

Fabrication of Fiber Couplers Using the Fusion Taper Method



AI Overview

Fiber couplers can be fabricated using the fusion taper method by heating and elongating optical fibers to form a biconical taper, enabling controlled optical power splitting or combining.

Overview of the Fusion Taper Method

The fusion taper method involves placing two or more stripped optical fibers in close contact, heating the contact region, and simultaneously pulling the fibers to form a tapered, fused section. This process creates a fused biconical taper (FBT) coupler, which allows light to transfer between fibers with a controlled coupling ratio. The method is widely used in telecommunications, fiber lasers, and specialty fiber applications.

Traditional Flame-Based Fabrication

Historically, FBT couplers were fabricated using a hydrogen or oxybutane flame as the heat source. The fibers are twisted or aligned in parallel, heated, and pulled while monitoring the output power at the coupler ports. Pulling is stopped once the desired coupling ratio is achieved. Limitations of flame-based methods include temperature fluctuations, contamination from combustion by-products, and environmental sensitivity, which can affect taper uniformity and device performance.

Modern Laser-Based Fabrication

Recent advances use CO₂ lasers as a precise, point-like heat source. The laser can be scanned along the fiber to produce linear or exponential taper transitions with high uniformity. This approach allows:

- Precise control of taper waist and shape, improving coupling efficiency and reducing excess loss.
- Automation of the pulling and heating process, including real-time monitoring of output power to achieve the desired splitting ratio.
- Reduced contamination compared to flame-based methods.

Two main laser-based approaches are used:

- Scanning laser beam:** The laser is moved along the fiber using galvanometer mirrors to create a uniform heat zone.
- Diffraction optical element (DOE):**

Article Content

Application of fused tapering optical fiber coupler in mode selective ...

In recent years, with the continuous refinement of fabrication technology, the high-precision emerging applications of fused tapering optical fiber couplers, such as mode conversion

Figure 5

Abstract: Fused couplers are made by joining two independent optical fibers, which work on the basic principle of coupling between parallel optical waveguides. The fabrication process and the

An optimum approach for fabrication of low loss fused fiber couplers ...

Most of the studies on the taper angle or taper shape in fiber couplers have been carried out using simulations to provide an accurate model. However, there is still limited information

Fused biconical taper fiber optic coupler station and fabrication ...

Biconical-taper fiber optic couplers are well known in the art. The performance of a coupler is judged principally by the criteria of uniformity of distribution from the input fiber to the output fibers and the

Carbon Dioxide Laser Fabrication of Fused-Fiber

We report the development of a fiber taper and fused-fiber coupler fabrication rig that uses a scanning, focused, CO (2) laser beam as the heat

Reproducible Method for Fabricating Fused Biconical Tapered

We describe two prototype manufacturing process that produces low-loss fibre tapers and fused FBT coupler devices using CO₂ lasers as the heat source instead of a flame, as is the norm in modern

Design of fusion cone type fiber coupler based on few-mode fiber

This article details the design, simulation, fabrication, and testing of a fused-tapered few-mode fiber coupler, specifically an SMF-Six-MF coupler, to efficiently generate first-order orbital angular

Eindhoven University of Technology MASTER Fabrication of

MASTER Fabrication of polarization-maintaining and polarization-splitting optical fiber couplers using the fused-biconical taper technology

Fabrication and modeling of fused biconical tapered fiber couplers

This article describes a model and the process technology of realizing fused fiber coupler-based branching components through the use of an experimental setup of a PC-controlled fabrication

An efficient taper shape model for fused optical fiber

Using this fabrication method, we propose in this paper a precise model for predicting the shape of thermally tapered fibers and for analyzing the

Fiber Couplers Fabrication and Modeling of Fused Biconical Tapered ...

Fabrication and Modeling of Fused Biconical Tapered Fiber Couplers BISHNU PAL a
aPhysics Department, Indian Institute of Technology, New Delhi, India Published
online: 21 Jun 2010.

Micro displacement sensing based on fused taper fiber coupler

In this study, a new micro displacement measurement method based on single-mode fiber combined with taper drawing technique was proposed. A new type of micro displacement sensor was

Fused biconical taper fiber optic coupler station and fabrication ...

The fibers are bound together about 1 cm apart. An oxy-propane torch is used to heat the fibers so that they fuse together. At the same time, the two relatively movable translational stages to

Precision in Fiber Fusion: Advances in FBT Machine

Fused Biconical Taper (FBT) is a fabrication process where two or more optical fibers are twisted together, heated, and fused to create a coupling

Precision in Fiber Fusion: Advances in FBT Machine

At the heart of many fiber-optic systems lies FBT (Fused Biconical Taper) technology, a method used to create optical couplers, splitters, and

Experimental measurement and numerical analysis of fused taper

For the light-wave guide, fused taper shape of fiber coupler has a significant influence on its optical performance. In the fabrication process, fibers are heated and fused by flame or other heating

Figure 5

Figure 5: 5: Fabrication of fused coupler: the basic fuse-pull-taper method For the fabrication of FBT couplers, a small section of an appropriately twisted pair of bare single mode fibers is fused laterally

Fused Fiber Couplers: Basic Theory and Automated

Fused couplers are made by joining two independent optical fibers, which work on the basic principle of coupling between parallel optical waveguides. The

Tech Note 26 How Fused Fiber Optic Couplers Work

Fiber Optics: How Fused Fiber Optic Couplers Work Introduction This technical note will describe how a fused optical fiber coupler works and how it is made. Once an understanding of this has been

Reproducible Method for Fabricating Fused Biconical Tapered Couplers ...

Fused biconic taper (FBT) couplers are essential elements in any fibre-optic communications network. We describe two prototype manufacturing process that produces low-loss fibre tapers and fused FBT

An optimum approach for fabrication of low loss fused

Abstract An optimum approach for the fabrication of low loss fused biconical taper couplers (FBTCs) is presented. The results show that the taper angle of the

Application of fused tapering optical fiber coupler in mode selective ...

In this study, a 3×3 microfiber coupler sensing structure is fabricated by the fusion taper technology, and the mode coupling distribution of its light energy is numerically simulated by the ...

An optimum approach for fabrication of low loss fused fiber couplers ...

Abstract An optimum approach for the fabrication of low loss fused biconical taper couplers (FBTCs) is presented. The results show that the taper angle of the device parameter is strongly

Taper-fused side pump combiner for all-fiber lasers and amplifiers: A ...

A taper-fused method, which is based on direct fusion-splice of one or several tapered pump fibers and a double-clad signal fiber, is one of the most potential methods because of its high

Figure 2. Fabrication process of fused tapered coupler:

This research focuses on the fabrication of 1×3 low-cost splitter based on polymer optical fiber (POF) and the characterization of the surface roughness on cross

Fiber Optic Couplers: Fused Biconical Taper Process

Learn how fused fiber optic couplers work using the FBT process. Understand energy transfer, bi-directionality, and WDM. Physics/Optics, College level.

Contact Us

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