

1st semester PhD Project Report

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PdD Topic: Investigation of recrystallization phenomena in face-centered-cubic polycrystalline systems

Description: Recrystallization occurs in polycrystalline materials during thermo-mechanical processing (TMP). This phenomenon involves recovery, nucleation, grain growth and in some instances abnormal grain growth. The kinetics of each mentioned event is a function of temperature, degree of deformation and time. In polycrystalline aggregates with face-centered cubic (FCC) structure, only several types of crystallographic orientations (also called texture components) tend to appear during the softening process. Additionally, this typical texture is disturbed in the case of particle-containing alloys, where particle-stimulated nucleation occurs after a certain straining level. However, the crystallographic textures evolved usually account for a strong anisotropy of mechanical properties, which is a main disadvantage of using light metals like Al alloys in the light-weight applications due to the poor performance during forming or drawing. Therefore, investigation of crystallographic texture evolution is of particular importance, since texture is a major source of anisotropy in metals. The proposed project aims to make the fundamental breakthroughs needed to enable the development of efficient materials with suitable mechanical properties via optimization of both microstructural characteristics and texture. The goal of this research can be reached via detailed investigation of texture evolution during recrystallization by various analytical techniques such as orientation imaging microscopy, indentation techniques and investigation of mechanical properties, which will enable the modeling of plastic anisotropy in the investigated alloys.

Subjects Registered

Courses	Remark / Grade
Analytical Electron Microscopy	Excellent/ 5
Lattice defects 1	Excellent/5

Research activities:

- Literature review on recrystallization phenomena in materials with FCC crystal structure.
- Literature review on texture evolution in metallic materials

On the basis of literature review the project work has been planned as following:

Aluminum Alloys 1050 (almost pure Al) and 6083 are taken into consideration. Initial texture thickness will be calculated and various reduction, as well as strain work, will be performed (symmetric rolling & asymmetric rolling). Kinetics of recrystallization will be observed in terms of Avrami Equation. Apart from that continuous and discontinuous recrystallization will be observed and rolling textures will be detected. Hence the project aims to define optimal thermomechanical parameters for best texture in favor of the lightweight application of aluminum alloys.