

A comprehensive linear and nonlinear study on a fluorescent stain

Abstract

The optical properties, linear and nonlinear, for Leishman stain are studied in ethanol and chloroform over a wide spectral region. The stain consists of two components: Methylene blue (MB) and Eosin (E). The low intensity optical measurements, linear regime, show the absorption and emission characteristics of the E and the MB components in ethanol and only the MB component in chloroform. Under the influence of optical intensity less than 15MW/m^2 , the stain shows nonlinear absorption characteristics at excitation wavelengths 532nm and 650nm only. The nonlinear absorption coefficients of the solutions are in $1-12.4 \times 10^{-3} \text{ cm/W}$ range in both solvents. Leishman stain solutions in ethanol and chloroform have a strong thermal nonlinearity with a negative index of refraction over the entire visible region. The value of the nonlinear refractive index (n_2) of Leishman stain in both solvents increases as the wavelength of the excitation radiation increases. The value of n_2 of the solutions is in the range of about $2-46 \times 10^{-7} \text{ cm}^2/\text{W}$. As an example of the optoelectronic applications, the stain shows excellent properties of an energy spreading optical limiter.