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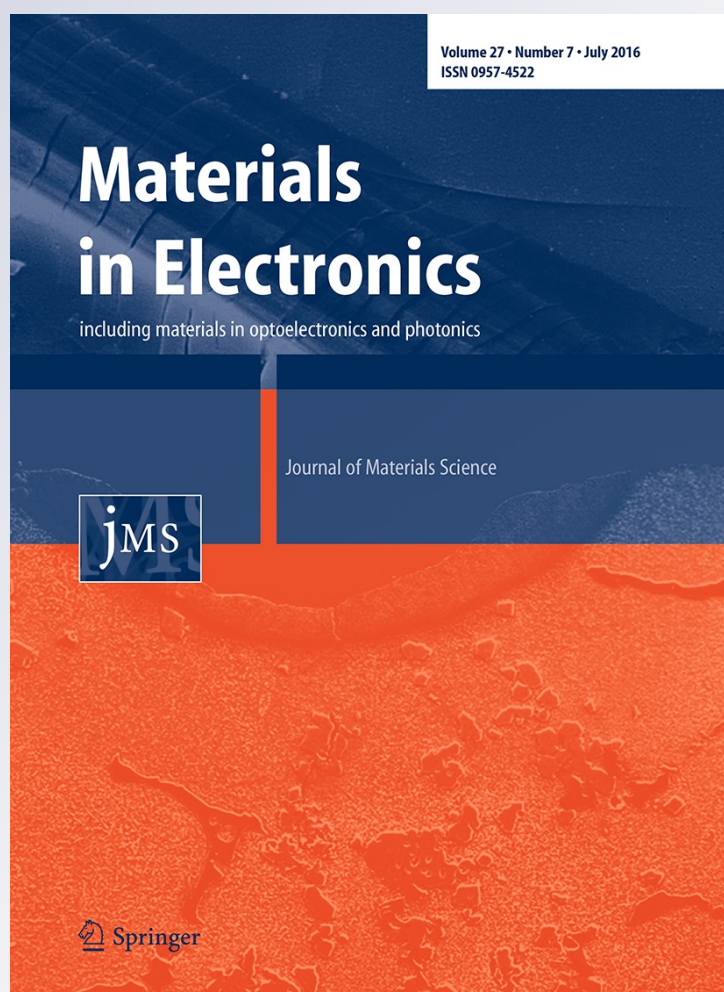
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Surface morphology and thermal figure of merit of a new compound thin film

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Abstract The third nonlinear optical properties of a new compound 4,4'-bis(3-methoxy benzylidene amino) biphenyl doped poly-methyl methacrylate (PMMA) have been studied using Z-scan technique. Experiments are performed using a continuous waveguide (cw) diode laser at 532 nm wavelength and 0.68 kW/cm² laser intensity. The optical power limiting behavior of sample doped PMMA was also investigated. It also shows a very good optical limiting behavior with a limiting threshold of 4.7 mW. We attribute the nonlinear absorption and optical limiting property of the sample film to two photon absorption effect at 532 nm. The experimental evidences of observing diffraction pattern in compound 4,4'-bis(3-methoxybenzylideneamino) biphenyl doped PMMA has been present. The refractive index change, Δn , and nonlinear refractive index, n_2 determined from the number of observed ring. We obtained good values of $\Delta n = 105.154 \times 10^{-4}$ and $n_2 = 154.154 \times 10^{-7}$ cm²/W. Variation of refractive index with temperature, dn/dT , and figure of merit, H, are found to be 8.858×10^{-6} 1/°C and 5.316×10^{-6} , respectively. This large nonlinearity is attributed to a thermal effect resulting from linear absorption. Theoretical diffraction pattern that agree well with experimental one are generated using a wave theory.

1 Introduction

Nonlinear optical materials continue attracting attentions due to their potential application in optical communications, optical storage, optical computing, harmonic generation, optical switching, optical limiting, etc. [1–4]. Among all the nonlinear optical (NLO) properties applications, optical limiting (OL) is one of the most promising in practice, such as the protection of human eyes and optical sensors from the damage caused by intense optical radiation [5–9]. A good optical limiting material should possess high linear transmission at very low incident light energy and low transmission under intense light radiation. The various nonlinear optical mechanisms for optical limiting include nonlinear absorption [reverse saturable absorption (RSA), two photon absorption (TPA)], nonlinear refraction and nonlinear scattering [10–13]. It is important to select suitable materials as optical limiting media by determining the magnitude of their nonlinearity. Previous researches on optical limiting materials were focused on nonlinear, organic [14–20] and semiconductor materials [21], because of their large nonlinearity and ultra-fast response time [22].

In this paper, absorptive nonlinear optical properties of sample film along with optical limiting performances will be presented. Z-scan experimental technique was utilized to determine the nonlinear parameters of our sample by using cw laser at wavelength 532 nm. The results show a strong Z-scan signal. The nonlinear absorption coefficient have been calculated from these measurements and found to be very large. Optical limiting potentialities were experimentally evaluated with the help of the intensity dependent transmission method. Experimental evidences of observing diffraction pattern in compound 4,4'-bis(3-methoxy benzylidene amino) biphenyl doped PMMA has been present. The refractive index change, Δn , and

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