

Thermal Stability of the 157 Series Optical Thickness Gauge

Accurate thickness measurements are critical in the development and manufacture of materials such as ophthalmic lenses, glass tubing, medical membranes, and plastic films. The 157 Series Optical Thickness Gauge from Bristol Instruments measures the thickness of these transparent and semi-transparent materials to an accuracy of $\pm 0.1 \mu\text{m}$ and with an exceptional repeatability of $\pm 0.02 \mu\text{m}$. This performance is guaranteed over specified operational environmental conditions, including a wide operational temperature range of 15°C to 30°C.

Such environmental stability is a result of Bristol's proven optical interferometer technology, including the following important design factors.

- Measurements are continuously referenced to the wavelength of a built-in HeNe laser, an intrinsic standard of length, that is independent of ambient temperature.
- The optical design maintains optimal alignment at all times, even with temperature changes.
- The optical path of the interferometer is in air and therefore its length is insensitive to changes in temperature, unlike competitive fiber-based systems.

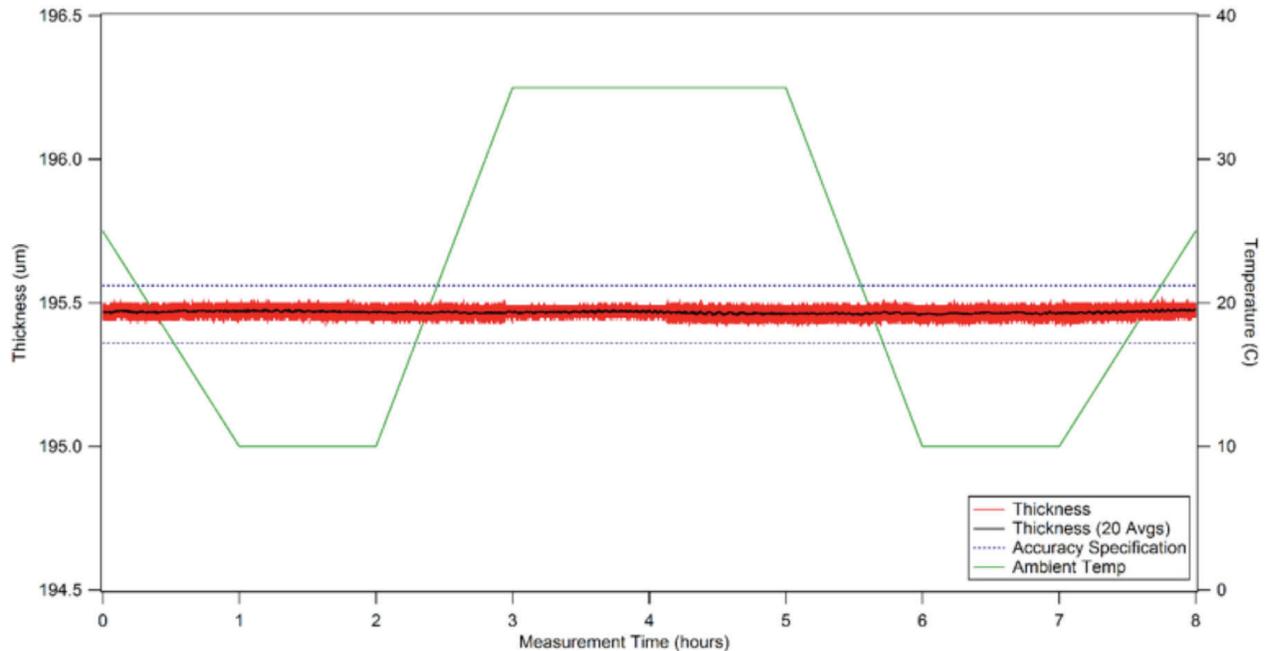
To demonstrate the thermal stability of the model 157, thickness measurements of a standard microscope slide coverslip were taken while the system's chassis was inside an environmental chamber. The optical probe was mounted perpendicular to the microscope slide coverslip, which was placed on an x-y stage fixture, as shown below. This fixture assembly was located outside of the environmental chamber.



The temperature of the environmental chamber was cycled from 10°C to 35°C, a range that exceeds the specified operational temperature range of the 157 Optical Thickness Gauge. Measurement data was transferred to a PC and logged for further analysis.

TECHNICAL NOTE 001-M - THERMAL STABILITY

The following graph shows the measured thickness over a period of about eight hours. Even a dramatic temperature change of 25°C does not affect the measurements made by the model 157. Every measurement taken over the eight-hour period, shown in red, is well within the specified accuracy limits of $\pm 0.1 \mu\text{m}$ given by the blue dashed lines. What's more, the measurement repeatability, or standard deviation, over the eight hours of testing is $0.011 \mu\text{m}$ (no averaging), also well below the 157 system's specified repeatability of $\pm 0.02 \mu\text{m}$.



The 157 Optical Thickness Gauge provides the most accurate, reliable and stable measurement of material thickness. Such unmatched thermal stability is one of the reasons why the 157 Series Optical Thickness Gauge will provide greater confidence in your test results.