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Abstract.

The introduction and development of optical fiber technology has largely influenced the rapid acceleration of communication efficiency over the last few decades. Having been proven to be much more capable than its metal predecessor, fiber optics can transfer data at higher bandwidth and longer distances. Since no electricity is involved, data transferred through fiber optics is less susceptible to signal loss and is completely waterproof. Given today's movement towards ultra fast communication, lower latency is of utmost importance, for applications ranging from algorithmic equities trading, advances in quantum computing, and the internet of things. With that said, we look to discuss areas in optical fiber technology that are being widely developed, including fiber composition and applications in sensing.

1. Introduction

Much like how metal wiring transmits data through electrons, fiber optics do so in the form of photons, or light particles, through thin strands of glass, which act as waveguides. This core is then surrounded by another layer of glass or plastic called cladding, which has a lower refractive index material compared to the core [1]. Data is transferred along the fiber by the principle of total internal reflection between the core and the cladding. Since the angle of the incident light is higher than the critical angle, light reflects back into the core and propagates along the fiber [2].

2. Recent Developments

For years, scientists have researched ways to reduce propagation loss in optical fiber technology. Silica has been shown to be one of the best materials, as it has very low absorption loss [3]. However, doping with other materials such as aluminum oxide and germanium dioxide increases the efficiency against the angle of incidence. However, recent research indicates that a hollow core (air as a medium instead of pure glass) has comparable attenuation properties as silica fibers [4]. Reminiscent of Rayleigh scattering loss, the scattering of light by the particles present in the atmosphere, this “air-guiding structure” looks to pave the way for innovations in quantum computing and laser power delivery.

Their lower than Rayleigh scattering loss in an air-guiding structure offers the potential for advances in quantum communications, data transmission, and laser power delivery.

3. Discussion and Comments

With society's movement towards a more interconnected body, ultra fast communication is becoming ever more important, hence any new developments in optical fiber technology are very impactful. As the world moves to integrate higher speeds from main channels to intersections with the home and local cabinets, we will continue to see not only improvements in our existing infrastructure, but new applications that are not yet imagined or realized. Therefore, this is an important field of study, from aspects of material science, physics, and electrical engineering.

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