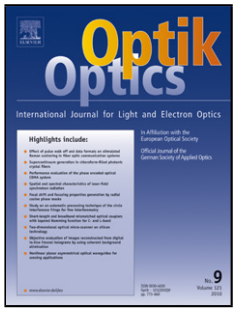

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Effect of Ethanol infiltration on the zero dispersion wavelength of Solid Core Photonic Crystal Fiber

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Abstract
In this paper, a hexagonal structure of ethanol filled solid core photonic crystal fiber having dispersion shifted properties is presented. The guiding properties, like effective mode area and dispersion, of the ethanol filled photonic crystal fiber are studied by using the full vectorial finite element method. The numerical simulation results show that the selectively filling of the ethanol in the cladding holes of photonic crystal fiber shifts the zero dispersion wavelength from near infrared region (0.98 μm) to mid infrared region (1.55 μm). This kind of photonic crystal fiber structure is very useful for dispersion compensating tool, sensing applications, fiber laser devices and non-linear applications like supercontinuum generation.

Keywords: Photonic crystal fibers; Fiber properties; Dispersion; Effective mode area; Ethanol.

1. Introduction

In recent years, Photonic crystal fibers (PCF) have been studied in a very large scale. They have some unique properties like dispersion shifting property, endlessly single mode property, very low confinement loss, high birefringence etc. which are not presented in the conventional optical fibers [1]. The PCF consists of core and microstructures cladding and ischaracterized by the size of the core, distance between two adjacent air-hole and diameter of the air hole. A very large number of different structures of the PCF have been designed and simulated theoretically and experimentally verified by the researcher [2-4]. PCFs with ultra-flat dispersion over a wide range of wavelengths have been studied by the researchers in last few years [5]. In addition to this, PCF with zero chromatic dispersion has been achieved by the study of dispersion flattened PCF [6, 7]. The previous studies involved adjusting the structural parameter of the PCF to design a dispersion shifted fiber.

Moreover, to control the optical, polarization and transmission properties of the PCF, many researchers haveused the air holes filled PCF completely or selectively with different type of liquids such as ethanol [8], water [9], liquid crystals [10, 11], and polymers [12-14]. In 2006, Gundu et al. presented a PCF with very low dispersion value(0 ± 1 ps/km/nm) over a bandwidth of about 400 nm. Two inner holes layers of this PCF have been filled with the same liquid[15].In addition to the controlling of the optical properties, such types of the PCFs filled with liquids, are used as a refractive index sensor, temperature sensor, magnetic field sensor and so on [16-19]. PCFs filled with liquids such as chloroform, water, CS_2 etc. have been used for the supercontinuum generation [20-22]. Liquid filled PCFs based tunable multi band pass filter have been recently presented by the researcher [23]. Fiber based polarizer have been experimentally achieved by using the ethanol filled PCF [24]. Interferometer based PCF sensor for the measurement of