Optical Fiber

Asst. lecturer. Ahmed Kareem Sameer

Department of General Science

College of Basic Education\Haditha - Anbar University

An optical fiber is a flexible, transparent strand of very pure glass that acts as a light pipe to transmit light between two ends of the fiber and find wide usage in fiber-optic communications, where it permits transmission over longer distances and at higher bandwidths (data rates) than electrical cables. Optical fibers have a core surrounded by a cladding layer made of dielectric material. The optical signals in the core confined by establishing a refractive index that is greater than the cladding. A fiber optic cable can contain a varying number of glass fibers -- from a few up to a couple hundred.

Basic Structure Of An Optical Fiber

The basic structure of an optical fiber consists of three parts; the core, the cladding, and the coating or buffer as shown in figures.

Because they have three very big advantages over old-style copper cables:

1 -Less attenuation: (signal loss) Information travels roughly 10 times further before it needs amplifying which makes fiber networks simpler and cheaper to operate and maintain.

2 -No interference: Unlike with copper cables, there's no "crosstalk" (electromagnetic interference) between optical fibers, so they transmit information more reliably with better signal quality

3 -Higher bandwidth: As we've already seen, fiber-optic cables can carry far more data than copper cables of the same diameter.

The core is a cylindrical rod of dielectric material. Dielectric material conducts no electricity. Light propagates mainly along the core of the fiber. The core is generally made of glass. The core is surrounded by a layer of material called the cladding. Even though light will propagate along the fiber core without the

layer of cladding material, the cladding does perform some necessary functions .

The cladding layer is made of a dielectric material . The index of refraction of the cladding material is less than that of the core material. The cladding is generally made of glass or plastic. The cladding performs the following functions :

• Reduces loss of light from the core into the surrounding air

• Protects the fiber from absorbing surface contaminants

• Reduces scattering loss at the surface of the core

• Adds mechanical strength

For extra protection, the cladding is enclosed in an additional layer called the coating or buffer.

The coating or buffer is a layer of material used to protect an optical fiber from physical damage. The material used for a buffer is a type of plastic. The buffer is elastic in nature and prevents abrasions. The buffer also prevents the optical fiber from scattering losses caused by microbends. Microbends occur when an optical fiber is placed on a rough and distorted surface .

Optical fibers applications :

☐ Medical industry. Because of the extremely thin and flexible nature, it used in various instruments to view internal body parts by inserting into hollow spaces in the body. It is used as lasers during surgeries, endoscopy, microscopy and biomedical research .

☐ Communication. Telecommunication to copper wires, fiber optics cables are has major uses of optical fiber cables for transmitting and receiving purposes. It is used in various networking fields and even increases the speed and accuracy of the transmission data. Compared

☐ Defense Purpose. Fiber optics are used for data transmission in high level data security fields of military and aerospace applications. These are used in wirings in aircrafts, hydrophones for SONARs and Seismic applications .

☐ Lightening and Decorations. By now, we got a fair idea of what is optical fiber and it also gives an attractive, economical and easy way to

illuminate the area and that is why, it is widely used in decorations and christmas trees .

☐ Mechanical Inspections. On-site inspection engineers use optical fibres to detect damages and faults which are at hard to reach places. Even plumbers use optical fibres for inspection of pipes.

Keyword: optical fiber , optical wire.