Laser weldability of polymeric 3D printed parts

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In last years, the awareness in 3D Fusing Deposition Modelling process (FDM) has been arising. This increasing attention is related to a more and more pressing interest from the industries in obtaining easily polymeric 3D printed objects as useful prototyping instruments. Indeed, creating prototypes with this technology leads to a prompt response in terms of processability and properties of the matrix, unlike other plastic processing procedures like injection moulding or extrusion. Furthermore, several industrial fields, such as automotive, aerospace, pharmaceutical, electrical, and electronics can take advantage of 3D printing process in order to create prototyped parts.

Moreover, in all these sectors, post-production processes, such as varnishing, metallization, bonding, or welding are typically used in order to improve not only the aesthetical aspects, but also the mechanical features of the final printed parts. With this purpose, a welding process can be employed as a useful tool to join parts of a single component and, in particular, the laser welding is one of the most suitable treatment for plastic. Nevertheless, specific materials have to be used in order to completely harness this technology: in fact, one of the part has to be transparent to the laser wavelength used for welding, while the other one should have a peak of absorbance closest to the same wavelength. This aspect must be considered, choosing the polymeric material in a prototyping phase.

In this work, 3D parts have been printed with different polymeric matrices. The 3D printed specimens were laser welded and, in order to verify the resistance adhesion of the welded area, were mechanically tested. Finally, the laser welding efficiency has been investigated on samples obtained with different processing technologies (injection moulding and film extrusion) and a comparison with the results of 3D printed samples has been performed.