

# An Interferometric Method to Determine the Kerr Constant of Perspex

Patricia Govender<sup>1,2</sup>, Dr. V.W. Couling<sup>1</sup>

<sup>1</sup> UKZN Pietermaritzburg, King Edward Avenue, Scottsville, Pietermaritzburg

<sup>2</sup> CSIR, DPSS, 3Meiring Naude Avenue

Patricia Govender e-mail address: [pgovender@csir.co.za](mailto:pgovender@csir.co.za)

**Abstract:** An adapted Michelson interferometric technique was used to measure strain induced birefringence in perspex. The birefringence was then used to determine the Kerr constant in perspex. The result obtained is compared to a polarimetric result and is shown to be a more sophisticated and reliable method.

## 1. Introduction

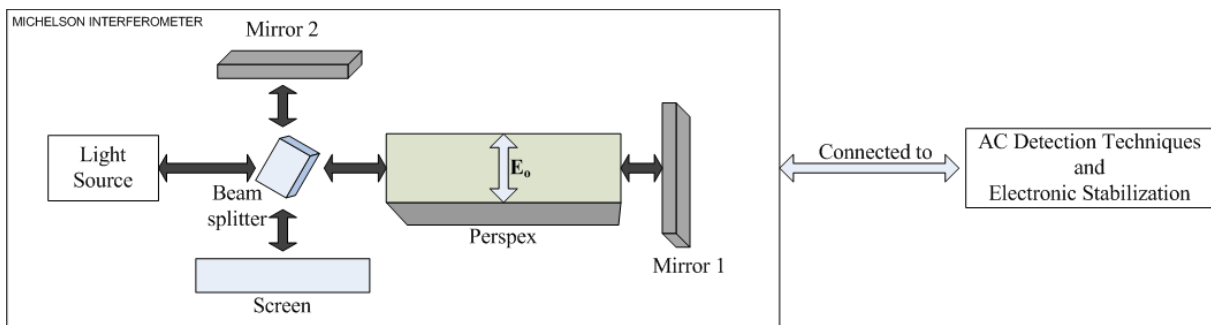
The purpose of this experiment was to determine the change in birefringence in ZnSe crystals. Due to a lack of resources perspex was chosen as an initial sample to allow a comparison between results from earlier work [2].

## 2. Experiment

The Kerr constant is determined by the applied bias field,  $E_0$ , as shown in the figure below, and the resulting birefringence,  $\Delta n$ , using:

$$K = \frac{\Delta n}{\lambda E_0^2}, \quad (1)$$

where  $\lambda$  is the wavelength of the light source [1].



## 3. Results

With an applied voltage of 4.0kV across the perspex specimen, the Kerr constant for the sample was found to be  $7.66 \times 10^{-16} mV^{-2}$ .

A comparison between the Michelson method and the Polarimetric method is given in the table below.

Michelson Method	Polarimetric Method	Comparison
$K = 7.66 \times 10^{-16} mV^{-2}$	$K = 3.52 \times 10^{-14} mV^{-2}$	The polarimetric method result is overestimated [3].
Method in general		The enhanced features in the Michelson setup allows for a higher sensitivity, a better wavelength resolution and thinner samples.

## 4. Summary

The work aimed at determining the Kerr constant for perspex using the Michelson method. When compared to the polarimetric method [2], one finds a 45% relative difference. From the results, the Michelson method appears to be superior for the determination of minute changes in a crystal's birefringence.

## 5. References

- [1] M. J. Gunning, *Some experimental and theoretical studies in crystal optics*, (1999).
- [2] T. K. Ishii and A. Griffis, "Measurement of electro-optic effects in acrylic plastic", *Microwave and Optical Technology Letters*, **4**, 387-389(1991).
- [3] W. Kucharczyk, M. J. Gunning, R. E. Raab and C. Graham, "Interferometric investigation of the quadratic electro-optic effect in KDP", *Physica B*, **212**, 5(1995).