8.1 Polarized Light Microscope

8.1.1 Introduction

Compensator plates of known optical properties can be inserted into the optical path of a polarizing microscope to help determine optical information about a specimen. The compensator devise is inserted into the accessory slot which is located between the objective lens and the analyzer of the polarizing microscope. The slot is oriented 45º away from the polarizer and analyzer and is not rotatable. The specimen orientation is changed by stage rotation.

The following compensator plates are commonly found in the Microscopy Section.

- The quarter-wave plate (¼λ) (140 nm ± 20 nm)
- The full-wave plate (λ) (560 nm ± 25 nm)

8.1.2 Safety Considerations

Standard Laboratory Precautions

8.1.3 Preparations

Köhler illumination

8.1.4 Minimum Standards & Controls

Köhler illumination must be set up before using the compensator.

The polarizer, analyzer and compensators must be in the proper orientation.

If measurements are made with an ocular scale, please refer to Microscopic Ocular Unit Calculation

8.1.5 Instrumentation

Polarized Light microscope

8.1.6 Procedure or Analysis

The quarter-wave and full-wave compensators work by aligning the slow direction of the compensator, indicated by an arrow on the device, with either the fast or slow direction the specimen.

To add retardation, the slow direction of the specimen must be parallel to the slow direction of the compensator. The quarter- and full-wave plates add a known constant amount of retardation. To subtract retardation, fast direction of the specimen must be parallel to the slow direction of the compensator. The quarter- and full-wave plates subtract a known constant amount of retardation.

By observing the resultant colors when adding or subtracting a known amount of retardation, and relating these colors to retardation values, in nm, on the Michel-Lévy chart, one can often determine the retardation, in nanometers, of the specimen with more precision than without the use of a compensator.

If the fast or slow directions of the specimen are not known, they can be determined by deciding whether addition or subtraction of retardation has taken place when a compensator plate is inserted between the specimen and the analyzer.

8.1.6.1 The Quarter-Wave Plate (¼λ) (147nm):

The quarter-wave plate, composed of a sheet of mica, has a known retardation value of 147 nanometers. This wave plate is useful for retardation determination in the second to fourth orders of retardation, where the addition or subtraction of a quarter wavelength of retardation is easily distinguishable.

8.1.6.2 The Full-Wave Plate λ (530nm)

The full-wave plate, composed of a piece of gypsum, has a known retardation of about 530 nanometers. This wave plate is useful in low orders of retardation (first to third) where the addition or subtraction of a full order is very distinctive.

8.1.7 References

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