

Abstract: The objective of the thesis is the study of microstructure evolution, mechanical properties, defect structure and corrosion resistance of ultra-fine grained magnesium alloy AZ31 prepared by a combined two-step process: the extrusion and the equal-channel angular pressing (ECAP). The microstructure development was studied using light and transmission electron microscopy and electron backscatter diffraction (EBSD). Mechanical properties were studied by microhardness measurement and tensile tests and the defect structure by positron annihilation spectroscopy (PAS).

The results of tensile tests indicates that the characteristic stress  $\sigma_{0.2}$  increases slightly with increasing number of ECAP passes only to the second pass and then decreases significantly with additional ECAP straining. This behaviour is in accordance with the results of PAS. EBSD measurements show that the microstructure of extruded and ECAPed material has a bimodal distribution of grain sizes. The bimodal distribution becomes homogeneous with increasing number of ECAP passes and no remaining large grains are observed after 8 passes. The average grain size in the specimen after 8 passes is in the submicrometer range and the fraction of high-angle grain boundary (HAGB) is approximately 80%. The extruded specimens after 8 ECAP passes show the best corrosion resistance from all investigated samples mainly due to its homogenous microstructure and a low density of microcracks in ECAPed specimens.