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Improved development procedure to enhance the stability of microstructures created by two-photon polymerization

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Abstract

Natural functional surfaces often rely on unique nano- and micropatterns. To mimic such surfaces successfully, patterning techniques are required that enable the fabrication of three-dimensional structures at the nanoscale. It has been reported that two-photon polymerization (TPP) is a suitable method for this. However, polymer structures fabricated by TPP often tend to shrink and to collapse during the fabrication process. In particular, delicate structures suffer from their insufficient mechanical stability against capillary forces which mainly arise in the fabrication process during the evaporation of the developer and rinsing liquids. Here, we report a modified development approach, which enables an additional UV-treatment to post cross-link created structures before they are dried. We tested our approach on nanopillar arrays and microscopic pillar structures mimicking the moth-eye and the gecko adhesives, respectively. Our results indicate a significant improvement of the mechanical stability of the polymer structures, resulting in fewer defects and reduced shrinkage of the structures.

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