Texture evolution of Ti-Zr-Nb alloy under high-temperature deformation

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Abstract

In this study, the texture evolution of Ti-46Zr-8Nb (mol%) alloy which is the b-type Ti alloy was investigated during high-temperature uniaxial compression in various deformation conditions. Uniaxial compression tests were carried out at various temperatures ranging from 473 K to 1473 K with true strain rates from 1 × 10-2 to 1 × 10-4 s-1 up to a true strain from -0.8 to -1.5. The work-softening type true stress–true strain curves were observed in the deformation conditions where the temperature was higher than 873 K. The flow stress reaches a maximum at an early stage of deformation and then decreases with further deformation. The steep increase and subsequent decrease in stress could be seen. When the conditions were lower than 873 K, work-hardening type true stress-true strain curves were detected. Microstructure after high-temperature deformation indicates undulation of the grain boundary due to the grain boundary migration. In addition, it seems that the degree of the grain boundary undulation during grain boundary migration increases with the increase in compressive strain during high-temperature deformation. Grains having {001} orientation parallel to the compression plane show larger grain size compared to the grains having other orientations. The main component of the texture was {001} which indicates the formation of {001} fiber texture in the deformation conditions in which the temperature was higher than 873 K. It is reported that grains having a small Taylor factor and a stable orientation for a given deformation mode grow preferentially. This grain growth behavior is so-called preferential dynamic grain growth. Characteristics of the microstructure development, grain boundary migration and undulation, and the formed texture shown above in our research are considered due to the occurrence of the preferential dynamic grain growth.

Keywords: beta type Ti alloy, high temperature deformation, texture, orientation control, preferential dynamic grain growth

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