

Systemen — ANNEMARIE BULLA¹, CARLOS CARRENO-BODENSIEK², ●EMIR SUBASIC¹, RALF BERGER¹, ANDREAS BÜHRIG-POLACZEK¹ und ANDREAS LUDWIG³ — ¹Gießerei-Institut der RWTH Aachen, 52072 Aachen, Deutschland — ²Department of Electromechanical Engineering, Faculty of Duitama, Duitama, Columbia — ³Department Metallurgie, Montanuniversität Leoben, 8700 Leoben, Österreich

Die fest-flüssig Grenzflächenenergie spielt während des Erstarrungsprozesses für die Keimbildung und das Wachstum der Phasen eine zentrale Rolle. Sie geht als wichtiger Parameter in viele analytische und numerische Erstarrungs- und Reifungsmodelle ein. In der Literatur finden sich nur sehr begrenzt experimentell bestimmte Werte. Für ternäre und höherkomponentige Systeme existieren bisher keine Messungen. Die zentrale Zielsetzung der vorliegenden Arbeit bestand darin, eine geeignete Vorrichtung für die Messung der fest-flüssig Grenzflächenenergie aufzubauen und auf im Rahmen des Schwerpunktprogrammes relevante ternäre Legierungssysteme anzuwenden. Dazu wurde entsprechend den Arbeiten der Gruppe von Prof. J.D. Hunt in Oxford eine radiale Wärmeflussapparatur aufgebaut, die die Einstellung eines sehr stabilen radialen Temperaturgradienten erlaubt, indem eine zylindrische Probe entlang ihrer Achse geheizt und auf der Außenseite gekühlt wird. Durch Formanalyse von Gleichgewichtskorngrenzenfurchen und die numerische Bestimmung der lokalen Unterkühlung entlang der Korngrenzenfurchung wurde der Gibbs-Thomson-Koeffizient und daraus die fest-flüssig Grenzflächenenergie bestimmt.

MM 3.3 Mon 12:15 H 1058

Phase Equilibria of Nanoscaled Systems — ●GERHARD WILDE¹, HARALD RÖSNER², PETER BUNZEL^{2,3}, and JÖRG WEISSMÜLLER^{2,3} — ¹Universität Münster, Institut für Materialphysik — ²Forschungszentrum Karlsruhe, Institut für Nanotechnologie — ³Technische Physik, Universität des Saarlandes

The impact of the morphology of the interface of matrix-encased nanoparticles on the melting transition has been investigated. To elucidate the interface contribution clearly, material of identical chemical composition has been synthesized by different processing pathways, resulting in distinctly different interface topologies. These results are discussed with respect of the mechanisms that lead to a size dependence of the melting temperature. Aside from the particle/matrix interfaces, internal heterophase interfaces necessarily occur, if multicomponent and especially multiphase materials are addressed. In multicomponent and nanoscaled alloy systems, interface segregation and interface-induced stresses are known to affect the phase boundary lines of the equilibrium phase diagrams at fixed size. Yet, already the presence of internal heterophase interfaces contributing an excess free energy is sufficient to severely modify the phase equilibrium and the associated phase transformations in nanosize alloy systems. Here, results on the constitutive behavior of binary nanoscaled model alloys obtained by modeling will be highlighted. In addition, experimental results concerning the constitutive behavior of nanoscale alloy systems and concerning a new approach for obtaining nanoscale systems with well-defined size are presented. Support by the DFG is gratefully acknowledged.

MM 4: Nanostructured Materials I

Time: Monday 10:15–11:30

Location: H 0107

MM 4.1 Mon 10:15 H 0107

Electrochemically induced surface charge effect on the properties of nanoporous Au-Fe alloys — ●AJAY KUMAR MISHRA¹, CHANDRAHAS BANSAL^{1,2}, and HORST HAHN¹ — ¹Institute for Nanotechnology, Forschungszentrum Karlsruhe, Karlsruhe 76021, Germany — ²School of Physics, University of Hyderabad, Hyderabad 500 046, India

Nanoporous Au-Fe alloys consisting of nanoparticles of about 5 nm diameter were synthesized by inert gas phase condensation. Charge was induced electrochemically on the surface of the nanoparticles, and in-situ measurements of strain, magnetization, and conductivity were carried out during the charging and discharging process taking place in the electrochemical cell. The observed strain could be explained to arise from a Coulomb pressure produced by the surface charge on the metal. The variation of magnetization with charging was also found to be consistent with the effect of this pressure. A charge induced variation in the dc electrical conductivity of about 6 percent was observed. An explanation of the rate of change of conductivity with charge was provided in terms of the additional charge density produced by the induced charge. Similarly at the microscopic level, Mossbauer isomer shift and quadrupole splitting were measured and showed a small but reversible behaviour with charge.

MM 4.2 Mon 10:30 H 0107

Charge induced ITO transistor for printable electronics — ●SUBHO DASGUPTA, SEBASTIAN GOTTSCHALK, ROBERT KRUK, and HORST HAHN — ¹Institute of Nanotechnology, Forschungszentrum Karlsruhe GmbH, P.O. Box 3640, D-76021 Karlsruhe, Germany

Although research on printable electronics has received increasing attention in the past two decades there are essential scientific and technical problems still to be addressed prior to commercialization. In general, printable electronics with organic or inorganic channels suffer from either very low mobility (pentacene or amorphous silicon FETs) or their fabrication is complicated, costly, requires sophisticated techniques, or involves high processing temperature (polycrystalline silicon or semiconducting oxide FETs). We have fabricated an alternative electrochemically gated JFET with commercial ITO nanoparticles as a channel (with nearly metallic conductance) and an electrolyte as a gate. The device principle is based on a charge induced variation of drain current without any redox reaction at the electrolyte/particle interface. Depending on the electrolyte used, the on/off ratio can be as high as 103. The calculated field-effect mobility is in the range 30–60 cm²/Vs when the whole channel is considered as an array of nanowires

whose diameter is equal to the average neck diameter of the nanoparticles. The subthreshold swing (415 mVdec⁻¹) is lower than most of the printable FETs reported so far. The high conductance of the channel can offer added advantage with high on-state current for submicron device sizes. Similar devices fabricated with a solid polymeric electrolyte as a gate dielectric can be ultracheap and readily printable.

MM 4.3 Mon 10:45 H 0107

Energy Transfer in Solution-Based Complexes of CdTe Nanocrystals Electrostatically Bound by Calcium Ions — ●SERGIY MAYILO, JAN HILHORST, ANDREI S. SUSA, CORNELIA HÖHL, THOMAS A. KLAR, ANDREY L. ROGACH, and JOCHEN FELDMANN — Photonics and Optoelectronics Group, Department of Physics and CeNS, Ludwig-Maximilians Universität München, Germany

Colloidal semiconductor nanocrystals with controllable surface properties are attractive objects for use as building blocks in different functional structures within the bottom-up assembly approach. We produced stable complexes from differently-sized water soluble CdTe nanocrystals capped by mercaptoacid stabilizers through electrostatic interactions of negatively charged carboxylic groups of capping ligands with positively charged Ca(II) cations. Energy transfer between smaller nanocrystals (donors) and larger nanocrystals (acceptors) in fabricated complexes is demonstrated by means of steady-state and time-resolved photoluminescence spectroscopy, paving the way to nanocrystal-based light harvesting structures.

MM 4.4 Mon 11:00 H 0107

Electronic transport properties of individual chemically reduced graphene oxide sheets — ●CRISTINA GÓMEZ-NAVARRO¹, THOMAS WEITZ¹, ALEXANDER BITTNER¹, MATEO SCOLARI², ALF MEWS², MARKO BURGHARD¹, and KLAUS KERN¹ — ¹Max-Planck-Institut fuer Festkoerperforschung, Heisenbergstrasse 1, 70569 Stuttgart, Germany — ²Department of Chemistry, University of Siegen, D-57068 Siegen, Germany

The peculiar electronic properties of graphene sheets have attracted substantial interest in the scientific community during the past few years (1-2). Micromechanical cleavage is currently the most effective method to produce high-quality graphene sheets. However this method does not enable the large-scale production required for most applications. Consequently alternative production methods for graphene sheets are highly desirable. Here we report on the electronic transport properties of single graphene sheets obtained via chemical reduction of graphite oxide. We find that reduced single layers exhibit room