Add-on: Homogeneity

General

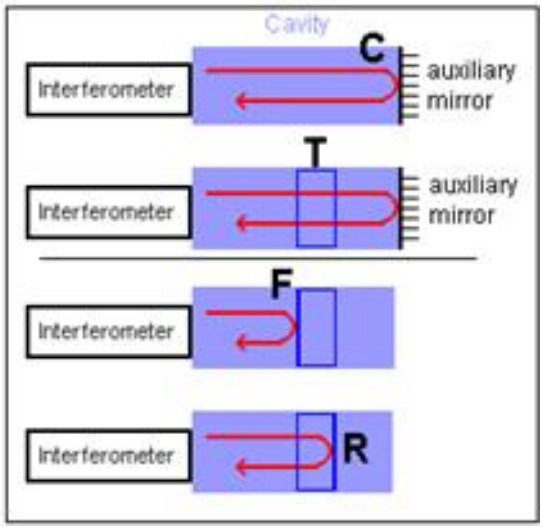
The described feature is available for µShape 4.5 and higher.

The module *Homogeneity* enables interferometric measurement of the homogeneity of transparent optical samples. The determination of sample homogeneity can be achieved with two different methods. The analysis is conducted in a separate process, the *homogeneity mode*. In this mode all measurements used for analysis can be displayed in addition to the homogeneity results. A reduced set of analysis functions is also available. The homogeneity analysis is offered as an add-on module.

1. Methods

Two methods are available. Both methods determine a variation of the refractive index and of the sample thickness by analyzing a set of measurements. The refractive index variation, often called the sample homogeneity, and the sample thickness variation are the two factors that influence the optical path through a sample.

Different arrangements of a cavity have to be measured for a homogeneity analysis. The cavity is constructed with the final plane reference surface of the interferometer and a plane auxiliary mirror. When using a Twyman-Green interferometer (e.g. µPhase®), the plane interferometer reference surface is a virtual surface defined by the plane test wave front generated by the test lens. The test sample is placed inside this cavity. It is mandatory that the sample and the auxiliary mirror are placed exactly in the same position and under the same alignment for all measurements, with the exception of the tilt. It is therefore not permitted to rotate the test sample and auxiliary mirror, or shift them perpendicular to the optical axis.



A Twyman-Green interferometer should be calibrated ensuring that all used measurements take the calibration data into consideration.

Note: A wedge in homogeneity and/or thickness is not detected.

1.1. 4-Measurement Method

This method is also known as Polished Homogeneity Analysis Testing and requires four measurements (see "Methods"):

- measurement of the empty cavity , called cavity measurement C
- measurement of the sample in (double) transmission, called transmission measurement T
- measurement of the front surface of the sample, called front measurement F
- measurement of the rear surface of the sample measured through the sample, called rear measurement R

These four measurements allow to determine both parts independently influencing the optical path difference (OPD) introduced by the sample.

1.2. 2-Measurement Method

This method is a simplification of the *4-Measurement Method* and requires an additional assumption. The last two measurements of the *4-Measurement Method*, i.e. the front and rear measurement can be neglected. Instead it is assumed that only one of both parts is responsible for the measured OPD caused by the sample. Nevertheless both parts can be calculated at the same time.

This method is often used for measuring samples with non-optical surfaces using oil plates for index matching. In this case the oil plates belong to the cavity and have to remain in the test arm for the "empty" cavity measurement C.

Note: The results do not show the real conditions, when both parts (homogeneity and thickness variation) are calculated simultaneously. It is only shown how homogeneity could look like assuming that the sample has ideal surfaces and, alternatively, how the sum of both surface deviations (front and rear surface) looks like in case of a homogeneous refractive index distribution. To get the actual conditions you have to apply the 4-measurement method. If you are only interested in the optical effect of the measured sample and not in the individual parts, make a usual transmission measurement with a calibrated interferometer. The displayed wave aberration shows the single-pass wave aberration of the sample.

If you need more information don't hesitate to contact us at software@trioptics-berlin.com.