PROCEEDINGS OF SPIE

Photonic Crystal Fibers III

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Editor

22–23 April 2009
Prague, Czech Republic

Sponsored by
SPIE *Europe*

Cooperating Organizations
Institute of Physics, Academy of Sciences (Czech Republic)
Department of X-Ray Lasers, Institute of Physics (Czech Republic)
Czech and Slovak Society for Photonics
Photonics Society of Poland (Poland)

Published by
SPIE

Volume 7357

Proceedings of SPIE, 0277-786X, v. 7357

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

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Please use the following format to cite material from this book:
Author(s), "Title of Paper," in *Photonic Crystal Fibers III*, edited by Kyriacos Kalli, Proceedings of SPIE Vol. 7357 (SPIE, Bellingham, WA, 2009) Article CID Number.

ISSN 0277-786X
ISBN 9780819476319

Published by
SPIE
P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445
SPIE.org

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Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.

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Introduction

It has been nearly twenty years since the conception of photonic crystal fibers, as devised by Philip St J. Russell in unpublished work dating to 1991. That work was a development of the "photonic crystal" ideas of Yablonovich and John who published two milestone papers on photonic crystals in 1987. The photonic crystal fiber (PCF) has given the field of fiber optics a newfound resurgence, resulting in revolutionary research and practical breakthroughs that would have proven otherwise impossible with conventional optical fibers; these include octave-spanning light continua, air guidance of light with low loss over several kilometers, and endlessly single-mode fiber operating over several hundred nanometers. The unusual confinement characteristics of PCF has resulted in their use in applications such as fiber-optic communications and sensing, fiber lasers, nonlinear devices, high-power transmission, and highly sensitive gas sensors, among others.

The term photonic crystal fiber has been used extensively to cover a class of optical fibers that include the photonic band gap fiber (with light confinement through the band gap effect), hole-assisted or microstructure fiber (guiding light through a conventional high-index core modified by the presence of air holes), and Bragg fiber (photonic band gap fiber formed using multilayer, concentric rings).

This third conference in the series on photonic crystal fibers reports some of the latest developments of PCF. The strength of photonic crystal fiber relates to its versatility and flexibility in terms of fiber geometry and material used. The fabrication and design of PCF is reported for the exotic doping of glasses and polymers to produce fibers with significant nonlinear properties, along with the characterization of PCF utilizing spectral interferometry. Developments of fiber-based light sources are supported by advances in super continuum generation and mid-infrared sources through non-linear mixing in hollow-core fiber and index-guiding crystal fibers. Grating sensor applications of PCF investigates the inscription of Bragg and long period grating sensors using continuous wave and pulsed laser sources, highlighting the effects of the hole-structure on grating inscription. The stability of grating structures is examined as are sensing of external parameters such as temperature and strain. Great strides have been made in the modeling of PCF, and a special session is devoted to the development of modeling and numerical analysis. Guided wave sensing applications are investigated through the role of microstructure on guided acoustic wave Brillouin scattering and through gas sensing, favored by the long interaction lengths afforded by PCF.

The conference has several invited papers listed below, presented by key scientists in the field:

- "Microstructured fibers with high lanthanum oxide glass core for nonlinear applications"
- "Bragg grating writing in photonic crystal fibers"
- "Role of microstructure on guided acoustic wave Brillouin scattering in photonic crystal fibers"

I hope the reader will find the conference proceedings as interesting as our recent meeting in Prague.

Kyriacos Kalli