Fatigue strength of PBF-LB/M and wrought 316L stainless steel: effect of post treatment and cyclic mean stress

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Abstract

Additive manufacturing (AM) enables the cost-effective production of complex components, many of which are traditionally manufactured using costly production steps among other processes. One widely applied AM process is Laser-based Powder Bed Fusion of Metals (PBF-LB/M); however, internal pores and rough surfaces are typically inevitable with PBF-LB/M, reducing fatigue and corrosion resistance compared to traditional processes involving turning and milling. Additionally, large defects often occur near to or just at the surfaces. Thus, this study investigates the effect of hybrid additive and subtractive manufacturing on the fatigue strength of AISI 316L. For this purpose, different post treatment routes are compared with wrought material. Additionally, computer tomography is used to determine the necessary machining depth of the surface layer. In this study, heat-treatment and machining are both found to significantly increase fatigue strength. Finally, cyclic mean stresses affect wrought and AM specimens differently.

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