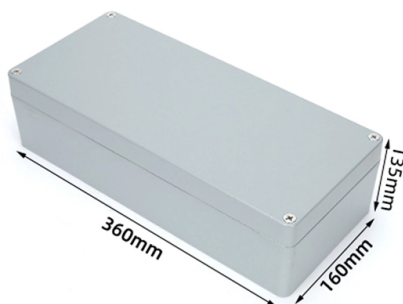


Dual-core fiber optic grating



Overview

Dual-core fiber We have developed and successfully fabricated a novel dual-core fiber (DCF)-assemble long-period fiber grating (A Optimizing photonic device.

Key Takeaways

A dual-core fiber optic grating is a fiber device where identical gratings are inscribed in two parallel cores within a single fiber, enabling optical coupling and advanced sensing or communication applications. Structure and Fabrication

Dual-core fiber gratings consist of two cores embedded within a single cladding, each capable of guiding light independently. Gratings, such as long-period gratings (LPGs) or fiber Bragg gratings (FBGs), can be inscribed in each core using techniques like point-by-point high-frequency CO₂ laser irradiation. This method allows precise control over the grating period and depth, producing strong and reproducible optical responses in both cores (Wang et al., 2018) .

Optical Coupling and Performance

The dual-core configuration enables inter-core optical coupling, where light propagating in one core can transfer to the other through the grating. Experimental studies have demonstrated peak coupling efficiencies up to 48%, with distinct attenuation peaks in each core, allowing selective wavelength filtering or signal routing (Wang et al., 2018) . This coupling can be tailored by adjusting the grating parameters, core spacing, and refractive index profiles.

Applications

- **Sensing:** Dual-core fiber gratings are highly sensitive to strain, temperature, and bending, as the differential response between the two cores can be measured precisely. This makes them suitable for structural health monitoring, curvature sensing, and shape reconstruction in three-dimensional space (Optromix) .
- **Communication:** In optical communication, dual-core gratings can serve as spatial division multiplexing devices, enabling multiple independent channels within a single fiber. They can also be integrated with few-mode fibers to achieve mode and core multiplexing, significantly increasing transmission capacity (MDPI, 2024) .
- **Fiber Couplers and Filters:** By exploiting the inter-core coupling, dual-core gratings can function as fiber couplers, wavelength-selective filters, or splitters, useful in photonic circuits and sensor networks (Wang et al., 2018) .

Advantages

- **Enhanced sensitivity:** Differential measurements between cores improve detection accuracy.
- **Compact design:** Two cores in a single fiber reduce the need for multiple fibers.
- **Multiplexing capability:** Supports simultaneous sensing or communication channels.
- **Robustness:** Less susceptible to environmental interference compared to single-core fibers.

Summary

Dual-core fiber optic gratings combine the benefits of multi-core fiber technology with the precision of fiber gratings, enabling efficient optical coupling, high-sensitivity sensing, and advanced communication applications. Their fabrication and design flexibility make them a versatile tool in modern photonics, particularly for distributed sensing, shape reconstruction, and high-capacity optical networks (MDPI, 2024; Optromix) .

Article Content

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We have developed and successfully fabricated a novel dual-core fiber (DCF)-assemble long-period fiber grating (A

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Fiber Bragg Grating Inscribed in Dual-Core Photonic Crystal Fiber

Zhang and Peng proposed a fiber Bragg grating inscribed in a dual-core photonic crystal fiber. 18 This type has

Micro-scale measurement device and method adopting dual-core optical ...

A dual-core fiber grating probe microscale measurement device and method based on a fiber ring laser belongs to the technical field

Fiber coupler based on dual-core fiber long-period grating

The use of long-period gratings (LPGs) to distribute optical power from one core to all the cores in a multicore fiber

arXiv:2407.14432v1 [physics.optics] 19 Jul 2024

D grating couplers with a coupling angle of 10. In order to match the diffracted mode field size with the optical field in a single-mode

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In this work we report on a fiber grating fabrication platform suitable for parallel fabrication of Bragg grating arrays over

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