On the fatigue notch sensitivity of Ti6Al4V specimens with α+β microstructure produced by laser powder bed fusion

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Abstract

Laser powder bed fusion (L-PBF) is an additive manufacturing (AM) process which offers several advantages over conventional manufacturing techniques, including material savings and design possibilities. For these reasons several industrial sectors such as biomedical, aerospace and automotive, are considering L-PBF for customized parts production. Among the processable material palette, Ti6Al4V gained increasing interest due to the high specific strength, and stiffness, and excellent bio-compatibility, and corrosion resistance. However, to include L-PBF Ti6Al4V parts in load bearing applications it is important to properly understand the mechanical properties of AM'ed materials with a specific focus on fatigue behaviour. In this study the fatigue notch sensitivity of Ti6Al4V L-PBF manufactured specimens is investigated in depth. Samples with different notches were subjected to stress relieving heat treatment to generate a fine α+β microstructure. The results were used to define a relation between the perturbed stress field generated by the geometrical discontinuity, the microstructure size and the notch sensitivity. Moreover, the critical distance has been calculated using the theory of critical distance formulated with the line method (LM). The estimated value were adopted to predict fatigue properties of notched components with different notch radii.

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