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An experimental study into the effects of bulk and flow behaviour of Laser Sintering polymer powders on resulting part properties

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Abstract

The properties of parts manufactured by Laser Sintering (LS) are, amongst others, influenced by the packing and flow efficiencies of the powders being processed.

In particular, this study investigated the influence of the bulk and flow characteristics of two thermoplastic elastomers, present in three different particle size distributions (PSD), on the resulting part properties. The powder characteristics examined, were the packing and bulk density as well as the flow efficiency of the powder samples. The resulting part properties were evaluated in terms of their mechanical properties (tensile), surface quality and density.

The results helped to validate the basic input from previous studies interconnecting the powder behaviour with the properties of sintered part's. The majority of the components with increased tensile properties were manufactured with powder fractions that showed enhanced bulk density and enriched flowability. The part's surface quality demonstrated a high dependence on the packing and the surface roughness of the raw powder bulk. A strong connection between the packing density of the powder bulk and the porosity of the sintered parts has been revealed for the observed polymers. In contrast to previous studies which have rarely taken into account the characteristics of the un-sintered powder and correlated them to the properties of components fabricated by LS, this work provided a novel approach describing the interconnection between the powder behaviour and the part properties.

Keywords: Bulk and flow behaviour, Powder processing, Laser Sintering, Part properties, Thermoplastic Elastomers.