory, and sensitivity analysis. Also, experimental validation was done. Dairy protein fouling was produced under flow conditions and it was shown that it is possible to detect its presence and absence using an ultrasonic measuring method. For this, an algorithm was developed which is based on a combination of acoustic and signal parameters which are fed into classification methods like artificial neural network (ANN) and support vector machine (SVM). Offline, detection accuracy of the ANN was 97.80 % and of the SVM 97.38 %. The code was then adapted and implemented for online analysis using an ANN as classification method. First online tests for cleaning succes were done.