Joint Special Interest Group meeting between euspen and ASPE
Dimensional Accuracy and Surface Finish in Additive Manufacturing,
KU Leuven, BE, October 2017
www.euspen.eu

Geometrical design and assessment of an industrially relevant benchmark part for selective laser melting

Stijn Schoeters[1], Karolien Kempen[1], Ann Witvrouw[1], Wim Dewulf[1], Brecht Van Hooreweder[1], Jean-Pierre Kruth[1]

[1]KU Leuven, Department of Mechanical Engineering, Leuven, Belgium
Member of Virtual Department 3 of Flanders Make, Leuven, Flanders, Belgium

stijn.schoeters@kuleuven.be

Abstract

Compared to conventional machining, Additive Manufacturing (AM) still faces challenges with respect to the achievable geometrical and dimensional accuracy, surface topology and the resolution of small features. Benchmark parts are a well-known practice to qualify the process capabilities. Several benchmark parts, specific to Additive Manufacturing have already been proposed, some of which are described in literature. However, the available Additive Manufacturing benchmark parts don't comprise all the features that an industrial consortium involved in a "Flanders Make" project (Flanders, Belgium) considered necessary. Therefore, the NIST benchmark part for AM (2013) is adapted considering features from use cases of this industrial consortium. Subsequently, a comparison is made between several build jobs of the proposed benchmark part by Selective Laser Melting (SLM) of Stainless Steel 316L using four different SLM machines of different manufacturers. The geometrical features were measured using a tactile probing CMM, tactile surface profilometer, optical microscopy and X-Ray CT. These measurements results were then used to quantify roughness, dimensional and geometric deviations of small features like small pins and holes ranging from 50µm to 2 mm in dimensions, as well as of other larger features. Also the effect of both top- and bottom-facing sloping surfaces was investigated as these are a known difficulty for powder bed based AM techniques. The results of this study allow for assessing the current state-of practice in industry, and for formulating advice regarding optimization of part design for AM and regarding possible process alterations.