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International Conference on

Laser, Optics and Photonics

August 23-24, 2018 | Paris, France

Hybrid structured photonic crystal fiber for terahertz applications

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Electromagnetic wave lying in between that of millimetre wave and Infrared ray in the frequency region of 0.1THz to 10THz has attracted the researchers for their wide spread application in the fields of sensing, biotechnology, imaging, security, pharmaceutical drug testing, spectroscopy and communication. But the biggest hindrance of its widespread development and commercialization material loss and propagation loss plays a vital role. Therefore, much research is conducted in this field for the development of ultra-low material loss Optical Fibers. In this letter a Kagome structured photonic crystal fiber for low-loss terahertz (THz) wave guiding has been designed and analyzed. A perfectly matched layer (PML) which is of 9% of the radius of the fiber has been used in the boundary to investigate the transmission characteristics. Most of the attention is given to the geometries of the fiber to increase the fraction of power transmitted through core air. The proposed fiber at the diameter of 420μm and porosity of 80% has shown ultra-low material loss of 0.0326 at relatively high frequency of 1.25THz. Properties like: Power fraction of the core air holes with respect to frequency and core diameter, responses of the effective material loss with respect to core diameter and frequency, confinement loss, dispersion have been reported and well discussed. The design can be fabricated following the existing fabrication technology. Due to the favorable wave-guiding properties of the proposed fiber, it can be anticipated that the proposed PCF can be applicable in polarized THz filters, sensors and multichannel communication.

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