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Optical Fibers: Materials and Applications

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

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

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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

1. P. Akrami, A. I. Adamu, G. Woyessa, H. K. Rasmussen, O. Bang, and C. Markos, "All-polymer multimaterial optical fiber fabrication for high temperature applications," Opt. Mater. Express **11**(2), 345–354 (2021).
2. D. Litzkendorf, A. Matthes, A. Schwuchow, J. Dellith, K. Wondraczek, and H. Ebendorff-Heidepriem, "Extruded suspended core fibers from lanthanum-aluminum-silicate glass," Opt. Mater. Express **11**(1), 142–156 (2021).
3. J. Carcreff, F. Cheviré, E. Galdo, R. Lebullenger, A. Gautier, J. L. Adam, D. Le Coq, L. Brilland, R. Chahal, G. Renversez, and J. Troles, "Mid-infrared hollow core fiber drawn from a 3D printed chalcogenide glass preform," Opt. Mater. Express **11**(1), 198–209 (2021).
4. J. Nunes, R. W. Crane, D. Mabwa, D. Furniss, M. Farries, T. M. Benson, and A. B. Seddon, "Internal examination of mid-infrared chalcogenide glass optical fiber preforms and fiber using near-infrared imaging [Invited]," Opt. Mater. Express **11**, (5), 1353–1363 (2021)..
5. M. K. Tarabrin, A. A. Bushunov, A. A. Teslenko, T. Sakharova, J. Hinkel, I. Usenov, T. Döhler, U. Geißler, V. Artyushenko, and V. A. Lazarev, "Fabrication of an antireflection microstructure on AgClBr polycrystalline fiber by single pulse femtosecond laser ablation," Opt. Mater. Express **11**(2), 487–496 (2021).
6. M. G. Coco, S. C. Aro, A. Hendrickson, J. P. Krug, B. Lai, Z. Cai, P. J. Sazio, S. A. McDaniel, G. Cook, V. Gopalan, and J. V. Badding, "Synchrotron X-ray metrology of dopant distribution and oxidation state in high pressure CVD grown TM^{2+}:ZnSe optical fibers," Opt. Mater. Express **11**(2), 289–298 (2021).
7. A. Donodin, V. Dvoyrin, E. Manuylovich, L. Krzczanowicz, W. Forysiak, M. Melkumov, V. Mashinsky, and S. Turitsyn, "Bismuth doped fibre amplifier operating in E- and S- optical bands," Opt. Mater. Express **11**(1), 127–135 (2021).
8. C. Liu, X. Yang, F. Laurell, and M. Fokine, "Widely tunable Er:Yb fiber laser using a fiber Bragg grating embedded in a 3D printed beam," Opt. Mater. Express **10**(12), 3353–3358 (2020).
9. M. Engholm, M. Tuggle, C. Kucera, T. Hawkins, P. Dragic, and J. Ballato, "On the origin of photodarkening resistance in Yb-doped silica fibers with high aluminum concentration," Opt. Mater. Express **11**(1), 115–126 (2021).
10. A. Gladyshev, Y. Yatsenko, A. Kolyadin, V. Kompanets, and I. Bufetov, "Mid-infrared 10-μJ-level sub-picosecond pulse generation via stimulated Raman scattering in a gas-filled revolver fiber," Opt. Mater. Express **10**(12), 3081–3089 (2020).
11. A. I. Adamu, Y. Wang, R. A. Correa, O. Bang, and C. Markos, "Low-loss micro-machining of anti-resonant hollow-core fiber with focused ion beam for optofluidic application," Opt. Mater. Express **11**(2), 338–344 (2021).
12. André D. Gomes, Jiangbo Tim Zhao, Alessandro Tuniz, and Markus A. Schmidt, "Direct observation of modal hybridization in nanofluidic fiber [Invited]," Opt. Mater. Express **11**(2), 559–568 (2021).