Texture formation during thermomechanical processing of biocompatible Mg-Li-Y alloys

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Abstract

The topic of biocompatible magnesium alloys has recently attracted significant attention due to their potential use in manufacturing of temporary orthopedic implants. This is due to the human bone-like modulus of elasticity and the potential for controlled *in vivo* degradation of these alloys, both of which are highly desirable properties for the proposed application.
However, in order to fulfill the intended load-bearing role, there are severe requirements on the mechanical performance of the utilized alloys (given the intrinsically small scale of such implants). The mechanical properties of magnesium can be enhanced by a suitable combination of alloying elements and thermomechanical processing, leading to enhanced strength and ductility.

The resulting mechanical behavior is largely determined by the texture arising from this thermomechanical processing. Understanding the mechanisms leading to its formation together with the influence of alloying elements, both individually and in combination, therefore enables optimalization of the performance of the material.
In this study we examined the microstructure and texture of several biocompatible ternary alloys of the Mg-Li-Y system, both in the single-phase hcp and dual-phase hcp + bcc compositions (as determined by the concentration of Li) after processing by hot extrusion and equal channel angular pressing (ECAP). The microstructure was observed by electron backscattered diffraction (EBSD), while the texture was evaluated based on X-ray diffraction measurements providing statistically relevant datasets. The key influences of the individual alloying elements and the effects of processing routes and conditions were identified, thus enabling the explanation of the mechanisms leading to the observed resulting texture.

Keywords: Magnesium, Lithium, Yttrium, DRX, Extrusion, ECAP

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