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An EBSD Investigation of Ti-6Al-4Nb Alloy Processed by Plan Strain Compression Test

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Abstract : Near α titanium alloys are important materials for aerospace applications, especially in high temperature applications such as jet engine. Mechanical properties of Ti alloys strongly depends on their processing route, then it is very important to understand micro-structure change by different processing. In our previous study, Nb was found to improve oxidation resistance of Ti alloys. In this study, micro-structure evolution of Ti-6Al-4Nb (wt %) alloy was investigated after plain strain compression test in hot working temperatures in the α and β phase region. High-resolution EBSD was successfully used for precise phase and texture characterization of this alloy. 1.1 kg of Ti-6Al-4Nb ingot was prepared using cold crucible levitation melting. The ingot was subsequently homogenized in 1050 deg.C for 1h followed by cooling in the air. Plate like specimens measuring 10×20×50 mm3 were cut from an ingot by electrical discharge machining (EDM). The plain strain compression test using an anvil with 10 x 35 mm in size was performed with 3 different strain rates: 0.1s-1, 1s-1and 10s-1 in 700 deg.C and 1050 deg.C to obtain 75% of deformation. The micro-structure was investigated by scanning electron microscopy (SEM) equipped with electron backscatter diffraction (EBSD) detector. The α/β phase ratio and phase morphology as well as the crystallographic texture, subgrain size, misorientation angles and misorientation gradients corresponding to each phase were determined over the middle and the edge of sample areas. The deformation mechanism in each working temperature was discussed. The evolution of texture changes with strain rate was investigated. The micro-structure obtained by plain strain compression test was heterogeneous with a wide range of grain sizes. This is because deformation and dynamic recrystallization occurred during deformation at temperature in the α and β phase. It was strongly influenced by strain rate.

Keywords : EBSD, plain strain compression test, Ti alloys
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