

Fabrication and Characterization of Poled Pyriliium Doped Nonlinear Organic Thin Film

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Abstract: Organic thin film doped with Pyriliium was fabricated and characterized. Optical second-order nonlinearity was obtained after poling with electric field. Maker Fringe measurements and analysis were performed to evaluate the nonlinear coefficients. The film demonstrates negligible absorption in the blue wavelength window.

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1. Introduction

In the recent years, nonlinear organic materials have been considered a strong candidate for many photonic applications including electro-optical modulators and all optical switches. Recently, a 110-GHz optical modulator using poled polymer with a half-wave voltage of less than 1V has been demonstrated [1,2].

2. Film Fabrication and Characterization

Pyriliium was synthesized from poly[oxyterphthaloyloxyethylene-(*N*-phenylimino) ethylene] (POPE) by the reaction with 2,6-diphenylpyriliium tetrafluoroborate [3]. Then PTOPTD was doped into commercially available UV sensitive organic solution (OG146 from Epotek) with a ratio of 1:100 by weight. The mixture was spin-coated onto a glass substrate and cured with UV light ($\lambda=366\text{nm}$) for 2 hours. Then the film was poled using the corona poling technique. The poling temperature was monitored and controlled at 110°C . The top electrode was placed 2cm from the film surface, and 8-kV_{DC} was applied between the needle and bottom electrode to provide electric fields. The poling process took about one hour. The physical properties of fabricated films were characterized by AFM and Tencor Profilometer. Thickness of the film was measured to be 300nm for spin-coating speed of 3000 rpm, and refractive index was characterized by an ellipsometer. Second order nonlinearity was evaluated by second-harmonic generation experiment under the Maker Fringe setup. A 1064-nm YAG laser was used as the fundamental source, and signal of second harmonic (Fig.1) was detected by Photo-Multiplier Tube (PMT). The second-order nonlinear coefficients d_{33} and d_{13} were extracted from a thorough Maker Fringe data analysis. The obtained values were $d_{13}=0.82$ and $d_{33}=2.5$ (pm/V).

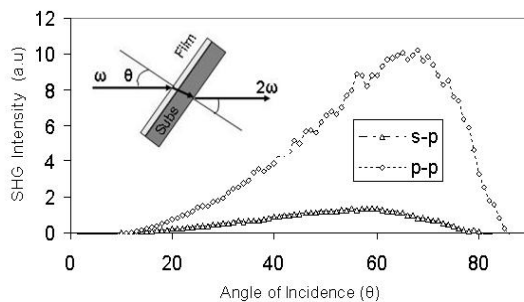


Fig.1. Second harmonic signal generated from the film versus incident angle.

3. References

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