Abstract

The fabrication of components for nano-photonics is a major challenge. One method to fabricate components with nanoscale patterns is to use super-resolved direct laser writing by using the non-linear properties of a mask, in particular its saturable absorption.

Here we detail the optimization of a material that can be used as a super-resolution mask, the Sb_2Te_3. This material is deposited as a thin films on a substrate . These thin films have been annealed in different ways (by oven, by laser and during the deposition) and their crystallinity has been verified by various methods (X-ray diffraction and electron microscopy).

We studied the dependence between the deposited thickness of Sb_2Te_3 and its nonlinear performance using the Z-Scan technique and found that the optimal thickness is around 10 nm. By carrying out Z-Scan measurements we have also determined the saturable absorption parameters of the thin films. These parameters are used when the material is employed as a saturable absorber for mode-locking laser systems.

The behavior of Sb_2Te_3 thin films under intense laser radiation was also studied. An attempt to achieve super-resolution has been performed by using As_2S_3/Ag multilayers for the inscription. Due to the cumulative nature of the modification the super-resolution effect was not observed.

Keywords : Nonlinear optics, chalcogenides, thin films, X-ray diffraction, electron microscopy, saturable absorption, Z-Scan, direct laser writing, super-resolution.