Optical Fibers: Materials and Applications

CHRISTOS MARKOS,1,* RODRIGO AMEZCUA CORREA,2 OLE BANG,1 NATALIE V. WHEELER,3 AND MICHAEL H. FROSZ4

1Technical University of Denmark, Anker Engelunds Vej 1 Bygning 101A, 2800 Kgs. Lyngby, Denmark
2University of Central Florida, 4000 Central Florida Blvd, Orlando, FL 32816, USA
3Optoelectronics Research Centre, University of Southampton, Southampton SO17 1BJ, United Kingdom
4Max Planck Institute for the Science of Light, Staudtstraße 2, 91058 Erlangen, Germany

*chmar@fotonik.dtu.dk

Abstract: This is an introduction to the feature issue of Optical Materials Express on Optical Fibers: Materials and Applications.

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Introduction

Since their invention in the 1960’s, optical fibers have had an enormous impact on a wide arc of aspects in our daily life. Nowadays, they are one of the most crucial elements in modern communications, medicine, sensing, manufacturing and the Internet of Things. Over the past three decades, many researchers around the globe have focused their activities to improve this unique technology and integrate it into our everyday life. Novel designs, processing methods and functional materials constitute the main palette that the community relies upon to demonstrate brilliant ideas and applications.

The motivation and purpose of this Special Issue of Optical Material Express is to collect and provide the most recent advances in optical fiber technology through a combination of invited and contributed articles from some of the world’s top research groups. The current Feature Issue has 12 articles that cover a wide range of materials, processing techniques and applications. This includes the use of an extrusion method towards development of novel high temperature polymer multimaterial fibers [1] and soft-glass suspended-core fibers [2]. Carcreff et al. report the use of the emerging 3D printing method for the development of a chalcogenide preform with a hollow-core antiresonant structure [3] while Nunes et al. show an interesting imaging approach using near-infrared light to reveal light-scattering defects in such chalcogenide preforms [4]. Other materials for the infrared spectral range also continue to be a topic of interest; for example, Tarabrin et al. demonstrate the fabrication of antireflective microstructures at the tip of polycrystalline fibers using femtosecond pulses to further increase their efficiency [5]. Coco et al. report an intriguing method to study the distribution of the dopants in ZnSe-based fiber using a synchrotron-based micro X-ray fluorescence (XRF) mapping as an efficient tool for improving the performance of laser materials in fiber geometry [6]. Donodin et al. report a bismuth-doped fibre amplifier in the spectral range from 1370 to 1490 nm, with a maximum gain exceeding 31 dB [7] while Liu et al. demonstrate a versatile method of tuning a narrow linewidth laser in the same spectral range using a fiber Bragg grating mirror embedded in a 3D printed polymer beam [8]. Investigating the photodarkening effects in ytterbium doped silica fibers, Engholm et al. present a thorough study on how the widely used aluminum co-dopant results in significantly photodarkening-resistant fibers and could be a very promising route for future high power fiber lasers [9]. On the other hand, Gladyshev et al. report on the first demonstration of a sub-picosecond mid-infrared Raman laser based on deuterium gas-filled hollow-core silica fiber [10] while Adamu et al. utilize a focused ion beam to micromachine such hollow-core antiresonant fibers for optofludic applications [11]. Finally, Gomes et al. demonstrate how the integration of novel materials into a nanofluidic fiber allows access to unusual modal guiding
properties, offering new pathways for dispersion management, thus expanding the capabilities and application areas of optical fibers [12]. We hope you enjoy this feature issue.

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References