Designing new Materials for 4D (Micro)printing

C. A. Spiegel, S. Catt , E. Blasco*

4D printing has become a promising tool for the fabrication of dynamic and adaptive structures. During the last years, promising examples of defined 4D microstructures employing stimuli-responsive materials have been shown using two-photon 3D laser printing. Herein, we present our recent work on the field with emphasis on new responsive materials enabling the preparation of adaptive and structures. In particular, shape memory polymers as well as liquid crystal elastomers have been explored. In the first case, a simple and versatile formulation has been developed enabling complex microstructures with remarkable shape memory properties. Also, multi-responsive structures using photo responsive liquid crystal elastomers, are demonstrated. Furthermore, we have exploited the inclusion of dynamic and living bonds in a printable formulation enabling the creation of microstructures with „life-like" characteristics such as adaptability by tunable shape and mechanical properties. In addition, we demonstrated at the macromolecular sequence, specifically the positioning of the crosslinkable group, plays a critical role in both the printability and final properties of the printed material. We envision that the careful and precise desing of new printable materials will open new opportunities for the additive manufacturing of functional devices in the near future.

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