Applied Surface Science

Volume 340, 15 June 2015, Pages 72–77

Nonlinear optical properties of poly(methyl methacrylate) thin films doped with Bixa Orellana dye

S. Zongo[a] A.P. Kerasidou[a] B.T. Sone[a] A. Diallo[a] P. Mthunzi[a] K. Iliopoulos[a] M. Nkosi[a] M. Maaza[a] B. Sahraoui[c]

Abstract

Natural dyes with highly delocalized π-electron systems are considered as promising organic materials for nonlinear optical applications. Among these dyes, Bixa Orellana dye with extended π-electron delocalization is one of the most attractive dyes. Bixa Orellana dye-doped Poly(methyl methacrylate) (PMMA) thin films were prepared through spin coating process for linear and nonlinear optical properties investigation. Atomic force microscopy (AFM) was used to evaluate the roughness of the thin films. The optical constants *n* and *k* were evaluated by ellipsometric spectroscopy. The refractive index had a maximum of about 1.456 at 508.5, 523.79 and 511.9 nm, while the maximum of *k* varies from 0.070 to 0.080 with the thickness. The third order nonlinear optical properties of the hybrid Bixa Orellana dye-PMMA polymer were investigated under 30 ps laser irradiation at 1064 nm with a repetition rate of 10 Hz. In particular the third-order nonlinear susceptibility has been determined by means of the Maker Fringes technique. The nonlinear third order susceptibility was found to be 1.00×10^{-21} m^2 V^{-2} or 0.72×10^{-13} esu. Our studies provide concrete evidence that the hybrid-PMMA composites of Bixa dye are prospective candidates for nonlinear material applications.