MM 49 Grenzflächen I

Zeit: Dienstag 14:45–16:00 Raum: TU H2038

MM 49.1 Di 14:45 TU H2038

TRANSITION FROM LOW ANGLE TO HIGH ANGLE GRAIN BOUNDARIES — •Myrjam Winning — Institut für Metallkunde und Metallphysik, RWTH Aachen, Kopernikusstr. 14, 52056 Aachen

Recent experiments showed a sharp transition from low angle grain boundary to high angle grain boundary behaviour. The transition is marked by a clear change in the activation enthalpy for the grain boundary motion without any extended range. It was found that the transition angle is at the same misorientation angle for the motion of curved as well as planar grain boundaries. We would like to present an overview about the existing experimental results and theoretical considerations of the structure of grain boundaries at the transition. Especially the observation that the transition depends on the rotation axis of the grain boundary is very important, because this will influence the Brandon criterion which is often used in experiments and simulations of grain growth and recrystallization processes.

MM 49.2 Di 15:00 TU H2038

Magnetically driven selective grain growth — •Peter J. Konijnenberg, Dmitri D. Molodov, and Günter Gottstein — Institut für Metallkunde und Metalphysik, RWTH-Aachen, 52074 Aachen

Thanks to an increasing field strength of resistive wide bore high field magnets, non-ferromagnetic anisotropic materials become increasingly interesting for magnetic annealing. In these materials a driving force for grain boundary migration can be induced by an appropriately directed and suitably high external magnetic field. Thermodynamically this stems from a difference in free energy density between adjacent grains.

It is experimentally shown that annealing of locally deformed single crystals (Zn, 99.99+%) in a high magnetic field, directed along the extraordinary axis, results in growth of individual selectively grown macroscopic grains into the single crystalline host matrix. Results are discussed in terms of grain orientation and grain boundaries between these grains and the host matrix in Rodrigues-Frank parameterization. It is shown that the boundary population is clearly non-randomly distributed, independently of the crystallographic deformation direction. Furthermore, in comparison with an identical but only locally at zero field recrystallized sample series, the boundary population after magnetic annealing is clearly biased towards large disorientation angles.

On rolled, recrystallized and magnetically annealed α-Ti (CP) it is shown how a similar growth selection also affects texture evolution in a polycrystalline aggregate.

MM 49.3 Di 15:15 TU H2038

In situ measurements of grain boundary migration with a high magnetic field polarization microscopy probe — •Peter Konijnenberg, Dmitri A. Molodov, and Günter Gottstein — Institut für Metallkunde und Metallphysik, RWTH-Aachen, 52074 Aachen

A space resolving high magnetic field polarization microscopy probe has been developed to track grain boundaries at the surface of magnetically anisotropic metals during magnetic annealing at high field strengths. It is known from experiments that also in non-ferromagnetic anisotropic materials a sufficient driving force for grain boundary migration can be provided by external high magnetic fields.Two major advantages in this approach are a constant, adjustable and accurately known driving force and the possibility to drive plane grain boundaries with a uniform and well defined boundary structure.

In essence this probe comprises a conventional polar magneto-optic Kerr setup; a remote controlled monochromatic polarizing microscope with CCD camera in field direction and a sample chamber equipped with a resistance heated sample stage perpendicular to the field direction. With a diameter of 50mm this device fits inside bore holes of commonly accessible resistive high field magnets. The current configuration was tested for sample temperatures up to 673K and fields of 25T.

The first ever in-situ boundary migration observation during magnetic annealing is presented. Absolute boundary mobilities and energies of various asymmetric tilt and twist boundaries in high purity Zn (99.99+%) bicrystals as well as grain growth kinetics data from polycrystalline samples are discussed as a function of temperature and driving force.

MM 49.4 Di 15:30 TU H2038

Effect of Impurities on Triple Junction Motion in Aluminum. — •V.A. Ivanov[1], D.A. Molodov[1], L.S. Shvindlerman[1,2], and G. Gottstein[1] — [1]Institute of Physical Metallurgy and Metal Physics, RWTH Aachen University, 52056 Aachen, Germany — [2]Institute of Solid State Physics, Russian Academy of Sciences, Chernogolovka, Moscow Distr., 142432 Russia

The results of an investigation of the steady-state motion of grain boundary systems with triple junctions in aluminum with different magnesium content (0.1 ppm-1000 ppm) will be presented.

The migration of triple junction systems was studied *in-situ* in the temperature range between 543 and 723K using an SEM. The contact angle at the tip of the triple junctions was measured. The effect of the triple junction is discussed in term of a dimensionless criterion Λ which describes the drag influence of the triple junction on the motion of the entire boundary system.

The experiments revealed that the motion of boundary systems, studied in the entire temperature range, is controlled by grain boundary kinetics irrespective of the Mg content. The drag effect of triple junctions on grain growth in 2D systems will be discussed.

Grain boundary mobility was found to depend on material purity. The dependence of grain boundary activation parameters (activation enthalpy and pre-exponential factor) on the Mg content will be analyzed.

MM 49.5 Di 15:45 TU H2038

Untersuchung von Kornrotationen an Kupfer mittels OIM — •Markus Ziehmer[1], Carl E. Krill III[2] und Rainer Birringer[1] — [1]Universität des Saarlandes, Technische Physik, D-66041 Saarbrücken — [2]Universität Ulm, Werkstoffe der Elektrotechnik, D-89081 Ulm

Die spezifische Energie einer Korngrenze ist stark abhängig von der relativen Orientierung der angrenzenden Kristallgitter. Einkristalline Kugeln, die auf ein einkristallines Substrat gesintert sind, stellen ein geeignetes System zur Untersuchung dieser Abhängigkeit dar. Die durch die Missorientierung induzierten Drehmomente führen bei entsprechender Wärmezufuhr zur Rotation der Kugeln auf dem Substrat. Bereits in den 70er Jahren wurde mit dieser sogenannten Kugel-Platte-Methode der Nachweis erbracht, dass für spezielle Orientierungen lokale Energieminima existieren, in die die Kugeln rotieren. Im Gegensatz zur damals verwendeten Messmethode (Texturmessung) ist es heute möglich, mit der Orientational Imaging Microscopy (OIM) die Rotation einzelner Kugeln über einen sehr weiten Kugelgrößenbereich zu detektieren. Die Messung der Rotationskinetik eröffnet den Zugang, die zugrundeliegenden treibenden Kräfte und die atomaren Mechanismen der Kornrotation zu identifizieren und Rückschlüsse auf die Korngrenzenenergie zu ziehen. Wir berichten über erste Ergebnisse, die wir aus Messungen an Kupfer erhalten haben.