

Title: Magnesium alloys designed for medical applications

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**Abstract:** This Master thesis is focused on the influence of hot extrusion and equal channel angular pressing (ECAP) on the microstructure, mechanical and corrosion properties of magnesium alloys. Investigated materials include three magnesium alloys with the addition of neodymium and/or yttrium elements - N3, W3 and WN43, as a potential material for medical applications. Moreover, the influence of alloying elements in solid solution state was studied. Microstructure development was characterized by scanning electron microscopy together with transmission electron microscopy and X-ray diffraction. Mechanical properties was studied by compression deformation tests in two perpendicular directions and by microhardness tests. The linear polarization method was used to study corrosion resistance.

The processing though ECAP resulted in grain refinement in all three alloys. Ultra-fine grained microstructure was achieved in W3 and WN43 alloy. The high degree of recrystallization during ECAP caused the formation of high-angle grain boundaries in all three alloys. Weak texture evolution was maintained during both processings. A different initial fraction of intermetallic phases before extrusion led to significant changes of microstructure after further processing; nevertheless, the final microstructure after ECAP does not depend on initial microstructure of WN43 alloy. The mechanical properties were substantially affected by the resulting microstructure, mainly grain size and the amount of alloying elements. Thus, the measured yield strength and ultimate strength increased significantly after ECAP processing together with microhardness. The relatively high amount of impurities (iron) in all three alloys probably influenced the corrosion resistance of the solid solution samples. The processing through ECAP had almost no or very slightly negative effect on the corrosion resistance of N3 and WN43 alloys; however, the increase of corrosion resistance of W3 alloy after ECAP was measured. We assume that the presence of intermetallic phases in the magnesium matrix in N3 and WN43 had negative effect on initial corrosion attack compared to W3 alloy, where only very small fraction of these phases was observed.