

Defect Inscription in 3D PBG Templates with Fs-laser Pulses

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Three Dimensional periodic structures of high refractive index material support a photonic band gap. By introducing defined defects into the structure, components such as waveguides, splitters/couplers, and filters may be produced. Here, two techniques are presented for defect inscription: material structuring (photo-ablation, photo-disruption, etc.) and two-photon polymerization.

Femtosecond laser pulses have been used to ablate polystyrene spheres from a colloid crystal. At low energies, a single pulse removes a single layer of spheres at the surface in the interaction region without destruction of surrounding spheres. With subsequent low energy pulses, this process can be adjusted for structural depth of several layers.

The inscription of defects into 3D templates can also be achieved with two-photon polymerization (2PP). After infiltration of a photo-sensitive resin into a colloid crystal, the liquid material can be polymerized with femtosecond pulses. The limited spatial extent of the focus allows for the possibility of inscribing defects at different depths in the sample. This technique can also be applied to templates created by 3D holographic lithography and direct write techniques.