ICSMA19 Metz, France, June 26 - July 1, 2022
International Conference on Strength of Materials

Crack initiation at basal twist boundaries in Ti-6Al-4V subjected to cold dwell-fatigue, low-cycle fatigue and high-cycle fatigue loadings

Cyril Lavogiez[a], Patrick Villechaise[a], Clément Dureau[a,b,c], Yves Nadot[a], Samuel Hemery[a]

[a] *Institut Pprime, ISAE-ENSMA, Université de Poitiers, CNRS UPR 3346, Téléport 2, 1 avenue Clément Ader, BP 40109, Futuroscope-Chasseneuil Cedex, 86961, France*

[b] *LABoratoire d'EXcellence Design des Alliages Métalliques pour Allègement de Structures, Université de Lorraine, 7 rue Félix Savart, 57073 Metz, France*

[c] *Laboratoire d'Etude des Microstructures et de Mécanique des Matériaux, Université de Lorraine, CNRS UMR 7239, 7 rue Félix Savart, 57073 Metz, France*

[a]*samuel.hemery@ensma.fr*

Titanium alloys are widely employed in the aerospace industry. The operation of aircrafts implies that components generally are subjected to cyclic mechanical loadings. Accurate fatigue lifetime prediction capabilities are then needed, alongside a proper understanding of mechanisms governing the different stages of fatigue failures. In particular, the crack nucleation stage has received a lot of interest over the past decades. Overviews of existing literature reveal that multiple crack formation mechanisms have been reported and conditions favoring with each mechanism are not clear yet. In the present study we have attempted at providing a unified view of room temperature crack nucleation processes in Ti-6Al-4V for different loading conditions including dwell-fatigue, low-cycle fatigue and high-cycle fatigue. In addition to uniaxial fatigue, bending fatigue was also considered. Advanced characterization of crack initiation sites was performed using electron microscopy based techniques. The reported findings suggest that a unique mechanism operates and key microstructural configurations are described.

Keywords: Fatigue, dwell-fatigue, titanium alloys, grain boundaries, crack initiation.

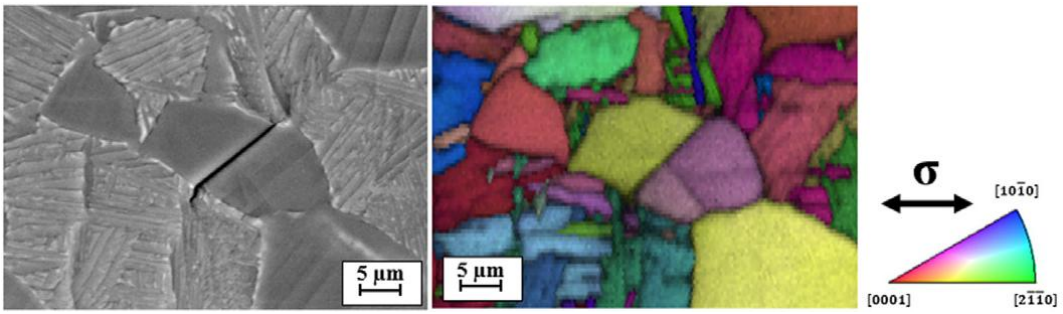

Fig.1 SEM micrograph and crystallographic orientations at a fatigue crack initiation site