Title: Physical properties of ultrafine-grained magnesium based alloys prepared by various severe plastic deformation techniques

Author: Jitka Stráská

Department / Institute: Department of Physics of Materials

Supervisor of the doctoral thesis: Doc. RNDr. Miloš Janeček, CSc.

Abstract:

The objective of the doctoral thesis is the complex investigation of ultrafine-grained magnesium alloy AZ31 prepared by two different severe plastic deformation techniques, in particular the hot extrusion followed by equal-channel angular pressing (EX-ECAP) and high pressure torsion (HPT). These severe plastic deformation methods, and as well as many others, are described in detail in the introductory theoretical section. Experimental results are summarized in the following experimental part of the thesis. Mechanical properties, lattice defect structure and especially microstructure were investigated using various experimental techniques. Thermal stability of ultrafine-grained microstructure of AZ31 after EX-ECAP was investigated and the activation energies for grain growth in different temperature ranges were calculated using kinetic equation for grain growth and Arrhenius equation. Results from the dislocation density measurements proved temperature ranges of the recovery and the following grain growth. Results from the grain size measurements verified the validity of well-known Hall-Petch equation. The efficiency of two investigated severe plastic deformation methods is also discussed in detail. HPT proved to be more effective method of grain refinement of AZ31 alloy resulting in significantly higher values of microhardness and dislocation densities.

Keywords: Ultrafine-grained (UFG) materials; magnesium alloys; severe plastic deformation (SPD) techniques; equivalent imposed strain; microstructure evolution.