Deformation induced phase transformations in γ-TiAl alloy under high-temperature compression.

Mohamed Keita*[1,2], Cecilia Solis[2], Weimin Gan[2], Yudong Zhang[1], Jean-Francois Moulin[2], and Emmanuel Bouzy[1]

[1]Laboratoire dÉtude des Microstructures et de Mécanique des Matériaux – Université de Lorraine, Centre National de la Recherche Scientifique, Arts et Métiers Sciences et Technologies, Centre National de la Recherche Scientifique : UMR7239 – France

[2]Helmholtz- Zentrum Hereon – Germany

Abstract

Usually, the TNM alloys are composed of only α and β in the $\alpha + \beta$ phase region, for example at 1280∘C. However, the thermodynamically stable phases could be destabilized when plastic deformation is introduced. Thus, in this work, we performed a uniaxial compression at 1280∘C with a strain rate of 10-2 s-1 to a thickness reduction of 40 %. The deformation process was inspected in-situ under High-Energy X-ray Diffraction (HEXRD) (at DESY, Hamburg, Germany) in the macroscopic scale and the resultant microstructure was analyzed by SEM-EBSD (at LEM3, Metz, France). The in-situ HEXRD measurement revealed that from about 30% reduction the diffraction peaks of the γ phase started to appear and the intensities continuously increased with the deformation, demonstrating deformation induced phase transformation. The SEM-EBSD measurements uncovered that the γ phase was precipitated not only in the α phase but also in the β phase, and in most cases the precipitates are in lamellar shape. Further crystallographic and microstructural analyses showed that the β to γ transformation is primarily intragranular and follows the K-S orientation relationship. In contrast, the α to γ transformation occurs both intergranularly and intragranularly, adhering to the Blackburn orientation relationship in the latter case.

Keywords: TiAl, Beta, Gamma, TNM, EBSD, HEXRD

*Speaker