Microstructure evolution during hot deformation of newly developed 30Nb5Ta30Ti15V20Zr high entropy alloy

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Abstract

In recent, a newly developed single BCC phase 30Nb5Ta30Ti15V20Zr refractory high entropy alloy has been reported to superior fretting wear resistance, in a comparison with Ti6Al4V. However, Ti alloys including Ti6Al4V are widely used for aviation fasteners; however, their performance is often restricted by their poor fretting wear resistance. The 30Nb5Ta30Ti15V20Zr alloy is designed for elevated temperature applications; furthermore, hot deformation is an important processing route to fabricate materials for desired shape. Therefore, in this study, hot deformation behavior and microstructure evolution mechanisms in the 30Nb5Ta30Ti15V20Zr alloy was studied via uniaxial compression up to a true strain of –1.0 at between 1273 – 1573 K under 0.01 - 0.0001 s-1 of a true strain rate. All true stress-strain curve demonstrated work-softening type due to dynamic recrystallization. At lower deformation temperatures of 1273 K and 1373 K, partial dynamic recrystallizations were observed with the necklace-like structure. At higher deformation temperatures of 1473 K and 1573 K, the microstructures were fully recrystallized. The recrystallized grain size typically increased with higher temperature and lower strain rate. At room temperature compression, the double and fiber texture was developed. During hot deformation at higher temperature of 1473 K and 1573 K, the fiber texture was dominant with a significant drop of volume fraction. The transition of the texture from to is expected to be resulted by the preferential dynamic grain growth (PDGG) of texture due to minimum Taylor factor.

Keywords: High entropy alloys, Hot deformation, Microstructure, Crystallographic texture

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