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Evaluation of the influence of post-processing on the optical inspection accuracy of additively manufactured parts

S Giganto[1*], S Martínez[1], J Barreiro[1] and E Cuesta[2]

[1] Department of Manufacturing Engineering, University of León, Campus de Vegazana, 24071 León, Spain
[2] Department of Construction and Manufacturing Engineering, University of Oviedo, Campus de Gijón, 33204 Gijón, Spain

*Corresponding author: sgigf@unileon.es

Abstract: Optical measurement systems are important techniques for rapid inspecting additively manufactured parts by techniques such as selective laser melting (SLM). Depending on their application, SLM parts require post-processes such as sandblasting or heat treatment, commonly applied in order to improve their surface finish or mechanical properties, respectively. These post-processes modify the parts surface characteristics, and therefore the suitability for optical inspection. This work evaluates the influence of these SLM post-processes on optical inspection. For this, a test part, manufactured in 17-4PH stainless steel using a 3DSystems ProX100 machine, was optically measured using a structured light scanner and compared to the values obtained from contact measurements (reference values). Both optical and contact measurements were performed under three conditions: as-built, post sandblasting, and post sandblasting and subsequent heat treatment. The analysis results show that applying the sandblasting post-processing provides a surface finish to the SLM parts suitable for optical inspection. This post-process allows precise inspection of this type of parts, reaching values close to those obtained by contact. Likewise, it is concluded that the used structured blue-light scanner is suitable for inspecting SLM parts.

Keywords: Accuracy, Additive manufacturing (AM), Non-contact inspection, Post-processes, Structured light scanner.

1. Introduction

Among other additive manufacturing (AM) techniques based on powder bed fusion (PBF), selective laser melting (SLM) stands out for its ability to create functional and high-complex metal parts of great interest to several sectors such as aerospace, medical or automotive, among others. In these sectors geometrical and dimensional accuracy is a critical factor.

Optical measurement systems play an important role in inspecting parts obtained by AM processes, as they allow the creation of dense point clouds in very short times, characterized as rapid inspection systems. In addition, the free form shapes and complex geometries typical of AM parts convert them into evident targets to verify using non-contact measurement systems. Nevertheless, for these inspection techniques to be extended, the accuracy that can be reached from the metrological point of view still needs to be determined. The evaluation of these non-contact inspection systems depends not only on the materials, surface finishes, lighting, etc. [1] but also on the technology used by the optical sensor [2].