MM 5: Interfaces I

Time: Monday 10:15–11:15 Location: H6

MM 5.1 Mon 10:15 H6

Stress Induced Migration of <100> Tilt Grain Boundaries in Al-Bicrystals — •Tatiana Gorkaya, Dmitri Molodov, and Günter Gottstein — Institut für Metallkunde und Metallphysik, RWTH Aachen, 52056 Aachen

The stress induced migration of planar grain boundaries in aluminium bicrystals was measured. Both low- and high angle symmetrical <100> tilt grain boundaries with misorientation angles in the range between 3.5° and 23.0° were examined. Boundary migration under a shear stress was observed to be ideally coupled to the lateral translation of grains. The measured ratios of the normal boundary motion to the lateral displacement of grains are in an excellent agreement with the respective boundary geometry. The temperature dependence of grain boundary mobility was measured in the temperature range between 290°C and 390°C, and the corresponding activation parameters were determined. The activation enthalpy of boundary migration was found to be independent of misorientation angle in the investigated misorientation range and amounts to H=1.44 eV.

MM 5.2 Mon 10:30 H6

Influence of low angle grain boundaries on recrystallization — •Myrjam Winning — Max-Planck-Institut für Eisenforschung GmbH, Abteilung Mikrostrukturphysik und Umformtechnik, Düsseldorf, Germany

Recrystallization is one of the most effective ways to change the microstructure as well as the properties of crystalline materials. On one hand primary static recrystallization is defined by nucleation and growth, whereas the growth takes place by the motion of high angle grain boundaries. On the other hand it is known that even low angle grain boundaries are able to move and therefore able to contribute to microstructural changes. But although there is some experimental evidence that low angle grain boundaries can play a role during recrystallization the influence of low angle grain boundaries are usually not taken into account neither in experimental investigations nor in simulations of the recrystallization process.

In general, recrystallization models discriminate between three different types of grain boundaries: low angle grain boundaries which are immobile, random high angle grain boundaries which are mobile and sometimes also some special grain boundaries with a higher mobility than the random grain boundaries.

The aim of this study is to investigate the influence of mobile low angle grain boundaries on the microstructure and texture evolution during recrystallization of deformed Al single crystals by using a cellular automaton model.

MM 5.3 Mon 10:45 H6

Migration and Faceting of Low Angle Grain Boundaries in Aluminium-Bicrystals — •Bingbing Zhao, Dirk Kirch, Dmitri Molodov, and Günter Gottstein — Insitute of Physical Metallurgy and Metal Physics, RWTH-Aachen University, Kopernikusstr. 14, 52056 Aachen, Deutschland

Migration and faceting behaviour of low angle <100> tilt grain boundaries in Al-bicrystals was investigated experimentally by in-situ observations in a scanning electron microscope. The results reveal that for grain boundaries with misorientation angles in the range $10°<\theta<15°$ there is a temperature TR, above which the boundary possess a curved shape and moves in a steady state under a capillary driving force. Below this temperature the grain boundary shows one singular facet corresponding to the minimum energy configuration with respect to the grain boundary inclination and does not move if the temperature remains constant. The transition temperature TR was found to depend on the misorientation angle θ. For boundaries with $\theta>15°$ no transformation faceted boundary-curved boundary was observed. At any temperature these boundaries moved in a steady state being curved. Also for boundaries with misorientations $\theta<10°$ no structural transition was observed. These boundaries keep their initial symmetrical straight configuration in the entire investigated temperature range up to the melting point of aluminium. The results are interpreted in terms of the grain boundary roughening transformation and the change of grain boundary properties in the transition range between low and high angle misorientations.

MM 5.4 Mon 11:00 H6

Modelling grains and bubbles: phase boundary evolution with volume constraints — Harald Garcke[2], Britta Nestler[1], Björn Stinner[3], and •Frank Wendler[1] — [1]University of Applied Sciences Karlsruhe, Moltkestr. 30, D-76133 Karlsruhe — [2]Department of Mathematics, University Regensburg, D-93040 Regensburg — [3]Department of Mathematics, University of Sussex, BN1 9RF, United Kingdom

In our talk we present a new phase-field model for the evolution of grain or bubble systems, where the motion of the interfaces is determined by the mean curvature and the volume of some or all of the phases is preserved. Based on previously published results [1] a multi-phase-field model of Allen-Cahn type is introduced wich includes nonlocal forcing terms. The phase boundary dynamics results from a gradient flow of a Ginzburg-Landau type energy and incorporates anisotropic surface energies and kinetics. The algorithms for the volume constraints and the numerical realization for a high number of phases are briefly presented. Simulation results are shown for 2D and 3D problems dominated by surface energy minimization like the formation of Wulff shapes, double crystals and bubble clusters. Wetting phenomena with a constant fraction of liquid phase are treated for cases where the bubble phase volume either is preserved (foams) or may change in time (solid/melt grain coarsening). Additional forcing terms due to a solid/liquid phase transition allow to simulate the inclusion of inert particles into a growing front.

[1] B. Nestler, H. Garcke and B. Stinner, Phys. Rev. E **71** (2005), 041609-1