A new device for the characterization of the powder layer quality in the SLS process

Marco Lupo*[1], Daniele Sofia[1], Diego Barletta[1], and Massimo Poletto†[1]

[1]Universita degli studi di Salerno – Italy

Abstract

Selective laser sintering (SLS) is an additive manufacturing process, by which artefacts with different shapes can be built through a "layer-by-layer" sintering of particulate materials. SLS can be affected by final object defects such as: poor surface resolution, porosity issues, low part density, low strength and lack of structural integrity. The appearance of most of these defects is strictly related to the particle layer thickness and to the possibility of attaining a good distribution of each single layer on the one below. In fact, the higher the particle packing and the layer homogeneity, the better the mechanical properties of the final artefact. Therefore, the powder used in the SLS process should be reduced to a thin and homogeneous layer whose dimensions and quality depend on the delivery method of the powder, as well as on interparticle forces, particle size distribution, particle size and shape. This work focuses on the spreading process, in which the powder is distributed on the previous sintered layer to obtain a new layer to sinter. The aim is to verify whether a certain powder is appropriate to be used in SLS by analyzing the quality of a single layer. Until now, many studies have reported some analysis tools to evaluate the flowability, that is the capacity of the powder to flow in a desired manner in a specific equipment. However, each of them has the limit of not considering the actual state of stress of the powder during the spreading step in SLS. More recent methods have tried to reproduce similar powder flow conditions of the spreading process, but they appear incomplete, inaccurate and cannot be used as a standardised tool for the evaluation of the powder layer quality. Hence the idea to design a new apparatus for the characterization of the quality of the layer. The apparatus has been designed considering the possibility to use different configurations for the powder spreading and compression, to change the layer thickness and to do tests at different temperatures, like those typical in the SLS.

Keywords: SLS, sintering, additive manufacturing, flowability, powder spreading

*Speaker

†Corresponding author: mpoletto@unisa.it