Numerical Analysis of Linear and Nonlinear Aspects of Chalcogenide Based Step-Index Fiber

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The field of nonlinear optics started with the advent of lasers in the early 1960s. It has grown enormously in recent years. Technological advances in fields like ultrafast phenomena, fiber optics, and optical communications have been closely linked to the growth of research in the field of nonlinear optics [1]. In ref. [2], the authors have proposed a designed for photonic crystal fiber in $Ga_8Sb_{32}S_{60}$ chalcogenide glass for mid-infrared (IR) non-linear applications.

In this work, we design and analyze a step-index optical fiber with $AsSe_2$ chalcogenide glass as core and As_2S_5 chalcogenide glass as cladding for nonlinear applications.

A numerical simulation was performed for the proposed step-index optical fiber in *COMSOL Multiphysics*® software to evaluate the effective propagating mode area, effective refractive index and dispersion profile in the fundamental mode for the complete range of transparency window of $AsSe_2$ core and As_2S_5 cladding glass materials. Further, the results are analyzed by calculating and plotting values of chromatic dispersion and nonlinear coefficient with respect to wavelength for different values of the radius ('*r*') of the core of the fiber.

From fig 1, it is observed that with the increasing value of '*r*', the flatness of the curve is controlled. Along with this, the zero-dispersion wavelength (ZDW) is shifted towards longer wavelengths for increasing the value of '*r*'. From fig 2, it is observed that the value of the nonlinear coefficient exponentially decreases with increasing value of wavelength for all values of '*r*'. Also, for shorter wavelengths, the value of nonlinear coefficient decreases with an increase in the value of '*r*'.

In the future, users can choose an appropriate value of '*r*' for fabrication of such step-index optical fibers and attain an ultra-broadband supercontinuum spectrum in the mid-infrared domain for their potential applications in optical coherence tomography, sensing and optical imaging.

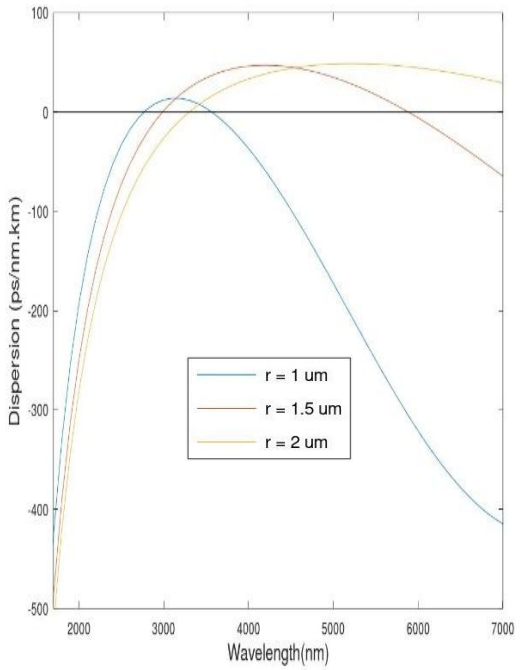

Fig. 1 Variation in chromatic dispersion with wavelength for different values of radius of core.

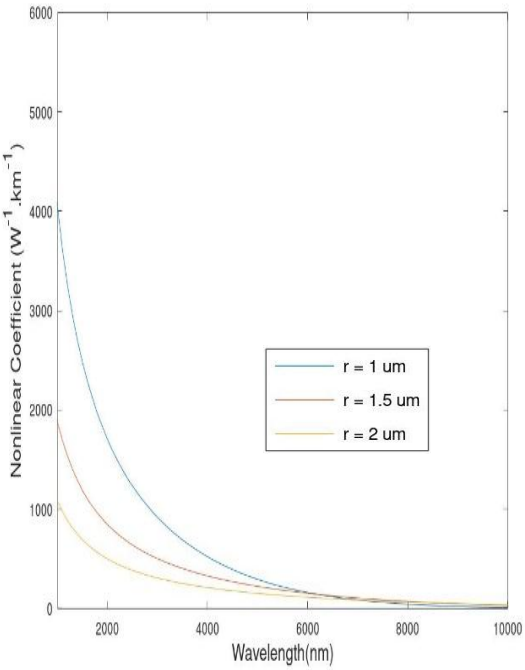

Fig. 2 Variation in nonlinear coefficient with wavelength for different values of radius of core.

References

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