EXICOR®

BIREFRINGENCE MEASUREMENT SYSTEMS

TECHNICAL PRODUCT BULLETIN

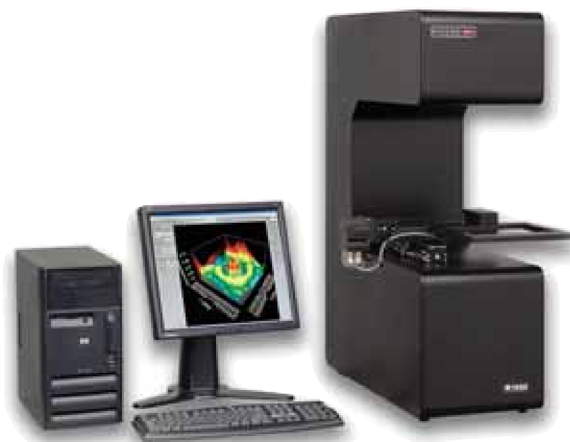
Birefringence Measurement Systems

150AT A System for Measuring Low-level Birefringence in Optical Materials

Under development for several years, Hinds Instruments' new Birefringence Measurement System has applications in optical component characterization, manufacturing, and quality control. The turnkey system maps low levels of retardation in optical elements, including scientific grade optics, industrial glasses, laser optics, and optics.

LEADING EDGE SENSITIVITY AND REPEATABILITY

Using Hinds Instruments' patented Photoelastic Modulator (PEM) technology, the system provides the highest levels of birefringence sensitivity available today. In addition, the PEM provides high-speed operation, modulating at a 50 kHz rate. Leading edge sensitivity and repeatability easily provide subnanometer levels of birefringence measurement, now critical to many applications.



CAREFULLY DESIGNED FOR SIMPLE, STRAIGHT FORWARD OPERATION

An optical sample as large as 6" x 6" (12" x 12" optional) can be characterized manually or automatically mapped and graphically displayed. Once a sample is placed on the translation stage, intuitive software guides the operator through the step measurement process. User interface software calculates the retardation value and angle and displays them in a variety of formats. The software also provides file management and calibration features.

SIGNIFICANT FEATURES

- Unprecedented sensitivity in low-level birefringence measurement
- Simultaneous measurement of birefringence magnitude and angle
- Precision repeatability
- High-speed measurement
- No moving parts in the optical system
- Automatic mapping of variable-sized optical elements
- Photoelastic modulator technology
- Simple, user-friendly operation

APPLICATIONS

- Quality control metrology
- Low-level birefringence measurements of
  - Plate glass
  - Scientific optical components
  - Laser crystals
  - DVDs
- Qualification of semiconductor photolithography components including
  - Calcium fluoride windows for operation at 193 nm and below
  - Fused silica optical components
  - Stepper reticles

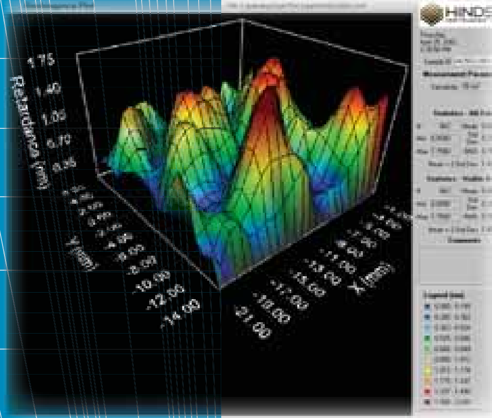
HINDS™ INSTRUMENTS

Birefringence Measurement Systems

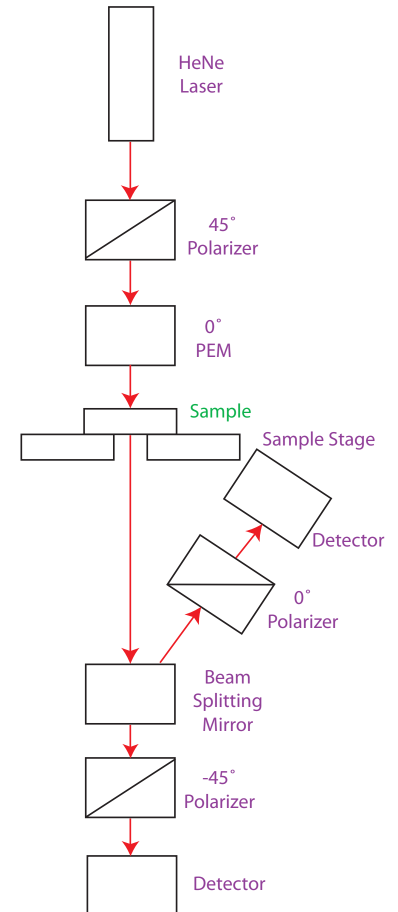
Exicor 150AT measures retardation integrated along an optical path through the optical sample under investigation. It is designed to measure and display both the magnitude and orientation of the retardation axis.

A unique design (patents pending) eliminates moving parts in the optical train and avoids the necessity to switch between measurement angles. A HeNe laser beam is polarized and then modulated by the PEM. The modulated beam is transmitted through the sample and divided by a beam-splitting mirror. Each beam passes through a combination of an analyzer, optical filter, and photodetector. The electronic signals are processed through a lock-in amplifier that provides very low level signal detection.

A software algorithm, developed by Hinds Instruments, converts the signal levels from the electronics module into parameters from which linear birefringence can be determined. The computer selects from two inputs, allowing sequential measurements from the two signal channels. The data is analyzed, and then retardation magnitude and axis angle are displayed and stored in a file. When operated in the automated mapping mode, the x-y translation stage will move the sample to the next predetermined measurement location. Results are displayed instantaneously in user-specified formats.



Birefringence map of CaF2 window



High Sensitivity Configuration

SPECIFICATIONS

	High Sensitivity	High Speed
Retardation Range	0.005nm to 100+ nm	0.005 nm to 300+ nm
Retardation Resolution/Repeatability[1]	0.001nm / ± 0.008 nm	0.001nm / ± 0.015 nm
Angular Resolution/Repeatability[1]	0.01° / ± 0.05°	0.01° / ± 0.07°
Measurement Time[2]	Up to 10 pps	> 60 pps
Modulation Frequency	50 kHz	50 kHz / 60 kHz
Wavelength[3]	632.8 nm	632.8 nm
Spot size	~ 1 mm typical	~ 1 mm typical
Demodulation Analysis Technique	Lock-in Amplifier	Wave Form Capture Card
Measurement Units	nm (retardation), ° (angle)	nm (retardation), ° (angle)
Scan Area[4]	150 mm x 150 mm	150mm x 150 mm

[1]Typical performance at 5nm Retardation
[2]Maximum data collection speed. Sample XY scan time dependent on stage movement parameters.
[3]Custom wavelengths available
[4]Custom stage sizes available

Hinds Instruments, Inc / 7245 NW Evergreen Pkwy / Hillsboro, OR 97124 / USA
T: 503.690.2000 / F: 503.690.3000 / sales@exicor.com / www.exicor.com
Exicor is a registered trademark of Hinds Instruments, Inc. Manufactured in USA under Patents and Patents Pending
Design and specifications subject to change without notice. © 2005-2008 Hinds Instruments, Inc. All rights reserved. Printed in USA