

Evaluation of Glan-Taylor prism by using of V-7100/VAP-7070 Polarizer Film Evaluation System

Polarizer has been widely used as the optical element forming linearly polarized light. Especially, Glan-Taylor polarized prism is well known with its highest extinction ratio (10^{-6}) among many available polarizers and widely used to the applications requiring the excellent polarization purity and transmittance. In this Application Note, the JASCO V-7100/VAP-7070 Polarizer Film Evaluation System (Fig. 1) will be explained for the evaluation of Glan-Taylor prism having such extremely high extinction ratio.



Fig. 1 V-7100/VAP-7070 Polarizer Film Evaluation System

The polarizer film evaluation system consists of model V-7100 UV/VIS Spectrophotometer and VAP-7070 Polarizer Film Evaluation Attachment including a Glan-Taylor prism, film sample rotating holder and integrating sphere (Fig. 2). The linearly polarized light will be formed by Glan-Taylor prism located before the film sample and by rotating the film sample on the sample rotating holder against the linearly polarized light, crossed-Nicol or parallel position can be determined. Each of transmittance spectrum in crossed-Nicol or parallel position can be obtained so that the characteristics of polarizer film can be evaluated. Also the distance between the Glan-Taylor prism and detector is adjustable freely so that you can collect selectively the diffuse transmittance or linear transmittance component from sample.

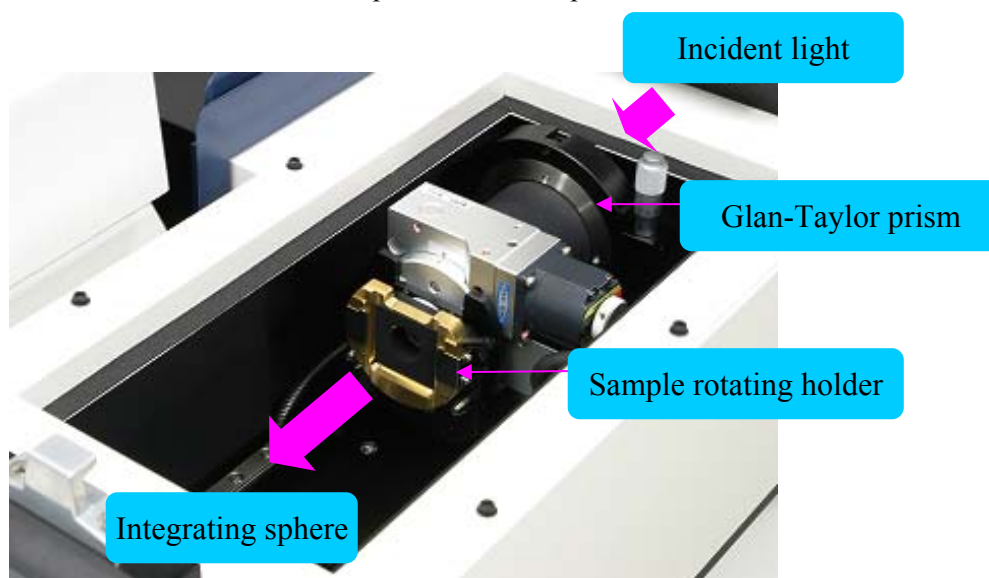


Fig. 2 Optical Layout of VAP-7070 Polarizer Film Evaluation attachment

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By monitoring the transmittance near crossed-Nicol position, the sample axis can be determined precisely with good reproducibility, which is an important factor for keeping the measurement accurate. Also, the system allows to determine the sample axis automatically. The dedicated software of this system can perform automatically the spectral measurement, calculation of degree of polarization and color analysis which are the key parameters in the polarizer evaluation.

In this application, a commercially available Glan-Taylor prism (extinction ratio; 10^{-4}) was used as a test sample. The sample was placed in the two different positions. The one position was very close to integrating sphere and, another position, apart from the sphere. The transmittance spectra of both parallel and crossed-Nicol positions were obtained at each of two different sample positions (Fig. 3.1.). In the parallel position, the significant difference in the two sample positions was not observed, however, in the crossed-Nicol position, the difference was clearly observed as shown in the Fig. 3.2. It can be considered that the difference was caused from diffuse transmittance component of sample and, its transmittance was 0.056%T at 600 nm. Further zoomed spectrum of crossed-Nicol position at “apart from sphere” location is shown in Fig. 3.3. At “apart from sphere” location, the linear transmittance component of sample can be obtained. The change of transmittance in the level of 10^{-4} can be observed so that it is possible to evaluate the only linear transmittance component of the Glan-Taylor prism (extinction ratio; 10^{-4}).

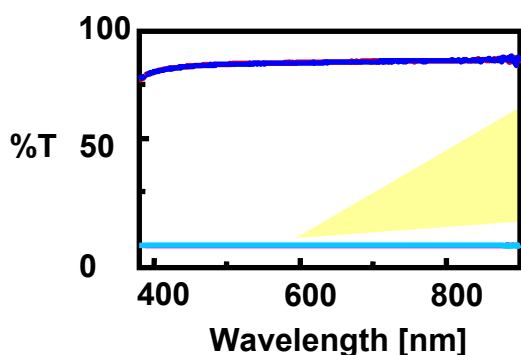


Fig. 3.1. Transmittance spectra in both crossed-Nicol and parallel positions.
Upper; parallel
Lower; cross-Nicol

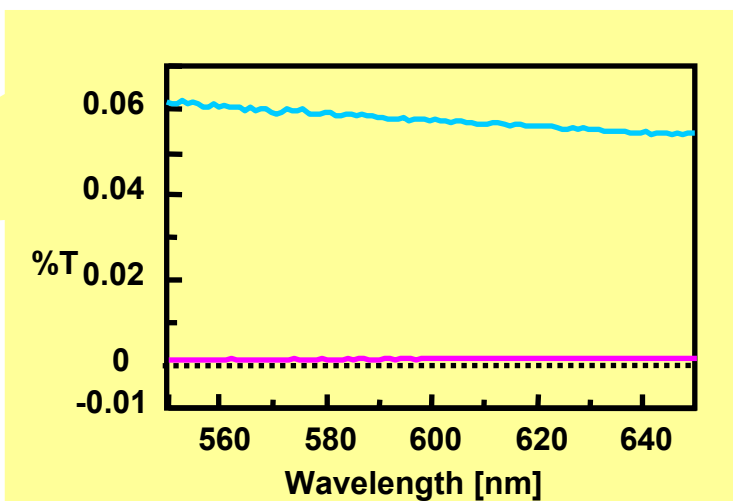


Fig. 3.2. Transmittance spectra in crossed-Nicol position.
Upper; apart from sphere
Lower; close to sphere

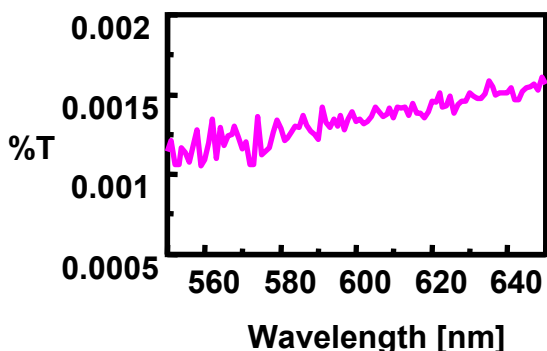


Fig. 3.3. Linear transmittance spectrum in crossed-Nicol position at “apart from sphere” location.

- Parallel (away from sphere)
- Parallel (close to sphere)
- n cross-Nicol position at “away from sphere” position.
- n cross-Nicol position at “close to sphere” position.

As demonstrated above, the JASCO V-7100/VAP-7070 Polarizer Film Evaluation System can be applied to the evaluation of excellent quality polarizer such as Glan-Taylor prism. The precise positioning in crossed-Nicol and adjustable sample distance from integrating sphere allow the users to obtain the important key parameters in polarizer evaluation.

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