

Title: Effect of composition and microstructure on mechanical and corrosion properties in magnesium alloys with a potential for medical applications.

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Abstract: Doctoral thesis is focused on the effect of thermomechanical processing through ECAP on the microstructure, mechanical properties and corrosion properties. The investigation was performed on the extruded magnesium alloys AE21, AE42 and LAE442, because their potential for medical applications. Microstructure development was characterized in detail by scanning electron microscopy together with detection of back scattered electrons, transmission electron microscopy and positron annihilation spectroscopy. Development of mechanical properties was investigated by tensile and compression deformation tests and microhardness measurement. Corrosion resistance was investigated by linear polarization method.

Fine-grain structure with grain boundaries with high angle misorientation was achieved by the thermomechanical processing. The resulting average grain size was $\sim 1.5 \mu\text{m}$ in all three alloys. Processing also led to significant change of texture, defined by channel parameters. Mechanical properties were substantially affected by resulting microstructure (grain size and texture). Pronounced decrease of yield strength due to texture evolution was measured in AE21 and AE42 alloy despite significant grain refinement. Texture evolution in LAE442 alloy was not so pronounced and therefore decrease of yield strength was not measured. Dependence of microhardness on grain size followed Hall-Petch relation. Moreover, in LAE442 a significant effect of dislocation density on hardening was found. Processing through ECAP had almost no effect on the corrosion properties of AE21 alloy; however increase of corrosion resistance in AE42 and LAE442 alloys was measured. It is considered that better spatial distribution of alloying elements in the matrix had major influence on the increase of corrosion resistance in these two alloys.

Keywords: magnesium, ECAP, texture, mechanical properties, corrosion