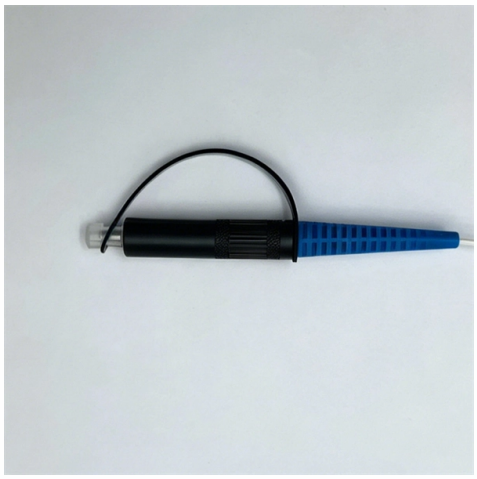
COETZER OPTICAL SYSTEMS (Pty) Ltd

Fiber optic sensor accurately detects thickness



Overview

This video was associated with the source search result. Verify technical details against current product documentation and project requirements.

Key Takeaways

Fiber optic sensors can measure film or coating thickness with sub-nanometer precision using interferometric techniques such as Fabry–Perot cavities and hollow-core fiber structures.Principles of Thickness Detection

Fiber optic thickness sensors operate by detecting changes in light properties—such as phase, intensity, or wavelength—caused by the presence of a thin film or coating on the fiber or substrate. Interferometric methods, particularly Fabry–Perot interferometers (FPIs), are widely used. In FPIs, a thin film forms a cavity between reflective surfaces, and as the film thickness changes, the interference pattern of reflected light shifts. By analyzing these shifts, the film thickness can be calculated with high precision .

Sensor Configurations
• Fabry–Perot Interferometer on Fiber Tip: A single-mode fiber (SMF) can be cleaved and placed in a deposition chamber, allowing the thin film to grow directly on the fiber tip. The cavity length of the FPI corresponds to the film thickness, and interferograms are analyzed using techniques like the Hilbert Transform to achieve nanometer-scale accuracy .

• Y-Shaped Optical Fiber: This configuration splits the light path, directing coherent light to the film surface and collecting reflected signals. The thickness is determined by measuring the wavelength difference between interference peaks and considering the film's refractive index .

• SMF–Hollow Core Fiber–SMF (SMF–HCF–SMF): A hollow-core fiber section is spliced between two single-mode fibers, and a thin layer is coated on the HCF surface. The anti-resonant reflecting guidance mechanism and transverse Fabry–Perot interference allow detection of sub-nanometer thickness changes, with high repeatability and low fabrication cost .

Advantages of Fiber Optic Thickness Sensors

• High Sensitivity and Resolution: Capable of detecting thickness changes down to sub-nanometer levels .

• Compact and Lightweight: Fiber probes are small, allowing integration into confined or harsh environments .

• Electromagnetic Immunity: Optical signals are unaffected by EM interference, making them suitable for industrial and laboratory applications .

• Real-Time Monitoring: Fiber sensors can track film growth dynamically, providing immediate feedback for deposition processes .

Applications

Fiber optic thickness sensors are used in semiconductor fabrication, optical coatings, functional material deposition, and surface roughness monitoring. They are particularly valuable where high precision, compact size, and resistance to harsh conditions are required .

Summary

By leveraging interferometric principles and specialized fiber structures, fiber optic sensors provide a highly accurate, compact, and versatile solution for thickness detection. Configurations such as FPIs on fiber tips, Y-shaped fibers, and SMF–HCF–SMF structures enable sub-nanometer resolution, real-time monitoring, and robust performance in challenging environments, making them ideal for both research and industrial applications .

Article Content

In-Depth Overview Fiber Optic Sensors in Thickness Measurement

A: Yes, fiber optic sensors can measure the thickness of transparent materials, provided that the material has a suitable index of

Thickness / Width | Selecting a Measurement Sensor

Thickness is measured by passing a target between two sensors. A newly designed optical system and dedicated jig allow for ultra

Fiber Optic Sensor

Fiber optic sensors are defined as sensing devices that utilize optical fibers to convert lightwave properties into information about the

Special Issue “Fiber Optic Sensors and Applications”: An Overview

This Special Issue seeks to bring attention to the most recent results in the field of fiber optic sensors offered by their unique features

A Novel Fiber-Optic Ice Sensor to Identify Ice Types Based on Total ...

Abstract To address the issues of not accurately identifying ice types and thickness in current fiber-optic ice sensors, in this paper,

FLUORESCENCE AND FIBER-OPTICS BASED REAL-TIME

These practical limitations, despite the employment of state-of-the-art technology involving high quality optical filtering,

Precision Thickness Measuring Meter using Simple Optical Fiber Sensor

The development of a family of sensors to detect a wide range of energy fields by exploiting their effects on the optical

Fiber Optic Sensor

Abstract Fiber optic sensors represent an innovative technology for automated measurement of cable forces which are critical in

Fiber optic sensors and fiber optics | Baumer USA

Fiber optic sensors and fiber optics - limitless and customized The perfect solution with the fiber optics sensor toolbox Over 350

What is a Fiber Optic Sensor?

Outline The fiber optic sensor has an optical fiber connected to a light source to allow for detection in tight spaces or where a small

Fiber-optic sensor

Extrinsic fiber-optic sensors use an optical fiber cable, normally a multimode one, to transmit modulated light from either a non-fiber

Fiber Optic Sensor

This paper reviews the fiber optic sensors that have been developed and applied to measure cable forces, including fiber Bragg

Related Video Reference

This video was associated with the source search result. Verify technical details against current product documentation and project requirements.

Contact Us

Continue your research online:

Website: https://coetzerinvestments.co.za
Technical inquiry: https://coetzerinvestments.co.za/contact.html

This document is for preliminary research. Verify specifications against current standards, product documentation and project requirements.