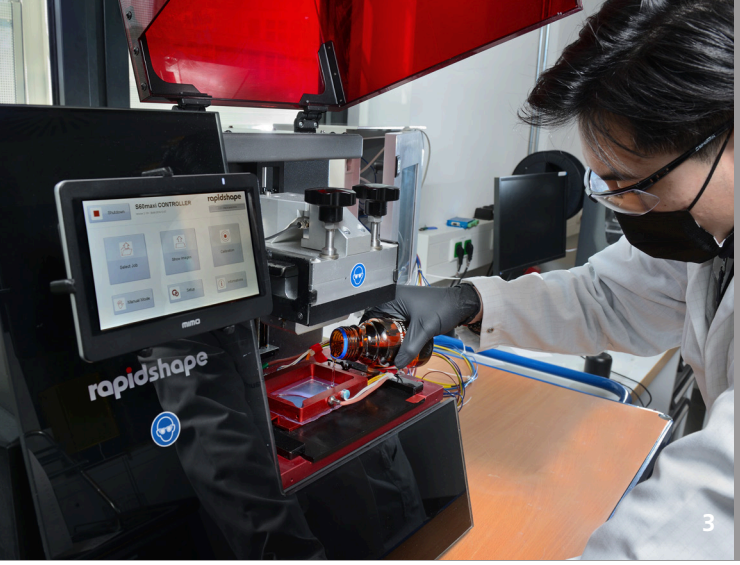

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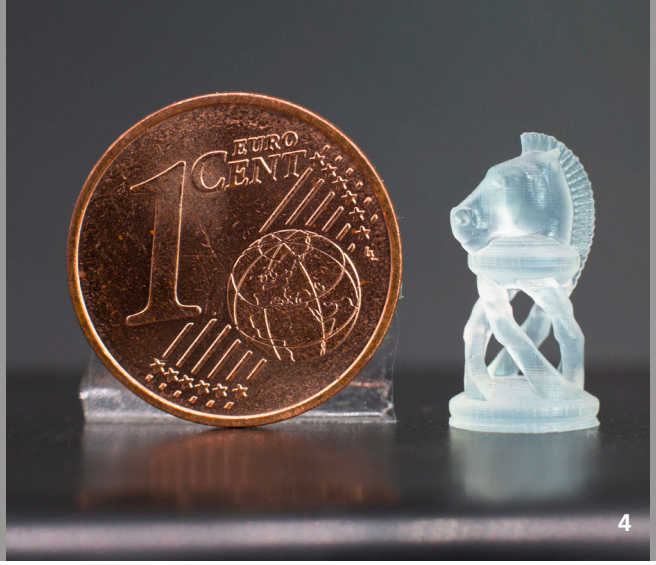

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3D PRINTING OF HIGH VISCOSITY OR SOLID PHOTO RESINS WITH A TEMPERATURE CONTROLLED PROCESS CHAMBER

Task

Additive manufacturing processes are developed to produce functional components defined by their mechanical, thermal and optical properties. For so-called 4D printing, the requirements are extended to include further properties such as thermo-responsiveness or self-healing. To achieve these material properties, research can use starting materials with high molecular weights. However, the viscosities of these materials (>> 1000 mPas) have led to considerable problems in stereolithography printers, such as component deformation due to high shear forces or significantly increased printing times. By controlling the temperature of the process chamber, Fraunhofer ILT has been able to reduce the viscosity of the resins since it decreases with increasing temperature.

Method

Based on a commercially available 3D printer, Fraunhofer ILT supplemented and redesigned relevant assemblies. The institute has focused on implementing a temperature control system for the photo resin bath and the build platform. In addition to designing the heating elements, it has integrated a control system and insulated the process area, and made safety-relevant additions. The exposure source (385 nm), exposure direction (constrained surface approach) and beam shaping method (digital light processing) were retained.

Results

The selected measures enable a process window for processing photo resins between 20 and 80 °C. The temperature can be maintained to within ±1 °C in the stable state. It is thus possible to process highly viscous starting compounds as well as TwoCure® materials, which are solid at room temperature.

Applications

With this approach, high-molecular-weight prepolymers and oligomers can be incorporated with their versatile properties into photo resin development. The aim of the application is primarily the production of dental and otoplastic components. At the same time, starting materials can be investigated for their suitability and influence in photo resin formulations in a time-efficient manner.

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3 DLP plant with temperature-controlled process chamber for processing high-viscosity photo resins.

4 Printed structure made of TwoCure® photo resin, © Nick Hüdepohl.

Subject to alterations in specifications and other technical information. 06/2022.