MAGNETICALLY CONTROLLED TEXTURE DEVELOPMENT DURING GRAIN GROWTH IN COMMERCIALLY PURE TITANIUM

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Introduction

Owing to the orientation dependence of the magnetic susceptibility the magnetic energy density in a magnetic field varies with crystal orientation. The gradient of the magnetic free energy across the grain boundary generates a driving force for grain boundary motion. Experimental observations of grain boundary motion in Bi [1] and Zn [2,3] caused by a magnetic field indicated the possibility to change the microstructure development in magnetically anisotropic non-ferromagnetic material by means of magnetic annealing, as demonstrated in the current experiment in terms of grain growth in titanium.

Results

Cold rolled (75%) titanium sheet specimens were annealed at 750°C in the field of 17 Tesla during 1, 2, 3 and 4 hours. The reference specimens were annealed at 750°C for the same time without any magnetic field. Crystallographic texture was determined by X-ray diffraction in the mid-layer of the sheet before and after annealing.

Annealing out of magnetic field results in a two-component texture. If annealing occurs in a field and if the sample is tilted with respect to the field the one texture component can be additionally favored for growth that results in a significant difference between usually symmetrical texture peaks (Fig. 1).

Correspondingly, texture evolution during grain growth in titanium can be effectively influenced and therefore tailored according to needs.

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References