BIREFRINGENCE MEASUREMENT

EXICOR® PV-SI

AUNION TECH 昊量光电

PRODUCT BULLETIN

During the production of Si solar panels, stress in Si crystals often remains undetected long into the fabrication process. We describe a stress birefringence instrument for measuring Si ingots, either squared or as-grown, before they are sawed into wafers. When this instrument is used as a QC tool, low quality Si ingots or segments can be identified before subsequent processing costs are incurred. In addition, this instrument provides growers of Si crystals a tool with which to improve the quality of Si ingots so they can produce thinner wafers with low mechanical yield loss.

Hinds Instruments' **Exicor® Birefringence Measurement System PV-Si** is an extension of the work horse platform of the Exicor birefringence measurement system family of products. This system employs high quality, symmetrical photoelastic modulators, a 1550 nm laser, and a Ge avalanche photodiode detector to enable high accuracy birefringence measurements for Si materials used in both the photovoltaic and semiconductor industries. In addition to Si, materials such as sapphire, silicon carbide, zinc selenide, cadmium sulfide can also be measured with this system. The PV-Si Ingot model is robust and versatile, built to hold and measure a 500mm length of raw ingot up to diameters of 8 inches. The bench top design and intuitive automated scanning software make this product the best choice for material improvement R&D efforts and day-in-day-out evaluation of raw Si ingots as well as other high tech materials.

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 50 kHz. Leading edge sensitivity and repeatability easily provide sub-nanometer levels of birefringence measurement, critical to many applications.

DESIGNED FOR SIMPLE, STRAIGHT FORWARD OPERATION

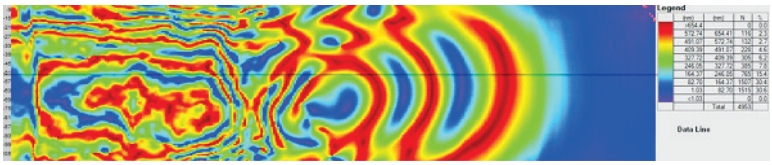
An ingot as large as 200 mm in diameter and 500 mm long can be characterized manually or automatically mapped and graphically displayed. Once a sample is placed on the translation stage, intuitive software guides the operator through the step measurement process. User interface software calculates the retardation value and fast axis angle and displays them in a variety of formats. The software also provides file management and calibration features.

Applications

- Quality control metrology
- Birefringence measurements of Ingots grown from semiconductor materials such as Si and GaAs

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



Retardation of Squared Si Ingot Segment

EXICOR® Birefringence Measurement Systems

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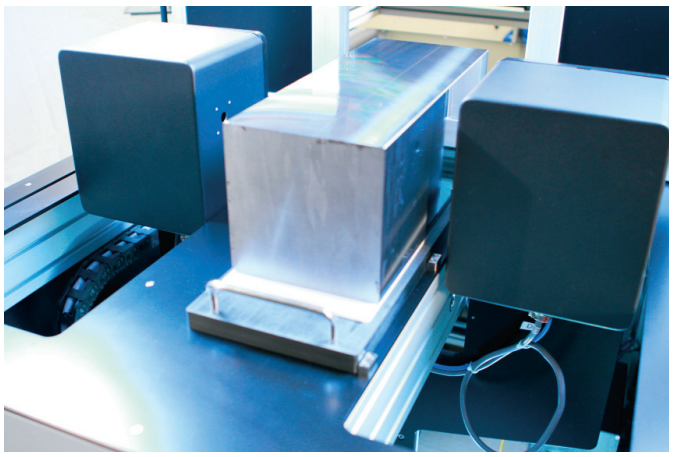
The Exicor PV-Si measures retardation integrated along an optical path through the optical sample under investigation. It is designed to measure and display both the magnitude and fast axis orientation of the sample's optical retardation. In this unique design the ingot remains fixed and the Exicor source and detector modules are moved by the PC-controlled stages. A 1550 nm laser beam is polarized and then modulated by the PEM in the source module. The modulated beam is transmitted through the sample and then passes through the detector module, a combination of a second PEM, an analyzer, and a Ge-APD photodetector. The electronic signals are processed through three lock-in amplifiers in parallel that provide 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 data is analyzed by the computer, and then retardation magnitude and axis angle are displayed and stored in a file. When operated in the automated mapping mode, the source and detector modules will be moved to the next predetermined measurement location. Results are displayed instantaneously in user-specified formats.



SPECIFICATIONS

	Extended Range ½ Wave Systems
Retardation Range, nm	0 to 775
Resolution / Repeatability	
Retardation, nm	0.1 / ±10nm, 1% thereafter
Fast Axis Angle	0.01° at ≥ 10nm
Measurement Rate/Time	Up to 100 pps
Spot Size	~ 2 mm typical
Sample Size	500 mm x 150 mm for squared ingots (standard, larger sizes available)
	length: 500 mm, diameter: 210 mm for as-grown ingots (standard, larger sizes available)

Specifications presented are based on 1550nm laser source unless otherwise noted. Custom wavelengths available for 850nm, 1064nm, 1310nm, and spectroscopic options.

Exicor PV-Si

Aunion Tech Co.,Ltd
Room2802, F Building, No. 86 Caobao Road, Shanghai 200235, China
Tel: +86-21-51083793 Fax: +86-21-34241962
E-Mail: info@auniontech.com Website: www.auniontech.com