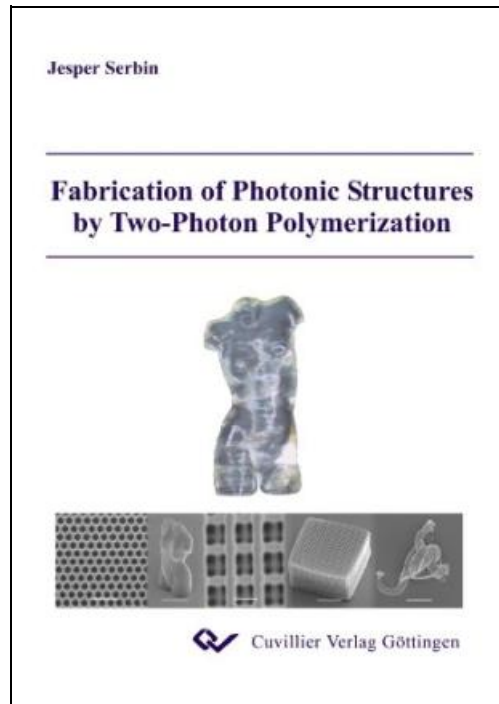


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Cuvillier Verlag Sep 2004, 2004. Taschenbuch. Condition: Neu. Neuware - Since the publications of E. Yablonovitch and S. John in 1987 on the optical properties of three-dimensional periodic structures the interest on photonic crystals has increased rapidly mainly driven by progress in their theoretical description. On the experimental side, the fabrication of photonic crystals still remains a major challenge since the fabrication methods either lack quality, flexibility or resolution. Subject of this thesis is the development of a new technique for the generation of threedimensional structures on the sub-micrometer scale that is suitable for the fabrication of photonic crystals. The crystals fabricated using this technique are characterized and their optical properties are discussed. If near-infrared femtosecond laser pulses are tightly focused into the volume of a transparent, photosensitive resin, two-photon absorption within the focal volume leads to photopolymerization. By moving the laser focus three-dimensionally through the volume of the resin, any 3D structure can be fabricated by means of two-photon polymerization. After the polymerization process the non irradiated polymer can be etched away with special solvents leaving the solid 3D structure that was exposed by the focused femtosecond pulses. Due to the threshold behavior of the two-photon polymerization process, one can overcome the diffraction limit by choosing the applied peak laser fluence just slightly above the threshold for polymerization. In this case only the central part of the laser focus contributes to the polymerization process. It is shown that complicated 3D structures with a resolution as small as 100 nm can be fabricated by means of two-photon polymerization using a laser wavelength of $\lambda=780$ nm. Woodpile structures having a face-centered-cubic symmetry and a photonic bandgap in the near infrared were fabricated with two-photon polymerization and were optically characterized by means of Fourier-transform infrared spectroscopy. Since the refractive index contrast in...

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