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Linear, nonlinear and optical limiting properties of carbon black in epoxy resin

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ABSTRACT

Films of an epoxy resin doped carbon black were prepared by casting method onto BK7 glass substrates. The surface morphology of these films were investigated together with the nonlinear optical properties under CW laser light irradiation of 532 nm wavelength using diffraction ring pattern and Z-scan techniques. The prepared samples exhibited strong self-defocusing effect and good optical limiting behavior.

1. Introduction

During the last three decades organic materials gained increasing and continuous importance due to their unique properties such as high nonlinearities, short response time, ease of manufacturing, availability and cheapness. It was proved by many researches their efficient photonic and electronic applications such as optical switches, optical limiting, high density optical data storage, optical phase conjugation, etc. [1–4].

The study of some optical characteristics such as optical limiting required the study of nonlinear optical characteristics of these materials especially their nonlinear refractive index. There exist three techniques used to evaluate the nonlinear refractive index viz., thermal lens [5], diffraction ring pattern [6] and Z-scan [7] respectively.

Carbon black (CB) is virtually pure elemental carbon in the form of colloidal particles [8] prepared by partial combustion or thermal decomposition of gaseous or liquid hydrocarbons under controlled conditions. Its physical appearance is that of a black, finely divided pellet or powder. CB is used in a diverse group of materials in order to enhance their physical, electrical and optical properties. Its largest volume use is as a reinforcement and performance additive in rubber products. In rubber compounding, natural and synthetic elastomers are blended with CB. CB provides reinforcement and improves resilience, tear strength, conductivity and other physical properties. CB is the most used and cost-effective rubber reinforcing agent

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