International Journal of Engineering and Technical Research (IJETR)
ISSN: 2321-0869 (O) 2454-4698 (P) Volume-8, Issue-8, August 2018

Analysis of Refractive index Profile, Transmission Curve with minimization of Dispersion in $A_{S2}S_{e3}$ Photonic Crystal Fiber

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***Abstract*— The photonic crystal fibers have been widely used materials as a transmission medium for communication purpose. They have been proposed 2 decade back and now a day they have preferred highest among all other transmission medium. Mostly Silica photonic crystal fibers are in use as a material for the PCF. Silica is the purest form of SiO2 which is easily available from the sand as a raw material. Chalcogenide glasses show high refractive indexes for sulfide glasses. High refractive index yields high Fresnel refraction loss and the well-guidance of cladding modes, which are the two major problems related to the light injection into chalcogenide glass fibers. The refractive index (n) of a given glass is wavelength (k) dependent. Chalcogenide glasses are transparent from the visible to the near infrared region and can be moulded into lenses or drawn into fibres. They have useful commercial applications as components for lenses for infrared cameras, and chalcogenide glass fibres and optical components are used in waveguides for use with lasers, for optical switching, chemical and temperature sensing and phase change memories. Chalcogenide glasses comprehensively reviews the latest technological advances in this field and the industrial applications of the technology.**

***Index Terms*— Dispersion, Refractive index, Photonic Crystal Fiber, Pitch value, Core and Cladding**

I. INTRODUCTION

Photonic crystals are periodic optical nanostructures that are designed to affect the motion of photons in a similar way that periodicity of a semiconductor crystal affects the motion of electrons. Photonic crystals occur in nature and in various forms have been studied scientifically for the last 100 years. Photonic crystals are composed of periodic dielectric or metallo-dielectric nanostructures that affect the propagation of electromagnetic waves (EM) in the same way as the periodic potential in a semiconductor crystal affects the electron motion by defining allowed and forbidden electronic energy bands. Essentially, photonic crystals contain regularly repeating internal regions of high and low dielectric constant. The design of chalcogenide As_2Se_3 glass Photonic Crystal Fiber, which is used at 0.3 µm to 4.0 µm wavelength. The study on dispersion characteristic is done on this PCF. In standard silica fiber which is commonly used for PCF, light does not propogates beyond $\lambda = 2$ µm but in proposed design of chalcogenide As_2Se_3 glass Photonic Crystal Fiber the light propogates in wavelength region $\lambda = 2 – 11$ µm and thus in this wavelength they have important defense and biomedical applications.

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Proposed Design: The chalcogens are the elements of the group 16 of the periodic table, that is, oxygen (O), sulphur (S), selenium (Se), tellurium (Te), polonium (Po), and ununhexium (Uuh) [12]. Chalcogenide glasses are compounds based on some of these elements (sulphur, selenium, and tellurium) by the addition of germanium, arsenic, or antimony to create stable glasses, leading to a small tendency of crystallization, and devitrification. Some elements, such as P, I, CI, Br, Cd, Ba, Si or Ti, can also be added to achieve particular thermal, mechanical and optical properties [13].

The proposed structure of the fabrication of a chalcogenide As_2Se_3 glass photonic crystal fiber (PCF) with increased core diameter. As comparision with the normal PCFs in which silica glass is used as core material, the proposed PCF has following feature; firstly we have used the chalcogenide As_2Se_3 glass as core material in which the first ring area contains no air holes.

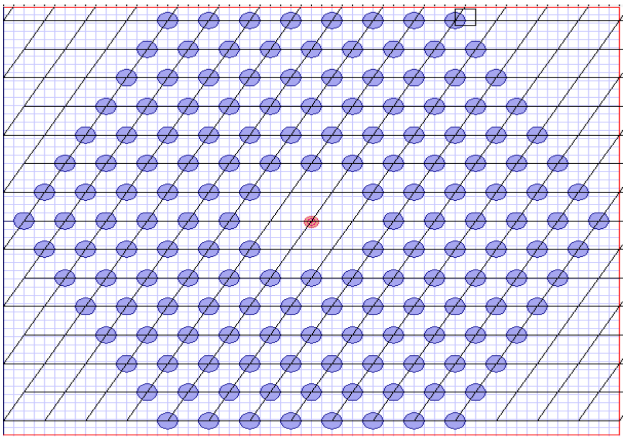

Figure 1: The structure of the proposed PCF

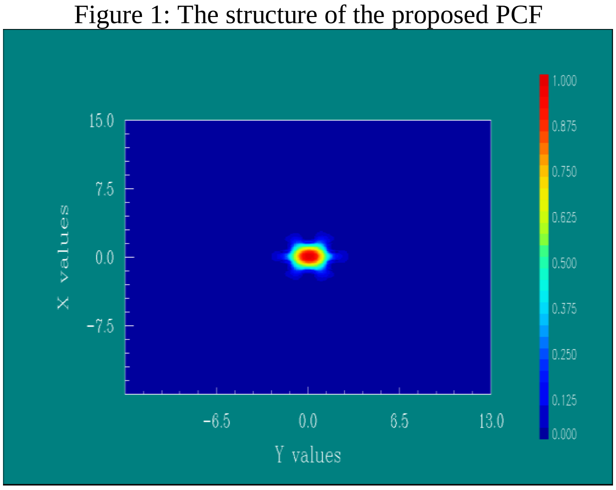

Figure 2: Simulated mode field of the PCF with ∧ = 2.0 µm and d = 1.0 µm at 2.4 µm.

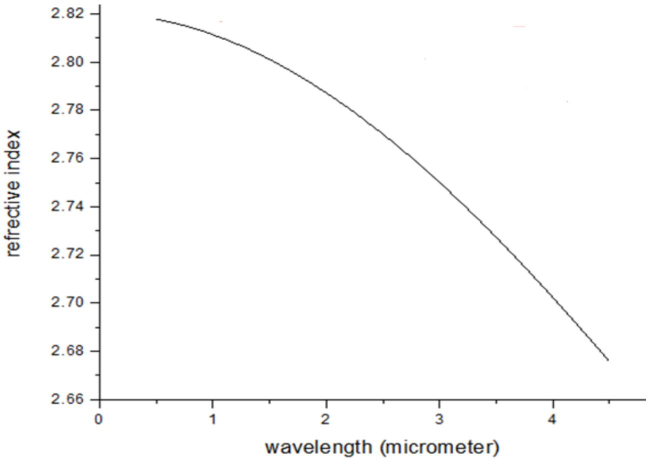

Figure 3: Refractive index Profile of proposed PCF.

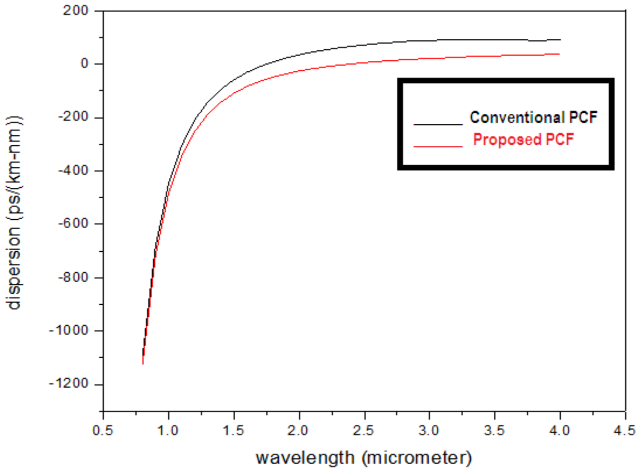

Figure 4: Variation of Dispersion profile of Chalcogenide Glass

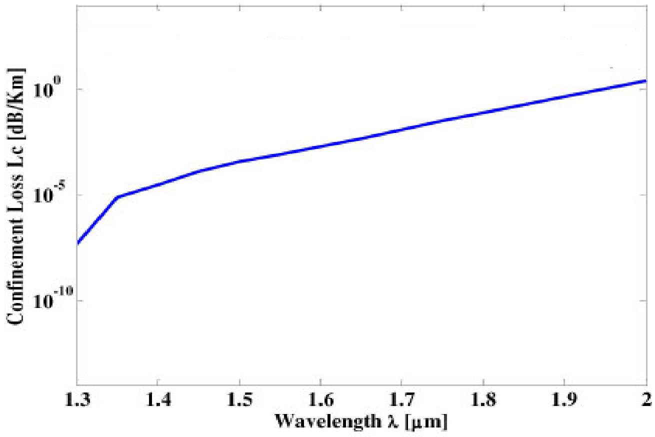

Figure 5: Variation of Confinement loss of Chalcogenide Glass

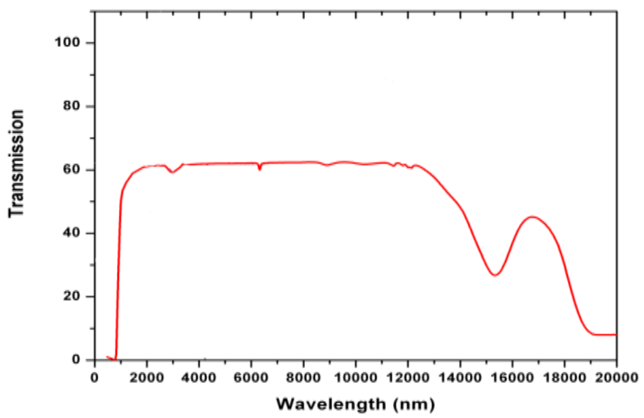

Figure 6: Transmission cure of chalcogenide glass

II. CONCLUSION:

we have proposed a novel structure of flattened and low dispersion of large core chalcogenide As_2Se_3 glass PCF compare to normal PCF structure. The features of the proposed PCF is that the center core is larger than that of conventional As_2Se_3 glass PCFs by removing seven air holes in core as compared to conventional As_2Se_3 glass PCF . The core material is used As_2Se_3 glass in both PCF. The large core structure makes the flat and near by zero chromatic dispersion compare to conventional PCF. Negative, positive and almost zero flat dispersions are also achieved by changing air hole diameter "d"while keeping pitch "∧" constant.

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