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Review of Recent Development in Optical Fiber Technology

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ABSTRACT:Fiber optic technology is dominating the market from a long time due to its high data rate, long distance transmission capability. Fiber optic technology has been proven to be a much better technology than metal wires. Signal loss is less in fiber optic and they are unsusceptible to interference. Less latency is a main requirement in many applications such as financial algorithmic trading and cloud computing, supercomputers. Fiber optics are used as data transmission medium in most of the telecommunication networks. Following are the area that are wieldy developed in the past decade: (1) material used in fabrication of fiber is silica, but now a days materials such as chalcogenide glasses, fluoroaluminate crystalline materials, fluorozirionate materials are used that will give larger infrared wavelength along with better transmission capability. (2) Fiber optic sensor field has shown remarkable development in the past few decade. Better sensor quality assure better reception of data. (3) New developments come to light in terms of technological aspect such as free- space technology.

KEYWORDS: Fiber optics, silica, chalcogenide, fluoroaluminate.

I.INTRODUCTION

Fiber optics has become a part of our telecommunication network now a days. Low loss optical transmission of data becomes a key aspect in optical communication technology success. Performance of communication system depend on signal to noise ratio (SNR) of bandwidth and received signal and this concept is called as channel capacity. Use of single mode fiber (SMFs) in the passive optical splitters was proposed for optical networks. Fiber-to- home network is the next generation network. First fiber optic amplifier was introduced in 1990. To avoid regeneration, amplification is done by using fiber optic amplifier so data signal could travel hundreds of kilometres. Wavelength division multiplexing is issued to improve transmission capability of optical network.Acoustic communication has many shortcomings in different environments such as shallow water and the only solution to overcome this shortcoming is optical underwater communication. The only reason optical communication is more successful is because optical signals are much faster than electrical signals. New developments have come into play where optical standards generate highly coherent optical carriers for transmitting purpose. Now a days fiber optic networks are played out on international scale where fiber optics transmit light which is modulated by electrical signal form an atomic clock.
This paper is design in following order. Section II represent description and assessment of fiber optic. Section III represent recent development in fiber optic communication. Section IV represent discussion and comment on fiber optic technology.

II.DESCRIPTION AND ASSESSMENT OF FIBER OPTIC

Fiber is nothing but the filament of molten silica glass. The medium of data transfer is light in fiber optic cable. Speed of light is 299792458 m/s, so data will transfer at much higher speed and that's why fibers are replacing conventional metal wire. This will severely increase their transmission frequency. Optical fiber is made of low-loss materials, it is a cylindrical dielectric waveguide. Research on fiber optics was started back in 1975. Back then it was made of highly chemical purified silica glass. Refractive index of core is slightly higher than refractive index of cladding. Light travels through the fiber because of internal reflection. Light that travels through the fiber carries information such as in

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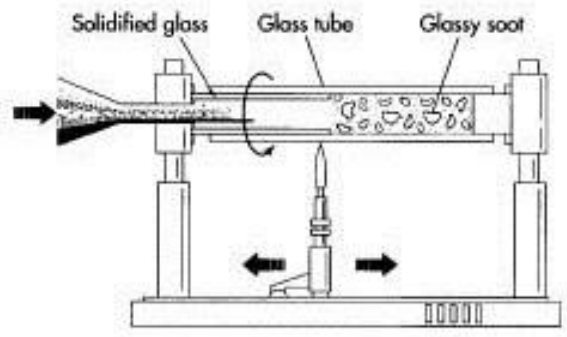
electrical transmission copper conductor carries information. In 1980 fiber optics was used in commercial applications, this fiber that was developed eliminated limited capability (100 Mb/s) transmission problem.

The reason, why fibers have a small diameter is because they fiber is covered with protective coating and they are much smaller than copper wire. Fibers are chemically purified glass so that's why they can be used in electrically hazardous environments. Data transmission in fiber optics take place at 99.7 % of the speed of light in vacuum. This light which travels in fibers, do not radiate therefore provide signal security.



Chemical vapour deposition

Modified vapour deposition technique is used in fiber optic. This technique is used for first layer deposition in which different chemical vapours and oxygen is combinely applied. In the result of this process multiple thick layers are created on the surface. Because thickness of layers is different light travels at different speed in optical fiber. The oxygen that we used or other material like chemical vapours is has to be pure. Any impurity will be result in losing energy.

III.RECENT DEVELOPMENTS IN FIBER OPTIC COMMUNICATION

There have been many developments occurring in fiber optic communication field in various aspects, some of them are as follows.

A. Material used in fiber optic cable

Along with silica, chalcogenide, fluoroziconate, fluoroaluminate are the materials which are used for fabrication of the fiber. Sapphire gives longer wavelength in all materials. Following are the few developments occurring in material wise fabrication of fiber fluoride glass and is composed of fiber fluorides of different metals. These are non-oxide optical glasses with low viscosity. Optical glasses with low viscosity. Optical attenuation of fluoride glasses is very low. Silica is the material which is used in most of the fiber.It is chemically purified and has very low absorption loss. Silica has high transmission range, but main property of silica which makes it highly efficient is that it can be doped with various materials such as aluminium oxide, germanium dioxide. Chalcogenide glass is made of one of chalcogenide which is an extremely versatile compound. Phosphate glass is fabricated from metaphosphates of various metals which have high concentration doping.

Though silicon dioxide (Sio_2) is the key material in fiber optic, but some time the core of the fiber is made of phosphorus oxychloride ($Poc1_3$). Fiber can also be made of germanium tetrachloride ($Gecl_4$). The material that we us is determine the degree of attenuation, which is the most important characteristic in the fiber optic communication. Higher the degree of attenuation will resulting in transmission of discrete light wave signals.

B. Sensor development

Fiber optic sensors are used as a sensing element in optical fiber communication. They can vary the intensity of light. Intrinsic sensors are developed to provide distributed sensing over large distance. Main job of these sensors is to measure temperature, strain, pressure and other quantities. Fiber optic temperature sensor are used in industrial monitoring applications. But the main purpose is to collect temperature data and gain experience of implanting. Tip

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covered sensor which is also known as point sensor which is used in such application where fiber comes in contact with reactive chemical element because chemical change can lead to change in the fiber. Fiber optic sensors are used as a sensing element in optical fiber communication. They can vary the intensity of light. Intrinsic sensors are developed to provide distributed sensing over large distance. Main job of these sensors is to measure temperature, strain, pressure and other quantities. Fiber optic temperature sensor are used in industrial monitoring applications. But the main purpose is to collect temperature data and gain experience of implanting. Tip covered sensor which is also known as point sensor which is used in such application where fiber comes in contact with reactive chemical element because chemical change can lead to change in the fiber.

Extrinsic sensors are used to transmit modulated light from either electronic sensor or non-fiber optic sensor. They can reach the inaccessible places. They can also measure internal temperature. Extrinsic fiber optic sensors are very popular due to its capability of measurement signals without noise corruption. They are mainly used to measure velocity, acceleration, rotation, vibration, displacement, and temperature.

C. Developments in fiber technology

Current research in fiber optic communications in technological aspect is going on high altitude platforms (HAPs). HAP are airships which are situated above ground levels of 17 to 25 Km. to avoid strong atmospheric impact on a laser beam. HAP works as data relation in this technology. Other technology which is rapidly developing is free-space communication in which optical-communication links can be used for satellite – to – satellite crosslinks. This technology is ready for development. By using photon counting receivers physical link communication efficiency can be improved. Backhaul network and telecommunication switches used copper-fiber network which will give 50 mbps speed, which is high bandwidth. This network uses fiber optic cables which give them 450 meter of coverage, which is quite moderate coverage. Optical laser is the key element in fiber optic communication. This is the device that generate source of light. If wave length of laser is short that it can generate high output power. Sudden change in wavelength can be controlled by laser. There has been tremendous development in single mode laser in the recent past. Optical fiber can also use as temperature, strain, pressure sensor. Interfero-metric sensor is depend of phase change of light, it is the light wave propagate through fiber. Intension metric depend on transfer of power, amount of power transfer through Fiber is radial.

IV.DISCUSSION AND COMMENTS

Fiber optics is major aspect in the telecommunication sector. Its low attenuation characteristics, low absorption loss characteristics and high bandwidth makes it ideal for higher bit transmission. Fiber optic chemical and temperature sensor are integrated and used for environmental monitoring and clinical application.Growth of fiber optics industry is going on increasing into next decade. In the next few decades fiber optic steps towards home applications. Now a days it is only used in industrial applications. Fiber optic technology is going to change our life and change the face of telecommunication.

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