Title: Microstructure stability and resulting mechanical properties of a low-alloyed Mg-Zn-Gd alloy prepared by rapid solidification

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Abstract:

In this work, the thermal stability of the microstructure and the resulting mechanical properties of the low-alloyed Mg-0.56Zn-1.5Gd (at.%) alloy prepared by the rapidly solidified ribbon consolidation technique were studied. Scanning and transmission microscopy were used to characterise the microstructure in the initial state and after annealing for 2 h at various temperatures between 300 and 500 °C. The initial microstructure consists of small recrystallised grains with an average size of 550 nm and large non-recrystallised grains. Moreover, the processing technique applied to the low-alloyed Mg alloy resulted in the formation of solute-enriched stacking faults (SFs), cluster-arranged layers, and cluster-arranged nano-plates, homogeneously distributed in the grain's interior. The microstructure of the alloy remains unchanged during heat treatment up to 350 °C, and with further increase in temperature, grain growth and redistribution of the solute-enriched SFs take place. The changes in the mechanical performance of the material, revealed by microhardness measurements and uniaxial tensile and deformation loading, were addressed with respect to the evolution of the microstructure. It was revealed that annealing up to 350 °C leads only to a minor decrease in the mechanical properties.