3D Analysis of Short Fatigue Crack Propagation in a Beta Ti alloy: Effect of the Local Crystallographic Orientation

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The influence of local crystallographic orientation on the propagation of short fatigue cracks in a metastable beta Ti alloy was studied in three dimensions by combining different synchrotron based characterisation methods.
First, the recently developed diffraction contrast tomography technique (DCT) [1] was used to determine the orientation and shape of the grains (approximately 100 grains) forming the gauge volume of a fatigue sample, containing an artificial crack nucleation site (FIB notch). Next, fatigue crack initiation and propagation through the sample were monitored in-situ by tomography [2]. Local crack configuration corresponding to the crossing of grain boundaries were analysed systematically as a function of the local grain shapes and their crystallographic orientations and compared to existing models in the litterature.

[1] Ludwig et al, J. Applied Crystallography (2008). 41, 302-309
[2] Ferrie et al, Acta Materialia (2006). 54, 1111–1122