

Abstract

Efficient parameter optimization in additive manufacturing – A systematic study on AlSi₁₀Mg in laser powder bed fusion

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Metal additive manufacturing (AM) has become increasingly important in the lightweight construction of complex components in the automotive and aerospace industries as well as medicine in recent years [1]. The alloys required for this must be both high-performant and safety-compliant. In order to accelerate the development of new materials for AM and save resources, an efficient material development methodology for qualifying new AM materials is essential. In this context, X-ray testing [2] opens numerous possibilities to replace a comprehensive metallurgical examination and micrograph analysis. Applying X-ray microfocus computed tomography, test specimens are analyzed reproducibly throughout their entire volume so that irregularities within an alloy sample can be reliably detected. In particular, a subsequent pore analysis of the AM material allows us to draw conclusions on the material properties, by classifying the pores and statistically evaluating their size and shape [3,4]. The derived information is compared to micrograph analysis from quality control and combined with complementary data on the samples' mechanical properties. The proposed AM development process is exemplified in a systematic study on an AlSi₁₀Mg alloy in laser powder bed fusion under variation of the laser power and the scan velocity. The resulting AM-parameter resolved datasets [5] allow to draw conclusions on the optimum 3D printing parameters for a specific case at hand – iteratively optimizing the AM process and thus improving the material development efficiency.

AUTHOR'S STATEMENT

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