INTER-LABORATORY MEASUREMENTS OF THE OPTICAL LOSSES IN FERROELECTRIC THINS FILMS BY PRISM COUPLING METHOD

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- **Project Description**

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- **Objective**

Optical devices using the Electro-Optic (E-O) effect of ferroelectric materials are attractive because of the potential high speed of such devices. It has been reported that the speed of E-O modulators is at least an order of magnitude larger than that of acoustic modulators, essentially because of the higher E-O coefficient of such materials [1]. The main idea behind these devices can be summarized as follows. Let us define two areas on a ferroelectric thin film with opposite polarization. Applying a uniform electric field across the ferroelectric will produce a change in the refractive index of domain 1 and 2 with $n_1=n+\delta$ and $n_2=n-\delta$, a change due to the E-O effect. This change in refractive index deflects the incident light beam at an angle θ, which depends on the applied electric field. Efficient E-O optical modulators or beam deflectors combining high quality, low optical losses ferroelectric thin films and the selective domain inversion that can be obtained using atomic force microscopy (AFM) can be imagined [2,3,4]. Such devices could be useful in advanced telecommunication as effective modulators, as well as efficient optical beam scanners, which can be used in switching, displays, scanning and printing.

- **State of the research**

In order to realize the above-mentioned devices, high quality ferroelectric thin films with low optical losses are important. Prior to the fabrication of the devices and the measurements of E-O coefficient after the domain inversion using AFM, checking the optical losses of the grown films is important. As a first step in this collaborative research, we started setting up a measurement system for quantifying the optical losses. Figure 1 shows the schematic diagram of the experimental set-up based on the prism coupling method. A Rutile prism is used to couple a He-Ne laser beam (633nm) to the sample, which is pressed against the base of the prism. The optical losses can be obtained by taking the photograph of the sample surface using a microscope during the light propagation and by further analysing the intensity variations of the scattered light from the wave-guide. By plotting the intensity thus obtained against the propagation distance, a straight line will be obtained and the slope of this line will give the optical losses. The setting up of this prism coupling method has just been completed and the measurement will start soon.

- **References**

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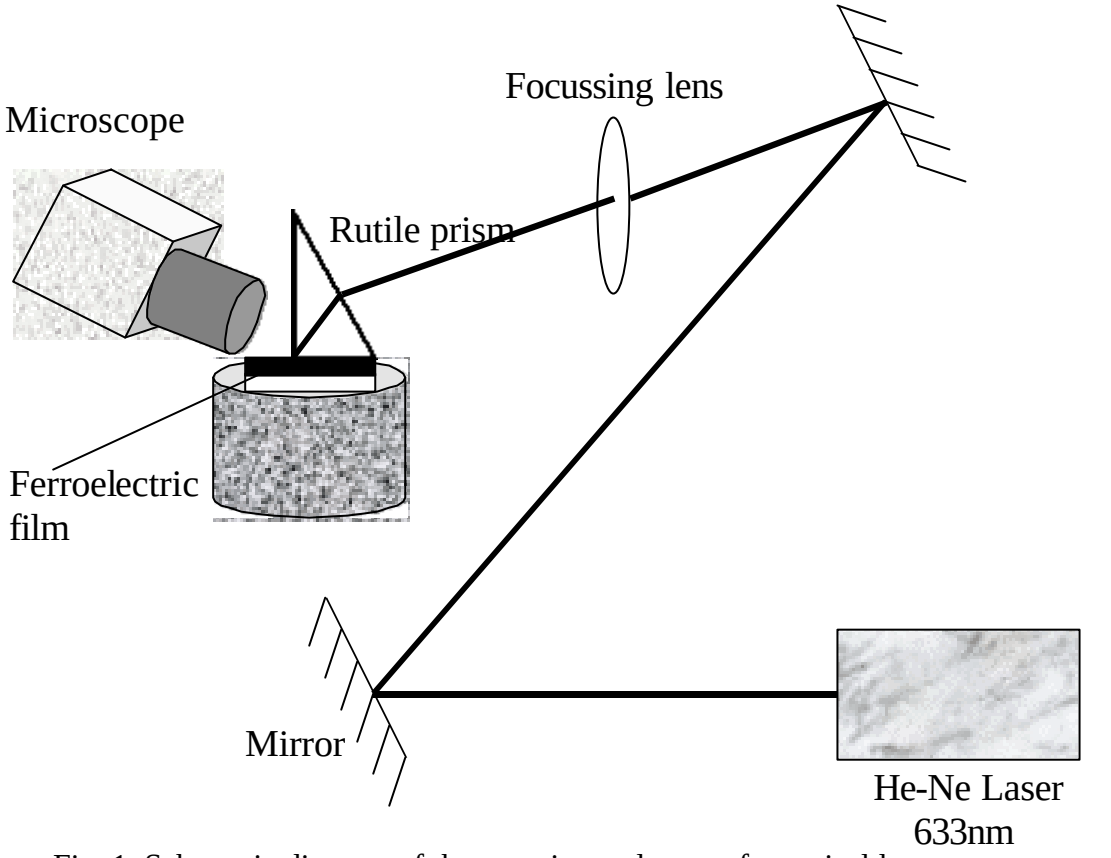

Fig. 1. Schematic diagram of the experimental set up for optical loss measurement