On Nonlinear Optical Properties of Polystyrene

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Introduction

Polystyrene has found known applications in integrated optics as passive waveguides [1], and also as active waveguides. Hu et.al. Demonstrated all-optical switching process in a polystyrene photonic crystal [2].

$$n=n_0+n_2 I$$
$$\alpha=\alpha_0+\alpha_2 I$$

Questions :

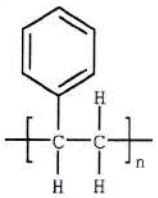
- What are the linear and cubic nonlinear properties relevant for all-optical switching?

Task: Measure α_2 and n_2 at 532 nm

Polystyrene

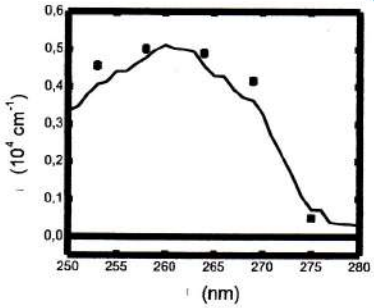
Polystyrenes are commercially available

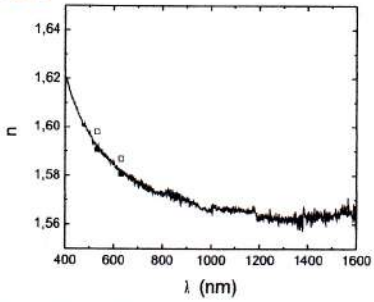
Polystyrene or PS
M_w = 1,300,900 g/mol



Molecular structure of Polystyrene

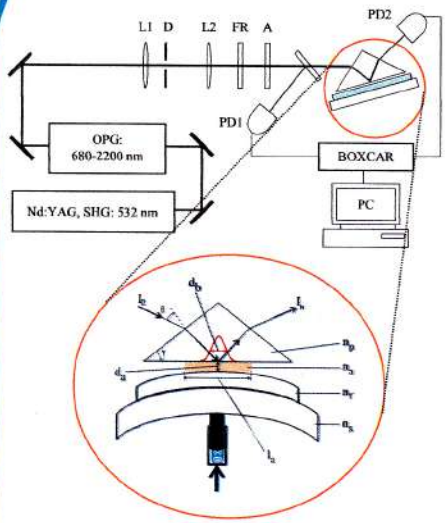
Linear Optical Properties



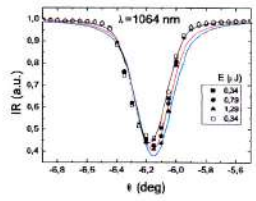


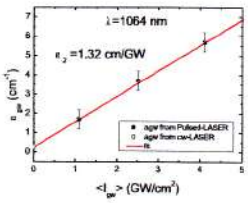
Films were made by spin coating from chlorbenzene solution onto fused silica substrates

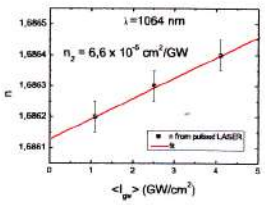
Experimental Setup



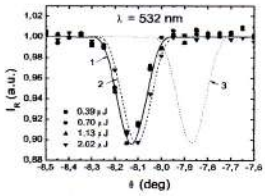
Intensity dependent prismcoupling

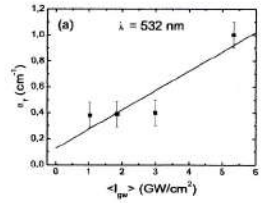


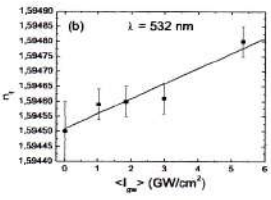




Results







Parameters (d_b,I_a) were measured and d_a was determined at low intensity. All parameters were kept constant. Only the incident intensity I_0 was varied and two parameters (n_f, α_{gw}) were used to fit the intensity dependent coupling curves [3].

Conclusion:

- n_2 and α_2.values of PS are 2.6×10^{-14} cm²/W and 1.5×10^{-10} cm/W, respectively.
- The value of n_2 of PS reported by Hu et.al.[2] is about 23 times higher of n_2 of ours.

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References

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[2] X.Y. Hu et.al., Appl. Phys. Lett. Vol.87 (2008) 185.
[3] K. Kovnov, et al., J. Opt. Soc. Am. B 19 (2002) 895.

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This certificate is hereby presented to :

Mohamad Jahja

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