Directions for Using the Elliptical Compensator

Calibration for the Compensator No. .....

A.

Phase difference $\frac{\lambda}{4}$ for $\lambda =$ ..... mμ

B.

λ:	C 656 mμ	D 589 mμ	F 486 mμ	Daylight optical centre 550 mμ
T_0:	λ resp. mμ	λ resp. mμ	λ resp. mμ	λ resp. mμ

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Measuring Phase Differences and Retardations through the Analysis of Elliptically Polarized Light

A. Compensator with $\frac{\lambda}{4}$ plate

(Sénarmont's measuring method)

The method with $\frac{\lambda}{4}$ plate permits measurements up to a maximum retardation of λ. For this purpose an analyser with graduation (an attachable top analyser with some microscopes) and a light filter are required; the range of transmission of the latter should not be too wide and should contain the wave length given in the calibration table under A.

After moving the tube analyser to the position of extinction, the compensator is introduced into the tube slot, and by turning the head of the measuring drum it is similarly set exactly to extinction. These positions of the analyser and the compensator are read off from the corresponding scales and are noted once and for all as zero positions.

Carrying out the measurement: With the analyser and compensator in the zero position, bring the specimen to be measured exactly to the position of extinction and turn it from here exactly 45° in any direction. Turn the compensator drum a little, and observe in which direction of rotation of the knob the intensity of the area in the mineral specimen to be measured diminishes. Bring the compensator again exactly to its previous zero position, and turn the analyser to full extinction in the same direction of rotation as the head of the compensator.

Let the necessary angle of rotation of the analyser be σ

then the phase difference of the two waves in the specimen is

$$\delta = 2\sigma$$

and the retardation of the two waves in the specimen

$$\Gamma = \frac{\sigma}{180}\lambda$$

B. Compensator with extremely thin plate

(Brace's measuring method)

The method with an extremely thin plate (approx. $^1/_{10}\,\lambda$ to $^1/_{30}\,\lambda$) only permits measurement of very small retardations, at most up to the retardation of the

compensator plate; but this can be done with greater accuracy than by method A. With measuring process B, it is also possible to use an ungraduated analyser; in most cases white light is adequate for such measurements.

The compensator is introduced into the tube slot between crossed polarizers, and is set exactly to the position of extinction by turning the knob of the measuring drum. The four possible positions are read off on the scale of the compensator and are noted once and for all as zero positions.

Carrying out the measurements: Set the compensator to one of the zero positions. Orient the specimen to be measured as accurately as possible to the position of extinction and turn it from here 45° in any direction. Turn the compensator drum in any direction to the position of maximum darkness. Let the difference between this position and one of the four zero positions be η, taking only the difference which is smaller than or at most equal to 45°. The retardation sought is then

$$\Gamma = \Gamma_0 \sin / 2\eta /$$

where Γ_0 represents the calibration values of the compensator under B, page 1.

If on turning the compensator, full extinction is not obtained, then the retardation in the specimen is already greater than that in the compensator.

C. Compensator with λ plate

(Combination of both measuring methods)

By this method the compensator can be used for a shorter wave length than a compensator with $\frac{\lambda}{4}$ plate, and for a few longer wave lengths than a compensator with a very thin plate, i. e. the measuring ranges of methods A and B are combined. But this compensator is particularly sensitive to strict monochromatic condition of the light and maintenance of the wave lengths given in the calibration. The use of light filters is no longer sufficient for this method.

Note: The accuracy of these measuring methods is considerably increased through the use of a half-shadow eyepiece with top analyser. For this purpose we recommend Wright's eyepiece with Macé de Lépinay's half-shadow wedge.

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