



COMBINATION OF UV AND MULTIPHOTON POLYMERIZATION FOR 3D PRINTING

Task

UV photo crosslinking in 3D printing can be used to make plastic components out of photo resins to precise specifications. A resolution above about 20 μm can be achieved for lateral structures, and the depth resolution is similar. Much more precise geometrical shapes can be made when multiphoton polymerization (MPP) with long-wave radiation is used, but the build-up rate is two to three orders of magnitude lower. Thus, extremely precise components can be produced, but not economically.

Method

High build-up rates and simultaneously high precision can, however, become possible when these two processes are combined: the majority of the component built with UV polymerization and only the finest structures with an MPP process. The planned process requires the two exposure modules for UV and MPP processes be combined in one system along with the option for using one or the other.

- 1 MPP printing of columns on a UV-polymerized base.
- 2 Writing of lines with 10 μm spacing and 2 μm width on a UV-cured base.

Results

In the first phase of the project, the processes were combined to test the individual modules and a plant concept was drawn up. Both modules could be used one after the other to produce a component in the same resin bath without having to remove the component.

Applications

The combination process can be used to great advantage for manufacturing components that are only produced in small or medium quantities and for which the manufacture of injection molding tools would be uneconomical. The largest volume fraction can be cross-linked with the relatively fast UV polymerization, whereby only geometric elements with a resolution < 10 μm can be written with the slower and more precise MPP process. Typical applications include microfluidic analysis chips that need to be connected to the macroscopic ports of analysis equipment, but require functional elements with dimensions in the micrometer range for mixing and filtering components.

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Contact

Andreas Hoffmann M. Sc.
Telephone +49 241 8906-447
andreas.hoffmann@ilt.fraunhofer.de

Dr. Martin Wehner
Telephone +49 241 8906-202
martin.wehner@ilt.fraunhofer.de