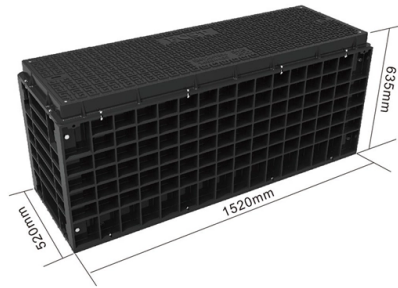


Thickness detection using fiber optic sensors



Article Overview

Fiber optic sensors can detect material thickness by measuring changes in light propagation, refractive index, or surface interactions, with high sensitivity and real-time capability.

Principles of Thickness Detection

Fiber optic sensors operate by guiding light through a core surrounded by cladding, where changes in the surrounding medium or material properties modulate the light signal. Intrinsic sensors detect changes directly along the fiber, while extrinsic sensors relay light to an external sensing element for measurement. Thickness detection often relies on refractive index variations, evanescent field interactions, or surface plasmon resonance (SPR) effects, which are highly sensitive to small changes in material thickness.

Sensor Types and Configurations

- Single-mode-multimode-single-mode (SMS) fibers: These structures enhance sensitivity by controlling modal interference. Adjusting the cladding thickness of the multimode fiber segment can optimize performance, balancing sensitivity, quality factor, and energy loss.
- Surface plasmon resonance (FOSPR) sensors: These sensors use a metal-coated fiber to detect thickness changes at interfaces, such as oil-water or air-oil layers. They provide real-time measurements with high repeatability and can detect thickn...

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Fig. 7. Fiber optic sensor configurations in biomedical engineering applications: intensity modulation using (a) fiber microbending

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