

Third harmonic generation process in Al doped ZnO thin films

Abstract

We have performed studies on the third-order nonlinear optical susceptibility of Al doped ZnO (AZO) thin films using z-scan and third harmonic generation techniques. From the present studies, it reveals that the introduction of Al in ZnO leads to substantial changes in the third-order nonlinear susceptibility. Additionally we have shown that using treatment by the 707 nm laser pulses of the Er:glass 20 ns laser also influence on the third harmonic generation. Such behavior is explained by the photoinduced charge re-occupation of the trapping levels on the borders substrate and ZnO. Further, the sign and magnitude of nonlinear absorption coefficient β_{eff} , nonlinear refractive index n_2 , real and imaginary parts of third-order nonlinear susceptibility were evaluated. Finally, the optical limiting studies for various concentrations of AZO thin films were determined. Reverse saturable absorption was the dominant process leading to the observed nonlinear behavior.

Keywords; Al doped ZnO thin films, Laser frequency generation, Photoinduced optical devices and electronics, Nonlinear optical studies, Optical limiting