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Static and total life fatigue behaviour of 7075 aluminium alloy produced by laser powder bed fusion

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One of the main drawbacks of Laser Powder Bed Fusion (L-PBF) is the limited material palette currently available and the often poor fatigue performance of the resulting parts. The production of parts using high-strength 7xxx aluminium alloys with the L-PBF technology is not yet well controlled and therefore not yet available for the aerospace industry. In this study, ZrH_2 addition to Al7075 powder allows obtaining nearly fully dense parts (99.9%) without hot cracking. Afterwards, an optimised heat treatment (HT) is applied to this alloy to enhance its mechanical performances and reach a yield strength of 515MPa. The influence of each microstructural feature on this high yield strength is analysed in detail. Furthermore, the effect of this HT on the total life in fatigue was assessed. Finally, friction stir processing is applied as a post-treatment to supress residual porosities and modify the fatigue behaviour of the alloy.