A Method of Determining the Dispersion of Double Refraction and the Thickness of a Crystalline Plate (e. g. Mica)[1].

By

Takeo Hori.

(Received October 2, 1925)

If a beam of white light be passed through a mica plate, half-silvered on both sides, and examined in a spectroscope, a continuous spectrum is seen crossed by a series of interference fringes. When the beam is incident along the α-axis of the optical indicatrix of mica (approximately normal to the cleavage plane), the fringes produced are seen to consist of two systems, each corresponding to one of the beams polarized in the β- and γ-directions of the plate and propagate with different velocities in the medium. If, therefore, the primary rays be previously polarized by a Nicol in the β- or γ-direction, the fringes reduce to a single system. It is obviously formed according to the formula,

$$2d\,(\mu_m/\lambda_m - \mu_0/\lambda_0) = m$$

where d is the thickness of the plate, μ the principal index (μ_β or μ_γ) and the band corresponding to λ_m is the m-th towards the violet from that corresponding to λ_0.

The problem is thus:

(1) By making use of the known values of μ_0 and μ_m corresponding to λ_0 and λ_m, and measuring m, to determine d;

(2) With d thus determined, to find the refractive index μ_m corresponding to any wave-length.

For this purpose, the present writer photographed the interference bands adjacent to the spectrum of iron arc (including D-lines and Li-line λ 6708).

---

1 cf. Williams, "On the Determination of Refractive Indices by Means of Channelled Spectra," Phys. Rev., **18**, 280 (1904).

Assuming the indices for the thallium-, sodium-, and lithium lines to be those observed by Pulfrich (cf. Landolt's Table), the thickness of the plate was determined as accurately as at least to a thousandth of a mm.,[2] and the β- and γ-indices for any wave-length in the visible portion of the spectrum were found to be approximately given by

$$\mu_\beta = 1{\cdot}5732 + 8782{\cdot}1/\lambda^2 - 58359 \times 10^4/\lambda^4$$
$$\mu_\gamma = 1{\cdot}5807 + 6837{\cdot}5/\lambda^2 - 32073 \times 10^4/\lambda^4.$$

The extension of the dispersion curves into the ultra-violet region may be made in a similar way, the plate now being not silvered but nickeled instead. As is suggested by the following figure, the two curves have a tendency to approach each other indefinitely as we proceed to the violet; they will perhaps make a rapid increase in the ultra-violet until we arrive at the point where the absorption band sets in (λ 330 $\mu\mu$).

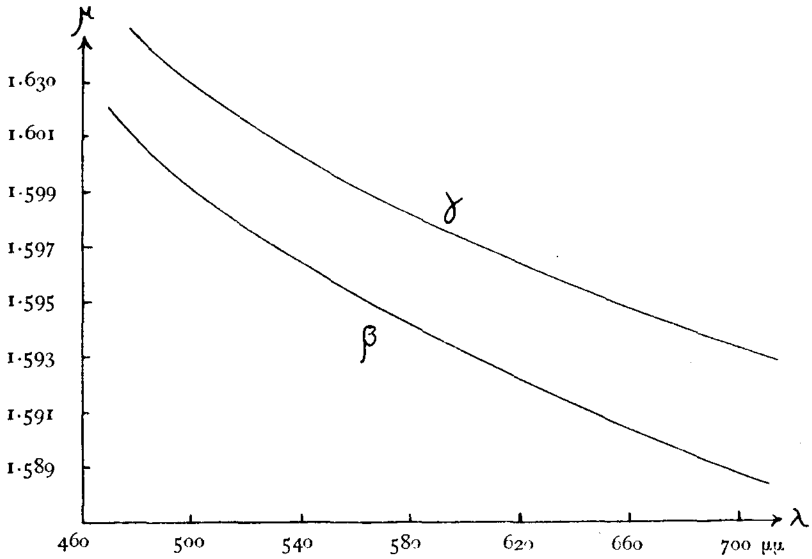

Fig. Dispersion of Double Refraction of Mica.

2 Measurement with a micrometer caliper gave additional support to the present method.