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Elastic properties of the α' martensite in Ti-6Al-4V alloy processed by powder bed-laser beam melting

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In additive manufacturing processes like Laser Beam Melting (LBM) high thermal gradients are generated, inducing residual stresses (RS) within the parts that lead to deformations and in worst cases cracks. In order to quantify such RS, the knowledge of the elastic properties of materials is essential. The elastic behaviour of Ti-6Al-4V alloy elaborated through LBM process is studied both experimentally and trough atomistic simulation [1]. By studying the rough samples after fabrication and after heat treatment, the elastic properties of the α' martensitic phase is compared to that of α+β microstructure from a global point of view (tensile and vibration experiments). The X-ray elastic constants were also measured through *in-situ* tensile testing under synchrotron radiations [2]. Atomistic calculations were also performed on various super-cells varying their chemical composition in order to simulate α and α' phases and their full elastic stiffness tensors were determined. Both experimental and simulation results show that the α' phase is softer than the α phase, while it presents a more anisotropic elastic behaviour.

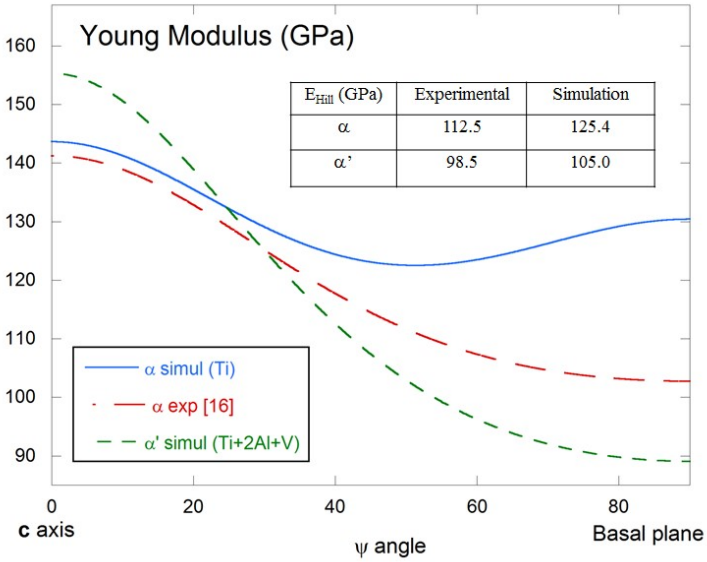

Fig.1: Variation of the elastic properties in α‘ and α.

Keywords: Ti64, martensite, X-ray elastic constants, elasticity, anisotropy, additive manufacturing.

References:

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[2] N. Dumontet, G. Geandier, F. Galliano, B. Viguier, B. Malard, Determination of the X-Ray Elastic Constants of the Ti-6Al-4V Processed by Powder Bed-Laser Beam Melting, Materials Research Proceedings, Vol. 6, pp. 289-294, 2018.