»T(w)oCURE«  
SUPPORT-FREE IN PHOTO-POLYMER 3D PRINTING

Task

Many additive manufacturing processes have a considerable disadvantage: They need support structures (supports), which the user has to plan in the design, to additionally build in the process and then to laboriously remove from the product. This also applies to processes based on photopolymers.

Method

Together with Rapid Shape GmbH, Fraunhofer ILT has developed a hybrid technology in which a liquid photopolymer is solidified chemically by light and thermally by cold. The material is applied while warm and then irreversibly cured by light. At the same time, the cooled space ensures that the layered thermoset component freezes into a block with the waxy, solidified resin. Because two hardening processes are used, the process, still in the development stage, is called »T(w)oCURE«. After printing, the user has access to the components by heating the block slightly, so that the supporting material flows off (Fig. 1). What remains are the 3D-printed components, which are only briefly cleaned and post-cured.

Results

The novel method not only does not require supports, but also enables the components to be positioned without being connected to a construction platform. Three-dimensional objects can be set up anywhere in the installation space. Because the entire installation space is used more efficiently, significantly more parts can now be produced per 3D print job. Furthermore, this procedure makes it possible to run additive manufacturing continuously, thus constituting an initial step towards additive production of polymer parts.

Applications

The new form of plastic 3D printing has been successfully tested on models for the jewelry industry. Until now, the jewelry manufacturers have been producing models with support structures and then removing them with great effort and smoothing the surface. These last two steps are expensive and unnecessary. Due to the new procedure, they can be dispensed with in the future. In addition to lost molds for casting, current development of new materials is addressing functional polymer parts.

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1 Melt of the frozen phases at room temperature and release of the printed structures.  
2 Rings printed with »T(w)oCURE«.