AUN/SEED-Net

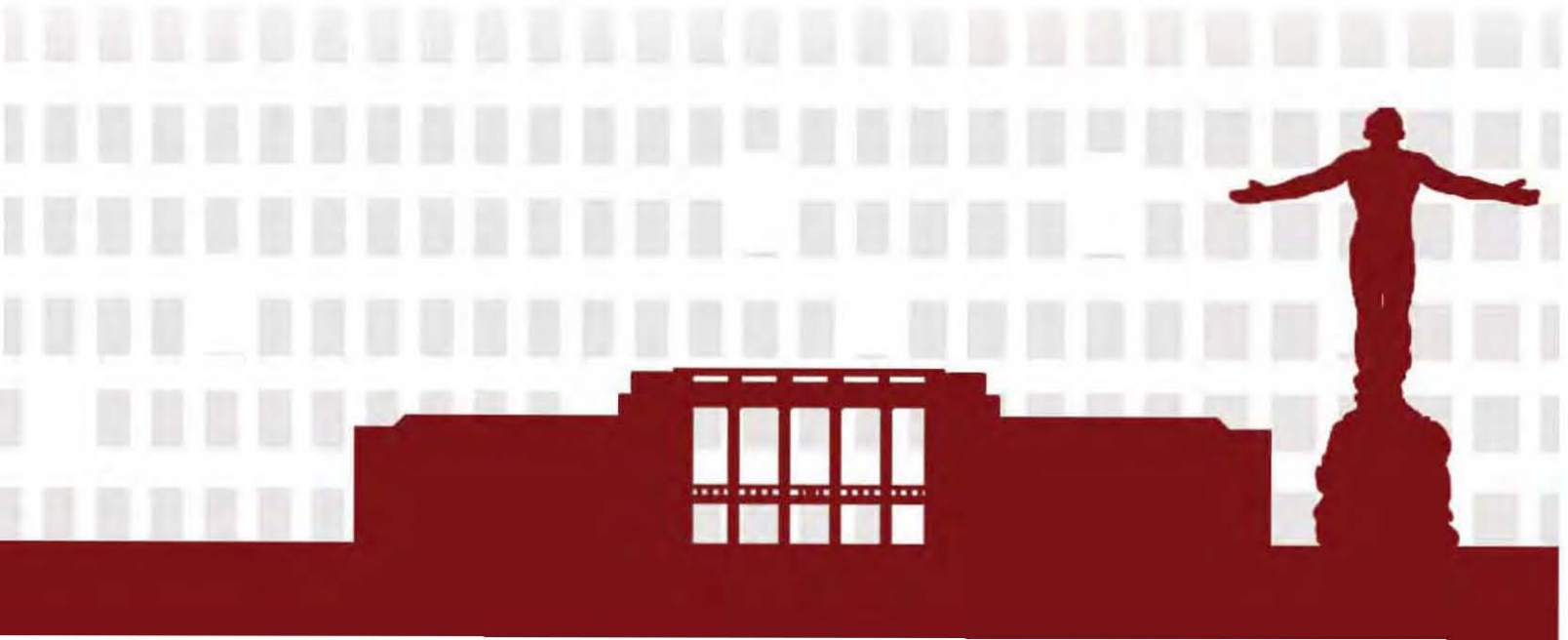
8th AUN/SEED-Net
REGIONAL CONFERENCE ON ELECTRICAL AND ELECTRONICS ENGINEERING

Envision, Enable, and Empower
Smarter and Resilient Societies

co-located with

11th ERDT Conference
on Semiconductor and Electronics, Information and Communications Technology and Energy

16-17 November 2015
Metro Manila, Philippines



Proceedings of the 8th AUN/SEED-Net RCEEE 2015 and 11th ERDT Conference on Semiconductor and Electronics, Information and Communications Technology, and Energy

Editors:
Dr. Joel Joseph S. Marciano Jr.
Dr. Jhoanna Rhodette I. Pedrasa
Dr. Rhandley D. Cajote

ISBN: 978-616-406-075-3

Published by: ASEAN University Network / Southeast Asia Engineering Education Development Network (AUN/SEED-Net) JICA Project
Faculty of Engineering, Bldg. 2
Chulalongkorn University, Bangkok
Thailand 10330

Printed in the Philippines by: ERZALAN PRINTING PRESS
45 Cotabato Street, Luzviminda Village, Batasan Hills, Quezon City, Philippines

8th AUN/SEED-Net Regional Conference
on Electrical and Electronics Engineering 2015

co-located with

11th ERDT Conference
on Semiconductor and Electronics, Information and Communications Technology, and Energy

Envision, Enable and Empower Smarter and Resilient Societies

Published by: ASEAN University Network / Southeast Asia Engineering Education Development Network (AUN/SEED-Net) in partnership with Engineering Research and Development for Technology (ERDT) and University of the Philippines Diliman.

ISBN: 978-616-406-075-3

ULTRA-BROADBAND LIGTH SOURCE AT 1060NM USING HIGHLY NONLINEAR OCTAGONAL PHOTONIC CRYSTAL FIBER

Dam Quang Huy* and Nguyen Hoang Hai

Telecommunication System Department, School of Electronic and Telecommunication,
Hanoi University of Science and Technology, VIETNAM.
*Email: dqhuy.fet.bk@gmail.com

ABSTRACT

This article shows a simple design a high-index core Photonic Crystal Fiber (PCFs) that has an array of air holes surrounding the Fluorite core region with nearly zero dispersion and the super high non-linear coeficient at 1060 nm center wave length. Using a full modal vector model based on the finite-element method and anisotropic perfectly matched layers absorbing boundary conditions.

In this paper, we design an ultra-broadband light source at 1060 nm for OCT application using a highly nonlinear octagonal photonic Crystal fiber. We show that it is possible to design a fiber with simply structure which has highly nonlinear and nearly zero dispersion over low OCT optical band by optimizing air hole diameter of ring and pitch. Structure of proposed PCFs with 5 air hole rings has an octagonal structure. This PCFs contains air holes in the cladding arranged in a stable array, where Λ is the center-to-center spacing between the air holes, di is the air hole diameter, d_i/Λ is the normalized diameters of the air holes in the cladding. The background material of PCF is pure silica with refractive index of 1.45, simultaneously doped Fluorite in core center with diameter dcore. This fiber has 5 air hole rings, diameter of inner ring air hole is d1,diameters of four outer four air hole rings correspond d_2, d_3, d_4, d_5, and hole-to-hole spacing pitch Λ.

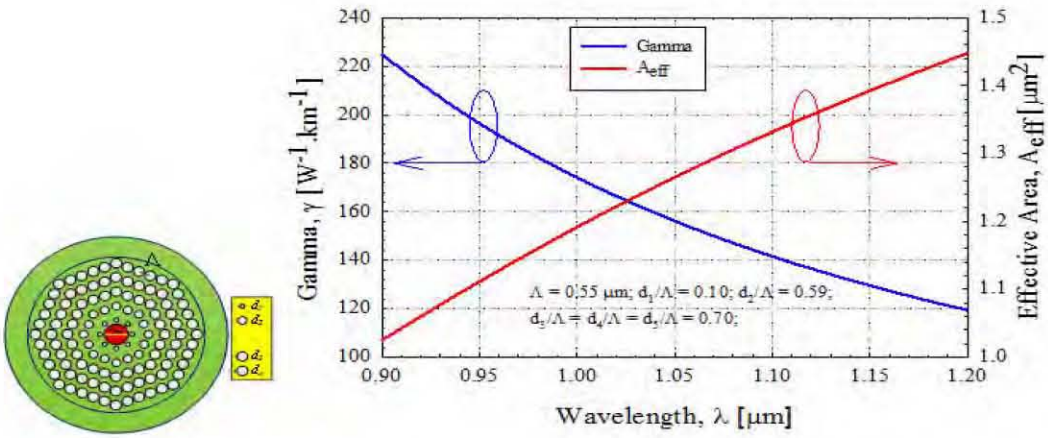


Figure 1. Schematic cross-section of new octagonal PCFs and Effective mode area and Non-linear coefficient of Fluorite PCFs .

The nearly zero dispersion can be obtained by a suitable design of these parameters d_1, d_2, d_3, d_4, d_5, and Λ. The parameters for calculation are *Gamma* = 152 (W^{-1}.km^{-1}),D=-0.08519 (ps/(nm.km)), β_2 = 0.048 (ps^2/km) and β_3 = 0.000045 (ps^3/km). Figure 2 shows spectral propeties of the proposed PCF obtained where the fiber length is 140 m and the peak optical power of the incident pulse is 10W, T_{FWHM} = 1 ps. Spectral Bandwidth is found at 175 nm at 3 dB bandwidth. The coherence length l_c and resolution l_r in biomedical tissue can be obtained. It is found that:l_c=2.83 μm, l_r = 1.96 μm at 1060 nm with n_{tissue} = 1.44 at 1060 nm center wavelenght.

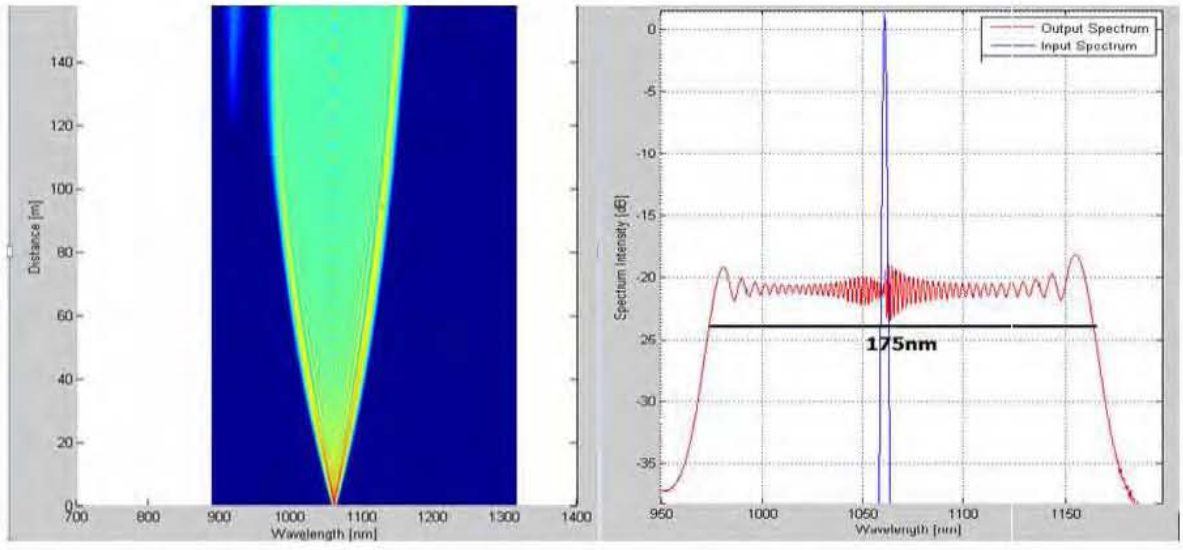


Figure 2. Spectrum width of 3 dB obtained to 175 nm with the laser source of 10W-1ps

In conclusion, the proposed PCFs may be suitable for chromatic dispersion management applications as a chromatic dispersion controller, also as an excellent candidate for nonlinear optical systems when can use for super continuum generation which useful in OCT application with high resolution optical image, provide the extremely apparent picture in dental capturing.

Keywords: Highly Nonlinear, Optical Coherence Tomography, Photonic Crystal Fiber….

References

[1] F. Poli, A. Cucinotta, S. Selleri, "Photonic Crystal Fibers Properties and Applications", 2007 edition.

[2] V. Husakou and J. Herrmann, "*Supercontinuum generation, fourwave mixing, and fission of higher-ordersolitons in photonic-crystalfibers*," Journal of Optical Society of America B,vol.19, pp.2 171–2182, Sept. 2002.

[3] Govind P. Agrawal, "Nonlinear Fiber Optics", Academic Press (San Diego, CA), 3rd Ed, 2001.

[4] T. Yamamoto, H. Kubota, S. Kawanishi, M. Tanaka, and S. Yamaguchi, "*SuperContinuum generation at 1.55μm in dispersion flattened polarization-maintaining photonic crystal fiber*", Optics Express, vol. 11, pp. 1537–1540, June 2003.