Nonlinear Laser Lithography: From basic science to applications

F. Ömer Ilday

Department of Electrical Engineering, Department of Physics and UNAM – Institute of Materials Science and Nanotechnology, Bilkent University, Ankara, Turkey

Nonlinear Laser Lithography exploits nonlocal nonlinear feedback for femtosecond laser-induced nanostructuring with unprecedented uniformity on nonplanar or flexible surfaces [1]. Nonlinear Laser Lithography also serves a model system for self-organization, whereby we show control of pattern geometries via "noise". We further answer the open question of how to control when nanostructures form parallel/perpendicular to laser field. Finally, we extend our results to 3D by creating structures deep inside silicon chips, demonstrating the first in-chip holograms, lenses, erasable information storage, microfluidic channels for cooling of microchips, through-Si vias, and even arbitrary 3D sculpturing of the entire chip.

[1] B. Öktem, I. Pavlov, S. Ilday, H. Kalaycıoglu, A. Rybak, S. Yavas, M. Erdogan and F. Ö. Ilday, "Nonlinear laser lithography for indefinitely large-area nanostructuring with femtosecond pulses," Nature Photon. 7, 897 (2013).