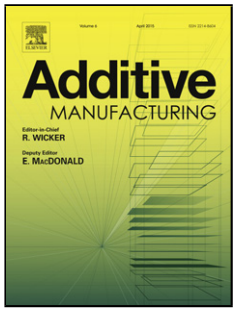

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Influence of layer thickness and post-process treatments on the fatigue properties of CoCr scaffolds produced by laser powder bed fusion

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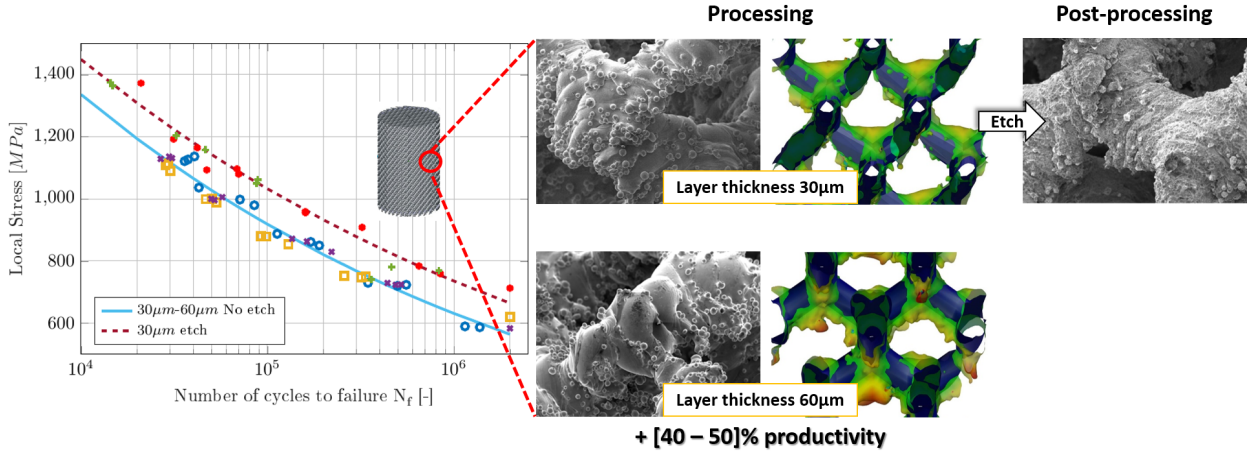
Abstract

Over the last years, additive manufacturing (AM) techniques such as laser powder bed fusion (L-PBF) have been frequently adopted for efficiently producing biomedical implants. L-PBF offers the advantage of low material waste and high accuracy enabling the production of complex and highly personalized geometries. However, when manufacturing time is considered, the L-PBF production rate is relatively low compared to conventional production techniques. The aim of this paper is to present the impact of layer thickness on static and fatigue properties of CoCr scaffolds produced by means of L-PBF. An increased layer thickness (from 30μm to 60μm) leads to an improvement in terms of production rate of 40 to 50% without affecting the final geometry of the structure. A fatigue test campaign was conducted on both 30μm and 60μm layer thickness samples in "as-built" condition. The analysis of the test results with a local stress method highlighted no significant differences in terms of fatigue performances. In addition, the effect of post-process treatments, such as hot isostatic pressing (HIP) and chemical etching on static and fatigue properties were investigated. It is shown that HIP does not affect the fatigue properties of the scaffolds whilst chemical etching is capable of improving fatigue resistance when the local stress approach is considered.



Keywords: laser powder bed fusion, CoCr, fatigue, layer thickness, (increased) productivity

1. Introduction

With their excellent biocompatibility and high resistance to corrosion and wear, CoCr alloys are extensively used for biomaterial applications, such as orthopedic implants and dental devices [1]. When considering such biomedical

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