The Relative Importance of Deformation and Phase Transformation on the Macrotexture and Microtexture of Hot Rolled Ti-6Al-4V

Xiaohan Zeng*[1], Christopher Daniel[2], Philip Prangnell[1], and João Quinta Da Fonseca[1]

[1]School of Natural Sciences, The University of Manchester – United Kingdom
[2]Jacobs – United Kingdom

Abstract

Ti-6Al-4V is a dual-phase titanium alloy which commonly undergoes thermomechanical processing in the alpha+beta processing regime. During hot rolling, the more common alpha phase in this material usually develops a characteristic 0002//TD alignment, and large zones of strong microtexture, often called macrozones. The development of this texture component has been attributed to deformation but also phase transformation on cooling from the working temperature. However, it is often challenging to separate the primary alpha and secondary alpha phases, especially in as-deformed, unrecystallized material. Therefore, it remains unclear how the primary alpha and secondary alpha contribute to the overall texture, and how this changes with the amount of deformation and working temperature. In this work, a series of hot rolling experiments were carried out to understand the texture evolution with temperature, using EBSD to analyse the primary and secondary alpha phase textures separately. Results showed that the material exhibited the strongest 0002//TD alignment when rolled at 895℃ to 87.5% reduction. This alignment was stronger in the primary alpha phase. The increase of 0002//TD intensity with reduction suggests this alignment developed through deformation. On the other hand, the secondary α phase exhibits a stronger 0002//RD alignment that results from phase transformation. Nevertheless, some 0002//TD alignment is also seen in the secondary alpha. Further investigation revealed that the secondary alpha phase in the 0002//TD macrozone undergoes epitaxial nucleation on the primary alpha boundaries, exhibiting a similar 0002 alignment but a different prismatic alignment. This study advances our understanding of the intricate texture development in Ti-6Al-4V and provides valuable insights into the distinct roles played by deformation and phase transformation during hot deformation.

Keywords: Deformation, Phase transformation, Microtexture, Rolling, Ti64

*Speaker