Nonlinear optical characterization of phosphate glasses based on ZnO using the Z-scan technique

ABSTRACT

The nonlinear optical properties of a phosphate vitreous system [(ZnO)x − (MgO)30−x − (P2O5)70], where x = 8, 10, 15, 18, and 20 mol% synthesized through the melt-quenching technique have been investigated by using the Z-scan technique. In the experiment, a continuous-wave laser with a wavelength of 405 nm was utilized to determine the sign and value of the nonlinear refractive (NLR) index and the absorption coefficient with closed and opened apertures of the Z-scan setup. The NLR index was found to increase with the ZnO concentration in the glass samples by an order of 10−10 cm2centerdotW−1. The real and imaginary parts of the third-order nonlinear susceptibility were calculated by referring to the NLR index (n2) and absorption coefficient (β) of the samples. The value of the third-order nonlinear susceptibility was presented by nonlinear refractive or absorptive behavior of phosphate glasses for proper utilization in nonlinear optical devices. Based on the measurement, the positive sign of the NLR index shows a self-focusing phenomenon. The figures of merit for each sample were calculated to judge the potential of phosphate glasses for application in optical switching.

Keyword: Z-scan technique; Nonlinear refractive index; Nonlinear absorption coefficient; Phosphate glasses.