

MM 42 Diffusion II

Time: Friday 11:00–12:00

Room: IFW B

MM 42.1 Fri 11:00 IFW B

Diffusion-induced recrystallization in Au/Cu thin films — ●BRITTA KRUSE, DIETMAR BAITHER, and GUIDO SCHMITZ — Westfälische Wilhelms-Universität Münster, Institut für Materialphysik, Wilhelm-Klemm-Str.10, 48149 Münster

Diffusion-induced recrystallization (DIR) was investigated in the Au-Cu system. Double layers of Cu and various AuCu alloys were deposited in (111) thin film texture on glass substrates. The as-prepared composition of the alloys varied from pure Au to 87at.% Cu in six steps, in order to control the lattice mismatch between the two diffusing materials. Heat treatments were performed at 435°C, which is well above the highest ordering temperature, so that the formation of intermetallic compounds is excluded. Nevertheless, XRD demonstrates intermediate intensity maxima after the heat treatments. Comparison with simulated XRD spectra and TEM demonstrate that these are related to newly formed grains of distinct compositions inside the diffusion zone. The sequence of the intermediate grain compositions depends characteristically on the initial mismatch. This behaviour may be understood by taking into account elastic stress and its relaxation.

MM 42.2 Fri 11:15 IFW B

Towards the influence of bulk solubility on grain boundary segregation: a case study of Fe and Ni diffusion in Cu — ●JENS RIBBE, SERGIY DIVINSKI, GUIDO SCHMITZ, and CHRISTIAN HERZIG — Institut für Materialphysik, Universität Münster

⁵⁹Fe and ⁶³Ni grain boundary (GB) diffusion in high-purity Cu was measured by the radiotracer method combined with mechanical sectioning in an extended temperature interval. At higher temperatures the conditions of Harrison's B kinetics were satisfied and the triple product $P = s \cdot \delta \cdot D_{gb}$ of the segregation factor s , GB width δ , and the GB diffusivity D_{gb} was determined at selected temperatures. Performing GB diffusion measurements at lower temperatures under C regime condition, the GB diffusion coefficient D_{gb} was directly measured. Using the estimate of the GB width deduced from GB self-diffusion measurements on FCC metals, $\delta \approx 5 \cdot 10^{-10}m$, the segregation factor s of Fe and Ni was determined as $s = P/\delta D_{gb}$. Fe reveals strong segregation and very slow diffusivity D_{gb} in Cu high-angle GBs. The measured triple product P^{Fe} for Fe GB diffusion is by orders of magnitude larger than the GB diffusivity P^{Ni} of Ni and many other elements. Small bulk solubility and strong segregation resulted in unusual penetration profiles of GB diffusion of Fe in the B kinetics. The nature of this phenomenon is discussed.

MM 42.3 Fri 11:30 IFW B

Study of Electrochemical Dissolution of Ternary Ag-Au-Dy Alloy — ●VISWANATH RAGHAVAN NADAR¹, HARALD RÖSNER¹, DOMINIK KRAMER¹, and JÖRG WEISSMÜLLER^{1,2} — ¹Forschungszentrum Karlsruhe, Institut für Nanotechnologie, Karlsruhe, Germany — ²Technische Physik, Universität des Saarlandes, Saarbrücken, Germany

We report results for the microstructure evolution during the dealloying of Ag-Au-Dy ternary alloys. The nature of the transport path during the formation of the nanoporous structure in dealloyed Ag-Au is the subject of current research, and in particular the role of bulk diffusion is debated. By exploring the dealloying of a supersaturated solid solution we aim at verifying the suggestion of an enhanced bulk diffusion coefficient due to excess vacancy injection at the dissolution front: the conceivable formation of solvent-rich precipitates in the alloy ahead of the dissolution front would support an enhanced diffusivity. In fact, the results for Ag-Au-Dy supersaturated in the rare earth Dy are not incompatible with this expectation. The suction-cast specimens were selectively dealloyed in 1M HClO₄ solution at different durations and investigated at each stages ex-situ using TEM, XRD and AC magnetometer. The material is two phase in its initial state, with a Ag-rich ternary solid solution as the majority phase and a Au- and Dy-rich ternary intermetallic as the minority phase. During dealloying a repartitioning of Dy between the solid solution and the ternary compound is found, a process which may suggest accelerated bulk transport, since Dy would oxidize immediately when brought in contact with the electrolyte.

MM 42.4 Fri 11:45 IFW B

Element Specific Defect Investigation on Mg-Alloys with Coincident Doppler Broadening Spectroscopy — ●MARTIN STADLBAUER¹, CHRISTOPH HUGENSCHMIDT², KLAUS SCHRECKENBACH², and PETER BÖNI¹ — ¹Physikdepartment E21, James-Franck-Straße, 85748 Garching — ²ZWE FRM-II, Lichtenbergstraße 1, 85748 Garching

A new coincident Doppler broadening spectrometer (CDBS) at the high intense positron source NEPOMUC [1] in Garching was set into operation. The Doppler broadening of the 511 keV annihilation line reveals not only information about the defect concentration of the sample but also the chemical surrounding at the annihilation site. Since positrons are efficiently trapped at open volume defects, it becomes feasible to identify the elements in the vicinity of these defects. For this purpose, two collinear Germanium detectors are used in coincidence in order to reduce the background efficiently. Annealed samples of Magnesium, Aluminum, Zinc and AZ31 were investigated with CDBS in order to compare the shape of the annihilation line in the high momentum region and to get reference spectra. Furthermore, ion irradiated samples of AZ31 were measured to reproduce the defect profile by quantifying the S-parameter versus sample potential between 1 and 30 keV and position. Additionally coincidence spectra were recorded in order to detect any changes in the chemical surrounding of the defects.

[1] Hugenschmidt, C., G. Kögel, R. Reppe, K. Schreckenbach, P. Sperr, B. Strasser und W. Triftshäuser: NEPOMUC - The New Positron Facility at FRM II, Mat. Sci. Forum, in press, 2004