

Hot lithography: 3D printing of components using high-performance plastics

Production of high-precision plastic components with excellent mechanical and thermal properties

There is a whole range of production technologies available in the field of additive manufacturing of plastic components. Until now, plastic components produced using additive manufacturing techniques have rarely been used for anything other than utility models or prototypes. The industrial application of technical or medical components, as well as everyday objects, requires high-quality material properties. Good thermo-mechanical material properties, such as those of thermoplastics (e.g. polypropylene or ABS) are required. At the same time, there are high geometric requirements – particularly relating to surface roughness and precision – which can be met, for example, using injection moulding. This profile usually can not be met by current additive manufacturing processes.

Objective

A spin-off of TU Wien, Cubicure GmbH was founded to tackle the dilemma of 3D printing – mechanically and thermally stressable components with a quality finish and high production accuracy – for industrial applications. The aim was to develop new photopolymers, characterised by high impact strength and heat distortion temperature. In addition, a suitable stereolithography-based printing process was to be developed, to enable the high-precision three-dimensional structuring of these special material systems.

Solution

The basic theoretical considerations for the creation of new photopolymers were discussed at the Institute of Materials Science and Technology at TU Wien, with the mechanisms of plasticisation and ductility of plastics being analysed in de-



Hot Lithography production machine for highly viscous photopolymers

tail. In collaboration with Cubicure, the theoretical molecular structure of the photopolymers was developed, and examined in collaboration with different disciplines from a physical, chemical and production technology perspective.

The optimised molecular structure results in extremely viscous and sticky starting substances, which can not be processed by standard 3D-printing systems. For this reason, and in order to exploit the full potential of these new plastics, Cubicure developed a new stereolithographic printing process: namely, hot lithography.

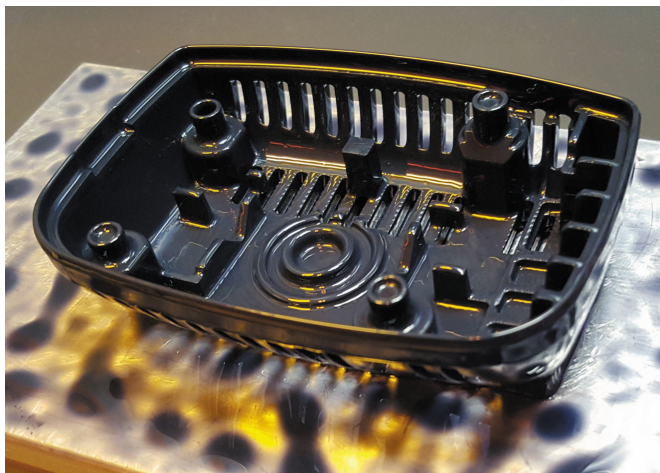
Results

Using new molecular structures, TU Wien and Cubicure were able to significantly increase the ductility of 3D-printed photopolymers (impact strength: 30–120 kJ m⁻²), without having to make any substantial compromises in terms of their strength (tensile strength 35–65 MPa) and heat resistance (HDT [B] 50–75°C).

This combination of properties is very interesting from a technical perspective: only tough plastics are able to plastically break down impact energy, and therefore facilitate non-destructive use in technical assemblies or in other everyday applications.

For the additive processing of these materials, Cubicure has adapted the standard stereolithographic structuring process and enhanced it with a system for the layered processing of highly viscous starting substances. A special coating unit prepares the viscous photopolymers for the actual printing process, at an increased temperature. Particular attention was paid to ensure the heating of the process was selective and fully controlled.

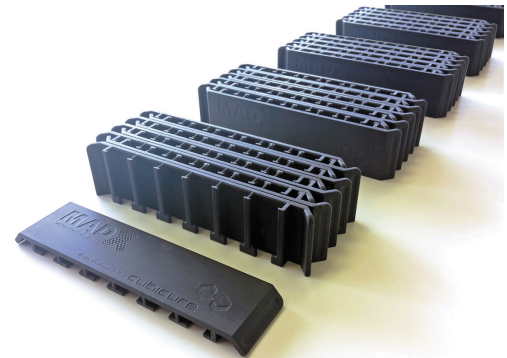
Cubicure is marketing the innovative photopolymers and the new 3D-printing process under the name 'hot lithography'.



Time and cost efficient production of functional prototypes

By combining this technology with the high-quality lighting technology used in stereolithography, hot lithography makes it possible for the first time to process technically relevant plastics in the highest resolution by using an additive manufacturing technology.

Cubicure covers the entire production chain, from material development of suitable photopolymers, to optimisation of machinery and processes development for lithography-based additive manufacturing.



Additive series production of technical polymer components

Benefits for you

Cubicure GmbH supplies: :

- Plastics and 3D printing solutions for industrial production
- High manufacturing precision with outstanding thermo-mechanical material properties

Hot Lithography from Cubicure offers the following advantages:

- Development phase – functional prototyping:
You get a tool for the fast and economical production of functional components, which yields significant time and cost advantages. You gain full product flexibility, which means that there are no tooling or set-up costs.
- Pilot and small-batch production
- Industrial series production:
Particularly for small parts and volumes of several thousand pieces per year an economical alternative to micro injection moulding is offered. You enjoy all the benefits of tool-free and digital production.

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