



HAL
open science

Dispersion-tailored optical fibers for specialty applications: Design and certain fabrication issues

B.P. Pal, Gérard Monnom, Bernard Dussardier

► To cite this version:

B.P. Pal, Gérard Monnom, Bernard Dussardier. Dispersion-tailored optical fibers for specialty applications: Design and certain fabrication issues. 7th Workshop on Fibre and Optical Passive Components (WFOPC), Jul 2011, Montréal, Canada. hal-00849022

HAL Id: hal-00849022

<https://hal.science/hal-00849022>

Submitted on 29 Jul 2013

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Dispersion-tailored optical fibers for specialty applications: Design and certain fabrication issues

Bishnu Pal⁽¹⁾, Gerard Monnom⁽²⁾, and Bernard Dussardier⁽²⁾

⁽¹⁾Physics Department, Indian Institute of Technology Delhi, New Delhi 110016 India

⁽²⁾Laboratoire de Physique de la Matière Condensée - UMR 6622, Université de Nice - Parc Valrose, F 06108 NICE Cedex 2, France
e-mail: bishnupal@gmail.com

Abstract: In this presentation we would discuss design and fabrication issues with regard to dispersion tailoring of optical fibers for specialty applications. Various design tools, which could be exploited for such purpose, would be discussed.

1. Introduction

Optical fiber communication witnessed mind-boggling progress in the late 1990s with the emergence of dense wavelength division multiplexed transmission in conjunction with fiber amplifiers. The demand for high speed, long-haul networks gave rise to demand for special fibers such as non-zero dispersion-shifted fibers (NZDSF), dispersion compensating fibers (DCF), fibers for realizing specialized components such as fiber couplers for multiplexing pump and signal wavelengths required in configuring fiber amplifiers, erbium doped fibers for realizing erbium doped fiber amplifiers (EDFA), fibers with enhanced photosensitivity for realizing in-fiber grating-based components, fibers with low sensitivity to nonlinear impairments, and many more applications. There has also been a resurgence of interest amongst researchers to design and fabricate an exotic class of special fibers; fibers in which transmission losses of the material would not be a limiting factor while nonlinearity and dispersion characteristics could be conveniently tailored to achieve certain application-specific fibers, not necessarily for telecommunication alone. Research targeted towards such fiber designs led to the emergence of a new class of fibers, broadly referred to as *microstructured optical fibers* (MOF), which are characterized by wavelength-scale refractive index features across its physical cross-section resulting in *photonic bandgaps* when appropriately designed.

2. Broadband DCF

A dual-core DCF was initially designed and fabricated by us with a high negative D within the EDFA band and through dispersion slope compensation, it was eventually made broadband DCF and individual designs compatible to conventional G.652 fibers as well as standard NZDSF's were realized with significantly reduced sensitivity to nonlinear impairments through large mode effective area [1,2].

3. Microstructured optical fibers

Bragg fiber is a 1D-version of MOFs. Realization of one of the initial Bragg fibers was reported in 2000 [3]. Several dispersion-tailored Bragg fibers have been designed by us for specialty applications like dispersion compensation, metro-centric applications, supercontinuum generation, etc. Introducing a slow chirp in an otherwise periodic cladding could be exploited to realize parabolic pulses in the temporal domain, ultra-short pulse transmission with insignificant dispersion broadening for biomedical applications, very large mode effective area fibers, etc [4-7].

4. References

- [1] J-L. Auguste, R. Jindal, J-M. Blondy, M. Clapeau, J. Marcou, B. Dussardier, G. Monnom, D. B. Ostrowsky, B. P. Pal, and K. Thyagarajan, "1800 ps/(nm.km) Chromatic dispersion at 1.55 μ m in a dual concentric core fiber," *Electron. Lett.* **36**, 1689-1691 (2000).
- [2] B. P. Pal and K. Pande, "Optimization of a Dual-core Dispersion Slope Compensating Fiber for DWDM Transmission in the 1480-1610 nm Band through G.652 Single-mode Fibers," *Opt. Comm.* **201**, 335-344 (2002); also *Appl. Opt.* **42**, 3785-3791 (2003).
- [3] F. Brechet, J. L. Auguste, J. Marcou, P. Roy, D. Pagnoux, J. M. Blondy, G. Monnom and B. Dussardier, "Very first evidence of propagation in a modified chemical vapour deposition photonic-band-gap fiber (Bragg type)," CLEO-Europe, Nice, France (September, 2000).
- [4] B. P. Pal, S. Dasgupta, and M. R. Shenoy, "Bragg Fiber Design for Transparent Metro Networks," *Opt. Exp.* **13**, 621-626 (2005).
- [5] S. Dasgupta, B. P. Pal, and M. R. Shenoy, "Design of a Dispersion Compensating Bragg Fiber with ultra-high Figure of merit," *Opt. Letts.* **30**, 1917-1919 (2005).
- [6] H. T. Bookey, S. Dasgupta, N. Bezwada, B. P. Pal, A. Sysoliatin, J. McCarthy, M. Salganskii, V. Khopin, and A. K. Kar, "Experimental demonstration of spectral broadening in all-solid silica Bragg fiber," *Opt. Exp.* **17**, 17130-17135 (2009).
- [7] S. Ghosh, R. K. Varshney, B. P. Pal, and G. Monnom, "A Bragg-like Chirped Clad All-Solid Microstructured Optical Fiber with Ultra-wide Bandwidth for Short Pulse Delivery and Pulse Reshaping," *Opt. Quant. Electron.* **42**, 1-14 (2010).