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A Brillouin Athermal Optical Fiber (2012-082)

Sapphire-derived optical fiber that contains a Brillouin frequency that is immune to temperature.

Market Overview

Optical fibers are enablers of a wide variety of modern technologies. However, during use, optical fibers heat up and their performance can subsequently change. This form of thermal dependence is especially problematic for high energy fiber laser and optical fiber sensor systems. Currently, the market for optical fiber sensors is projected to be $4 billion by 2017 and experience a growth rate of 20.3%. The addition of alumina to the silica fibers can mitigate the thermal effects of the fibers. However, conventional methods severely limit the addition of alumina to silica. In order to solve this problem and take advantage of the optimal market environment, Clemson University researchers have developed a novel process that uses a molten-core technique to add sapphire (Al_2O_3) to silica (SiO_2) glass. Ultimately, this is an industry accepted and scalable manufacturing technique that allows for unstable glasses to be directly obtained in fiber form, creating an optical fiber that has a temperature independent acoustic spectrum. These fibers will substantially enable higher performance optical fibers and open the door to more market opportunities.

Technical Summary

Clemson University researchers have developed a molten-core technique to add sapphire (Al_2O_3) to silica glass. The addition of alumina to silica fibers greatly enhances the fiber's immunity to selected optical non-linearities. The core material is able to melt the temperature in which the cladding glass draws into the fiber. The high quench rates permit previously unrealizable core compositions to be directly obtained in fiber form. This invention accomplishes the formation of an optical fiber whose acoustic (Brillouin) spectrum is temperature independent, a characteristic that has never been previously validated.

Application
High energy fiber lasers; optical fiber sensors

Development Stage
Validated Prototype

Advantages
- Record low Brillouin scattering, eliminating one drawback of current high-powered systems by offering athermal acoustic Brillouin spectrum characteristics
- Low cost precursor materials, enabling scalability and competitive pricing for entry into new markets
- Utilizes a continuous process with high speed manufacturing that is compatible with existing commercial techniques, allowing for easy adaption and switch to this invention

App Type	Country	Serial No.	Patent No.	CURF Ref. No.	Inventors
Utility	United States	14/245,448	9,139,467	2012-082	John Ballato Peter Dragic

About the Inventors

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Dr. John Ballato is a Professor of Materials Science and Engineering and Director of COMSET, which is a South Carolina Research Center of Economic Excellence. He earned his Ph.D. in Ceramic and Materials Engineering from Rutgers University in New Jersey. Previously, Dr. Ballato served as the interim Vice President for Research. He has published more than 200 archival scientific papers, holds 25 U.S. and foreign patents, has given in excess of 125 invited lectures/colloquia, and has co-organized 25 national and international conferences and symposia. Dr. Ballato's primary research interests include new optical materials and structures for high-value photonic and optoelectronic applications.

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