

In-Situ SEM Investigation of Individual and Connected Grain Boundaries in Aluminum



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Cuvillier Verlag Mai 2008, 2008. Taschenbuch. Condition: Neu. Neuware - The recent development in experimental research on grain boundary and triple junction migration and structure in metals has been reviewed in this thesis. The dependence of grain boundary mobility on boundary character (misorientation and inclination) as well as the dependency of the triple junction mobility on the junction crystallography was addressed. The motion of individual grain boundaries and triple junctions was investigated in specially grown bi- and tricrystal samples of high purity aluminum. Orientation contrast imaging in an SEM combined with an in-house developed heating stage was used for in-situ tracking of the microstructure evolution at elevated temperatures. Furthermore, a novel laser powered heating stage was developed in order to enable the microstructure and -texture characterization at elevated temperature up to 1000C. The migration of connected tilt grain boundaries, was studied experimentally as a function of temperature between 400C and 580C. The study revealed that the majority of grain boundary systems were controlled by the lower mobility of the curved grain boundaries rather than the triple junction mobility within the investigated temperature range. Solely one grain boundary system (TJ-41) revealed two different kinetic regimes of coupled triple junction - grain boundary motion dependent on temperature proving the existence of a specific triple junction mobility and its dependence on triple junction crystallography. At low temperatures the motion of the grain boundaries was found to be retarded by the low triple junction mobility. In contrast, at elevated temperatures the system kinetics was found to be grain boundary controlled. The migration of grain boundary systems with triple junction, composed of mixed twist and 40 tilt grain boundaries, was studied experimentally in dependence of temperature for a range of boundary misorientations. In analogy to the study on connected tilt grain boundaries, the majority of...

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