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Texture and microstructure evolution of TNM alloy during hot compression

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Owing to low density (3.8-4.0g/cm3), high specific strength and stiffness, excellent creep resistance, and good corrosion resistance, the β-solidifying TNM alloys with properly aligned (α2+γ) lamellar structure have been considered as excellent candidates for modern turbine blades. Recently, it has been evidenced that when the γ lamellae are oriented to the load direction the mechanical properties of the alloys can be greatly increased, thus, lamella orientation control has become an interesting topic for property optimization.
In the present work, the microstructure and texture of a TNM alloy (Ti-43Al-4Nb-1Mo-0.1B (at%) hot compressed to different strains at various strain rates were characterized by synchrotron radiation diffraction at a macroscopic scale to obtain the bulk texture information and by SEM EBSD at mesoscopic scale to analyze with respect to the orientation relationships and microstructure stability. Results have shown that the microstructure at the initial state was composed of grains from three different phases, BCC β phase, hexagonal α phase and tetragonal γ phase. After the uniaxial compressive hot deformation at 1280℃ to different deformations at different strain rates, it seems that (1) the microstructure changed and the α to lamellar (α+γ) was inhibited with the increase of the strain rate. The microstructure became mainly composed of the alpha phase. (2) All three phases can be textured. For each phase, a different texture was obtained and the change of microstructure was revealed in details thanks to the complementary characterization methods.
In conclusion, texturization of the TNM alloy seems to be possible thanks to the hot compression. It leads to different types of microstructures depending on the amount of deformation and the strain rates as well as the used temperature.

Keywords : TNM TiAl alloy, texture, microstructure, synchrotron radiation diffraction, SEM-EBSD

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