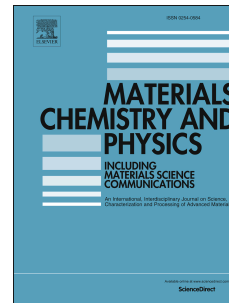


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Pulsed laser deposited $Zn_{1-x}Ti_xO$ ($0.000 \leq x \leq 0.050$) thin films for tunable refractive index and nonlinear optical applications

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Abstract: In the present paper, a systematic study on the structural, linear and nonlinear optical properties of $Zn_{1-x}Ti_xO$ ($0 \leq x \leq 0.050$) thin films is documented. The thin films are grown onto fused silica substrate via pulsed laser deposition technique employing 2nd harmonic of a Q-switched Nd:YAG laser (532 nm, 10ns, 10Hz). The crystallinity of the film is observed to be increased initially up-to $x=0.02$ and then decreased for higher values of x . A small variation in band gap energy is observed in the $Zn_{1-x}Ti_xO$ thin films with x which is mainly due to the Burstein Moss effect followed by the weak quantum confinement effect. The third order optical nonlinearities in the films are experimentally recorded using modified z-scan technique under cw He:Ne laser ($\lambda=632.8$ nm) illumination. The nonlinear optical coefficients; β and n_2 , are observed to be in the range of 1.1-6.0 cm/W and $(1.0-4.1) \times 10^{-4}$ cm²/W respectively. The maximum value of β (6.0 cm/W) and n_2 (4.1 cm²/W) are observed in the $Zn_{1-x}Ti_xO$ film having $x=0.02$. These studies suggest that an optimum concentration of Ti content in ZnO is required for the enhancement in nonlinear optical behavior.

Keywords: pulsed laser deposition, $Zn_{1-x}Ti_xO$ thin film, nonlinear optical property, z-scan

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