MM 21 Amorphous and Liquid Materials II

Time: Tuesday 16:30–17:45 Room: IFW D

MM 21.1 Tue 16:30 IFW D

DeGennes slowing down in a liquid metal revisited: A neutron spin echo study — •Franz Demmel[1], Peter Fouquet[2], Wolfgang Haeussler[3], and Christoph Morkel[3] — [1]ISIS Facility — [2]ILL Grenoble — [3]TU Muenchen

The decay of density fluctuations shows a slowing down at the structure factor maximum in liquids, which is well known as deGennes narrowing in the frequency domain. Molecular simulations for the liquid metal Rubidium and mode coupling theory has suggested that the relaxation process has to be described with two terms in the memory function [1]. We have probed these predictions by inelastic neutron scattering using the spin echo technique to measure the dynamics directly in the time domain. The liquid alkali metal Rubidium was measured near the melting point with the spin echo instrument IN11C at the ILL, Grenoble. The resulting intermediate scattering function is in remarkable quantitative agreement with predicted values from the mode coupling calculations and the molecular dynamics simulations. The question will be discussed whether this slow decay is related to the solidification process. [1] U. Balucani and R. Vallauri (1989) Phys. Rev. A 40 2796

MM 21.2 Tue 16:45 IFW D

Inelastic Neutron Scattering on AlNi melts — •Sebastian Stüber, Suresh Mavila Chathoth, and Andreas Meyer — Physik Department E13, TU München

We report on inelastic neutron scattering (INS) measurements on Al_4Ni melts, comparing an alloy with natural Ni isotopic composition to a ^{58}Ni enriched sample. The experiments were performed at the new time-of-flight instrument of the neutron source FRM-II in Garching, yielding an exceptionally good signal-to-background ratio.

AlNi melts exhibit an intermediate range order (IRO), associated with a strong non-linear behaviour of the Ni self-diffusion coefficients as a function of composition [1]. Isotopic comparison enables a closer look on intermediate correlations, as ^{58}Ni scatters only coherent, whereas Ni in natural abundance is a strong incoherent scatterer. The amplitude as well as the time scale of diffusive atomic motion exhibit a strong dependence on coherent, respectively incoherent contributions to scattering, and secondly, their oscillations are in phase with the static structure factor. This data set allows a detailed investigation of the diffusion mechanism in AlNi melts. The experimental results are compared with Molecular Dynamics computer simulations.

[1] S.K. Das, J. Horbach, M.M. Koza, S. Mavila Chathoth, A. Meyer, Appl. Phys. Lett. **86**, 011918 (2005)

MM 21.3 Tue 17:00 IFW D

Short-range Order in Undercooled Ti-Fe-Si-O Melts — •Oliver Heinen, Dirk Holland-Moritz, and Dieter M. Herlach — DLR, Inst. für Raumsimulation, D-51170 Köln

Comparing the energy of different types of monoatomic clusters and assuming radial symmetric Mie type interaction potentials, the icosahedron truns out to be the most stable configuration of all clusters with 13 atoms. Basing on this finding Frank proposed an icosahedral short-range order (SRO) prevailing in metallic liquids. This hypothesis has been approved by a number of experimental and theoretical examinations. The assumption of radial symmetric interaction potenials is justified for purely metallic systems. In this work we present investigations of the SRO of liquids containing metallic as well as covalent bonding atoms. For the investigation the Ti-Fe-Si-O system was chosen since this system is supposed to have strong covalent Ti-O bonds in the solid as well as in the liquid state. The liquids were containerlessly processed and in-situ investigated using the combination of the electromagnetic levitation technique together with energy dispersive diffraction of synchrotron radion at the European Synchrotron Radiation Facility as well as neutron diffraction at the Institute Laue-Langevin. This work was financially supported by DFG under contract No. Ho1942/4 and by ESRF and ILL.

MM 21.4 Tue 17:15 IFW D

The oscillation spectrum of two-phase liquid drops — •Leonie Kraus[1], Karol Debinski[2], Rudolf Schmitz[2], and Ivan Egry[1] — [1]Institut für Raumsimulation, DLR Köln — [2]Institut für Theoretische Physik, RWTH Aachen

The interfacial tension between two immiscible liquids is of basic and technical interest, especially concerning melts of multicomponent metallic alloys. In principle, it may be calculated from the oscillation spectrum of a two-phase droplet. For a force free, spherical droplet, two frequencies are expected which can be clearly assigned to the surface oscillations and the interface oscillations respectively. This assumption is approximately fulfilled for electromagnetically levitated droplets under microgravity conditions. A corresponding experiment was performed within a parabolic flight campaign in 2005. The alloy Cu40Ni30Ag30 was examined, which has a stable miscibility gap in the liquid range.

In levitation experiments on Earth, the gravitational force and the levitation force break the spherical symmetry of the droplet. So the external forces need to be considered and the corresponding theory should be extended. In general, for the lowest translation and oscillation modes, one gets a 16-dimensional equation of motion, which may be approximatively diagonalized.

In this talk, both the experimental results from the parabolic flight and the theory for aspherical two-phase drops are introduced and discussed.

MM 21.5 Tue 17:30 IFW D

Structure and transport properties of amorphous Ag-Sn Alloys — •D. Hauschild, S. Neubert, P. Haeussler, I. Kaban, and W. Hoyer — Chemnitz University of Technology, Institut of Physic, 09107 Chemnitz, Germany

Within the last years binary amorphous alloys of metal-metal and metal-semiconductor type were investigated resulting in a model of global resonances between the electronic system and the forming static structure [1].

Two of us (I K and W H) have measured the liquid state by means of X-ray diffraction. It was shown that the liquid state contains clusters of well defined composition and is micro-inhomogeneous. The variation of the overall composition results in a variation of their volume fraction, whereas the composition of the individual clusters stays constant. By decreasing the temperature the size of the clusters is increasing. Three of us (S N, D H and P H) have measured the amorphous state by means of electron diffraction in transmission. Here we compare a-Ag-Sn with l-Ag-Sn as well as with the corresponding states of Au-Sn and Cu-Sn. The results were discussed in the Hume-Rothery-Model with a possible enhancement by hypridization.

The amorphous alloys were prepared in situ at T = 4K in a HV-cryostate. Immediately after the evaporation and at various annealing steps, up to the crystalline state, we measured the static structure and the resistivity.

[1] P. Haeussler, Collective dynamics of nonlinear and disordered systems, Springer (2004)