

Design and manufacture of thin cavities insert for micro injection molding process via stereolithography

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Abstract

Additive Manufacturing (AM) technologies have recently emerged as key technologies to be integrated in current process chains. In particular, AM technologies could be successfully applied for molds and inserts fabrication for small batches production of components and microcomponents. In terms of economy and sustainability, the AM offers several advantages with respect to traditional manufacturing technologies for molds and inserts fabrication, such as waste reduction, minimized energy consumption, reduced cycle time and time to market.

In this work, a thin cavities mold insert was manufactured via inverted (bottom-up) stereolithography (SLA) and tested via micro-injection molding in order to assess the feasibility of the SLA/ μ -IM (Injection Molding) process chain. The designed geometry is composed by four thin cavities: this particular feature represents the actual challenge, due to the large surface to volume ratio that characterizes the sample. Design rules for AM have been applied in order to fulfill injection molding issues and ensure a longer mold insert duration. The mold insert cavities have been characterized to evaluate the achieved dimensional and geometrical precision showing a quite good geometry accuracy in thickness; the mold insert geometrical deviation, which could prevent the correct assembly of the insert into the mold, have been measured too. Finally, a short-series of about 30 molding cycles has been carried out evaluating the capacity of filling the thin cavities and the capability of SLA mold insert.

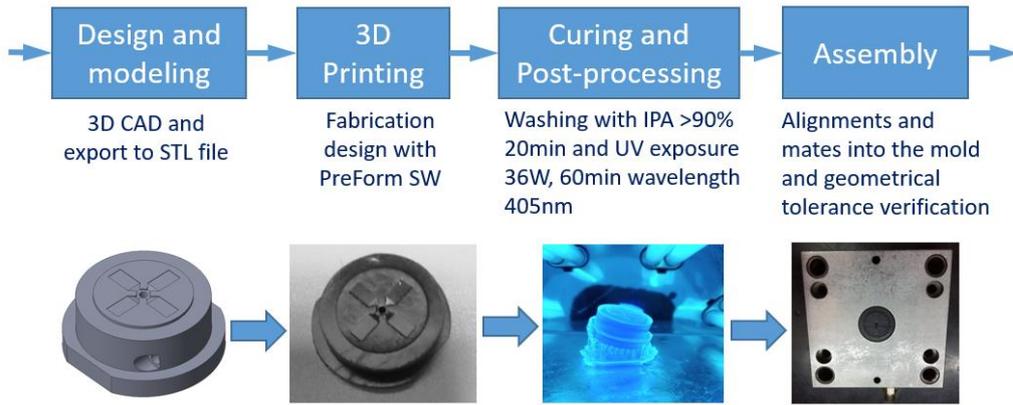


Figure 1: Mold insert fabrication steps

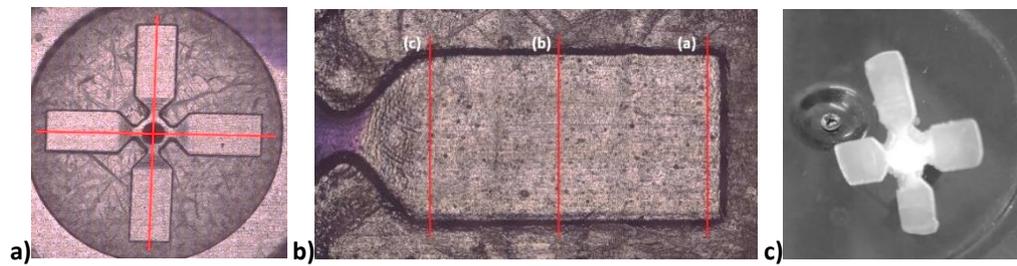


Figure 2. Z-scan acquisition image of the mold insert. Red lines trace scanning directions: a) planarity evaluation; b) Cavity #1; c) example of produced part.