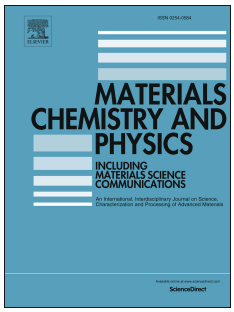
Accepted Manuscript



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

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PII: S0254-0584(18)30502-9

DOI: 10.1016/j.matchemphys.2018.06.004

Reference: MAC 20703

To appear in: *Materials Chemistry and Physics*

Received Date: 2 February 2018

Accepted Date: 2 June 2018

Please cite this article as: Gyan Prakash Bharti, Partha P. Dey, Alika Khare, Pulsed laser deposited Zn1-xTixO (0=x=0.050) thin films for tunable refractive index and nonlinear optical applications, (2018), doi: 10.1016/j.matchemphys.2018.06.004

Pulsed laser deposited $Zn_{1-x}Ti_xO$ (0.000≤x≤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≤x≤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 (λ=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)×10^{-4} cm^2/W respectively. The maximum value of β (6.0 cm/W) and n_2 (4.1 cm^2/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