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Abstract:

Metal additive manufacturing (AM) techniques are promising to manufacture complex parts in demanding sectors (e.g. automotive, aircraft or aerospace). However, the fatigue properties of components must be assessed and depend on the residual stress (RS) field in the built material. Up to now, there is a need in literature for data about the RS of metal powder bed AM processes.

The paper presents the analysis of the RS on samples manufactured using two different technologies: Selective laser melting (SLM) and electron beam melting (EBM). The crack compliance method is used to deduce the residual stresses in a sample by monitoring the strain variation while opening a crack along the depth of a part. A good reproducibility is observed while comparing samples manufactured with the same process conditions.

A comparison is made between samples made with the same alloy using both AM techniques (Titanium alloy (Ti6Al4V) obtained by EBM and SLM). Then SLM samples are observed and the effect of the material (titanium alloy and aluminium alloy) and preheating for the fabrication of SLM samples is analysed.