

STUDY OF OPTICAL FIBER AND ITS USES

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ABSTRACT

Optical fiber is a device based on total internal reflection with the help of which the light signal can be carried over short or long distances through a crooked path with the same intensity. What is optical fiber? Where is it used and why is it used? Cosmic fiber is made up of very long and thousands of fine fibers of high quality glass or quartz. The diameter of each fiber is approximately 0.0001 cm and the refractive index is 1.7. These fibers are coated with a thin layer of material with refractive index 1.5. When light is incident at a small angle at one end, it hits the inside of the fiber. The value of refraction angle is greater than the critical angle of the fiber with respect to the layer. Therefore, there is repeated internal reflection of light from the interface of the thin layer and the layer. As a result, in the end the light comes out with the same intensity as the other. Uses - (i) It is used as a light tube in medical and optical testing. With the help of optical fibers, the internal parts of the lungs and other parts of the body, which cannot be seen directly, are studied. (ii) They can be used for transmission of optical signals.

Keyword: - Optical fiber, Material, Hght, Lungs, etc.

1. INTRODUCTION

"Optical fiber is a device based on total internal reflection, with the help of which the light signal can be transported over short or long distances through a straight or curved path with the same intensity." Optical fiber works on the principle of total internal reflection.

Optical fiber (or simply fiber) is a fiber made of glass or plastic that can transmit light along its length. Nowadays they are being used extensively in communication because with their help the signal can be transmitted over long distances without any amplification. They are very little affected by any electromagnetic interference. Nowadays, optical fiber is used by telecommunication companies to transmit signals, for internet communication and mobile phone signals etc. Optical fibers guide dielectric waves and are equipped with electromagnetic barriers and radio frequency barriers. It is also used in transmitting and acquiring electrical signals by converting them into optical signals. In fact, optical fiber is a cylindrical dielectric waveguide which transmits light in the direction of its length. In this process there is total internal reflection of light. When the optical fiber has to be finally connected to some device, an optical fiber connector has to be used for it. These connectors are usually of standard types like FC, SC, ST, LC, or MTRJ etc. To connect the two ends of optical fibers together, either connectors are used or they are joined by splicing process to form a continuous waveguide. Fiber optics is a new device related to information and communication system, under this system optical fiber is used instead of electrical energy to send information from one place to another.

This system works on the principle of total internal reflection of light. These optical fibers are made of silica oxide and their size is very fine. In this technology, information is converted from sound energy into light rays and transmitted through these silica tubes.

In this technology light waves are used instead of electricity.

Through this technology, information flows very rapidly.

The raw material for making optical fiber i.e. silica oxide is available in abundance and it is an environment friendly technology.

This technique is cheap and error free.

Their use has become quite popular in the field of medicine, industries and telecommunication.

In the field of medicine, earlier surgical incision was made in a particular area or part of the body to remove or destroy various infectious organs from the body. With this technology, it has become possible to destroy the infectious organ by introducing laser beam into the body, and there is no need for any kind of dissection.

1.1 Types of Fiber Optics

There are many types of fiber optic networks, but they all start with fiber optic cables that provide fiber optic network connections from a network hub near the home or directly to you. The fastest fiber optic

network is called Fiber to the Home (FTTH) or Fiber to the Ground (FTTP) because it is 100% fiber optic and refers to fiber optic cables installed at terminals that connect directly to homes and buildings. Home and team. Fiber to the curb (FTTC) is a part of the fiber optic connection as fiber optic cables connect to the sidewalk near homes and businesses, while copper cables carry a light red path. Similarly, fiber to the premises (FTTB) is a fiber optic cable that connects to a point on a common property, with a different cable connecting to the office or other area.

2. PROCEDURE

When light is incident at a small angle at one end of the fiber, it starts passing inside the fiber. It undergoes repeated total internal reflection from the interface of fiber and cladding because the angle of incidence is greater than the critical angle. In this way, many times after total internal reflection the light finally comes out from the other end with the same intensity.

3. DESCRIPTION OF MAJOR PARTS OF OPTICAL FIBER.

Optical fiber has three parts.

1. core
2. Cladding
3. Protective jacket

1. Core – The central part of the optical fiber is called core. It is made of glass or plastic having uniform refractive index.

2. Cladding - Above the central part there is a layer of material of refractive index less than the refractive index of the core, which is called cladding.

3. Protective jacket – The outermost cover or layer in optical fiber is called protective jacket. It is made of insulating material.

4. USES OF OPTICAL FIBER

1. Optical fiber can be used to transmit optical signals.
2. Optical fiber can be used to carry laser rays inside the body for medical purposes.
3. Electrical signals can be converted into optical signals and used for their transmission.
4. It is used as a light tube in medical and optical testing.

Optical fiber

A TOSLINK optical fiber audio cable is illuminated at one end

Optical fiber (or simply fiber) is a fiber made of glass or plastic that can transmit light along its length.

Nowadays they are being used extensively in communication because with their help the signal can be

transmitted over long distances without any amplification. They are very little affected by any electromagnetic interference.

Communications

Nowadays, optical fiber is used by telecommunication companies to transmit signals, for internet communication and mobile phone signals etc. Optical fibers guide dielectric waves and are equipped with electromagnetic barriers and radio frequency barriers. It is also used in transmitting and acquiring electrical signals by converting them into optical signals.

Detector

Other uses

In illumination applications

For medical use - to carry light through a crooked path to a hard-to-reach place inside the body.

For endoscopy

For decoration

Working principle

Total internal reflection of light

In fact, optical fiber is a cylindrical dielectric waveguide which transmits light in the direction of its length. In this process there is total internal reflection of light.

To join fibers together or with a device

ST fiber connector connected to a multimode fiber

When the optical fiber has to be finally connected to some device, an optical fiber connector has to be used for it. These connectors are usually of standard types like FC, SC, ST, LC, or MTRJ etc.

To connect the two ends of optical fibers together, either connectors are used or they are joined by splicing process to form a continuous waveguide. Splicing work can be done in two ways -

Arc fusion

Mechanical Splicer (This is suitable for quick work)

Some advantages of using optical fiber are given below

- Optical fiber weighs less
- There is minimum loss in it hence power consumption is less.
- It costs very little in the long run.
- Optical fiber is secure and keeps data private.
- It has large data transmission capacity.

- This does not cause any sparking or accidental accidents.
- Optical fiber does not emit any harmful electromagnetic radiation.

The applications and uses of optical fiber can be used(2):

- medical industry
- Communications
- protect
- Industries
- broadcast
- lighting and decoration
- mechanical inspection

Continuous Improvement:

Be faster: Technological developments that will increase data transfer.

Efficiency increase: Increase fiber optic performance and reduce signal loss.

Miniaturization: Creating thinner, modified optical fibers for a variety of applications.

Challenges:

Cost: Initial setup and installation can be expensive.

Fragility: possibility of damage during installation and maintenance.

Complexity: Requires special equipment for installation and maintenance.

Optical fiber research is constantly evolving with continuous research aimed at improving capabilities, improving performance and discovering new applications in many places.

5. CONCLUSION

Optical fibers are thin strips of glass or plastic used to transmit signals. They have a core through which light passes and are surrounded by a coating that keeps the light in the core as all internal reflections are protected by a layer. Fiber optics continues to evolve with ongoing research focused on improving performance, increasing efficiency, and generally discovering new applications and technology improvements.

Fiber optics has revolutionized communications and technology, becoming the backbone of world connections. They transform many industries and applications by effectively transmitting optical signals over long distances with low loss. They have become an important part of the Internet infrastructure with their high bandwidth, low latency and anti-interference features.

Medicine: State-of-the-art diagnostics and diagnostics with endoscopes and endoscopes. Photo equipment.

Detection technology: Temperature, pressure, etc. in the industrial field. It is used for accurate measurement of measuring sensors.

Defense, aerospace and industrial applications: Support critical communications, information and manufacturing.

Advertising and Entertainment: Transmission of quality sound and image quality.

Despite its advantages, challenges such as cost, fragility and need for special care remain. But continuous progress promises constant innovation and wider use, aiming to increase speed, efficiency and diversity.

As a result, fiber optics have become an important part of today's technology, supporting global connections, making information transfer faster and finding many uses in many aspects. Further advances are expected in the future that will strengthen fiber optics' position as the foundation of the digital age.

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