

PROCEEDINGS OF SPIE

Optical Fibers and Their Applications 2015

Ryszard S. Romaniuk
Waldemar Wojcik
Editors

22–25 September 2015
Lublin – Nałęczów, Poland

Organized by
Laboratory of Optical Fibres Technology, Faculty of Chemistry,
Maria Curie-Skłodowska University (Poland)
Institute of Electronics and Information Technology, Lublin University of Technology (Poland)

Sponsored by
SPIE

Cosponsored by
Committee of Electronics and Telecommunication, Polish Academy of Sciences
Polish Committee of Optoelectronics of SEP – Association of Polish Electrical Engineers
Photonics Society of Poland

Published by
SPIE

Volume 9816

Proceedings of SPIE 0277-786X, V. 9816

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

Optical Fibers and Their Applications 2015, edited by Ryszard S. Romaniuk,
Waldemar Wojcik, Proc. of SPIE Vol. 9816, 981601 · © 2015 SPIE
CCC code: 0277-786X/15/\$18 · doi: 10.1117/12.2230241

Proc. of SPIE Vol. 9816 981601-1

The papers in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIDigitalLibrary.org.

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings:

Author(s), "Title of Paper," in *Optical Fibers and Their Applications 2015*, edited by Ryszard S. Romaniuk, Waldemar Wojcik, Proceedings of SPIE Vol. 9816 (SPIE, Bellingham, WA, 2015) Six-digit Article CID Number.

ISSN: 0277-786X
ISSN: 1996-756X (electronic)
ISBN: 9781510600577

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

Copyright © 2015, Society of Photo-Optical Instrumentation Engineers.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/15/\$18.00.

Printed in the United States of America.

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

**SPIE. DIGITAL
LIBRARY**
SPIDigitalLibrary.org

Paper Numbering: *Proceedings of SPIE* follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article at the time of publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online and print versions of the publication. SPIE uses a six-digit CID article numbering system structured as follows:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc. The CID Number appears on each page of the manuscript.

Contents

- ix *Authors*
- xi *Conference Committee*
- xv *Introduction*

SESSION 1 CONFERENCE OVERVIEW

- 9816 02 **Development of optical fiber technology in Poland 2015** [9816-1]
- 9816 03 **Optical fiber technology in Poland: four decades of development 1975-2015 (Invited Paper)** [9816-2]
- 9816 04 **Applications of optical fibres at Lublin University of Technology (Invited Paper)** [9816-82]

SESSION 2 PHOTONIC MATERIALS ENGINEERING

- 9816 05 **Near infrared luminescence in Yb³⁺/Ho³⁺: co-doped germanate glass (Invited Paper)** [9816-4]
- 9816 06 **2.7 μm emission in heavy metal oxide glasses doped with erbium ions** [9816-18]
- 9816 07 **The xanthene dyes doped PMMA microspheres for optical sensor applications** [9816-22]
- 9816 08 **Effective glued connection between multimode polymer and silica optical fibers** [9816-24]
- 9816 09 **Investigation of physical properties of TiO₂ nanolayers** [9816-27]
- 9816 0A **Surface plasmon resonance study of comb copolymers containing regioregular poly-3-hexylothiophene** [9816-31]
- 9816 0B **Temperature behaviour of optical parameters in (Ag₃AsS₃)_{0.3}(As₂S₃)_{0.7} thin films** [9816-74]
- 9816 0C **Influence of external factors on optical parameters in Cu₆PS₅l thin films** [9816-76]

SESSION 3 OPTICAL FIBERS AND PLANAR OPTICAL WAVEGUIDES

- 9816 0D **Sol-gel derived optical waveguide films: technological platform for development of planar evanescent wave sensors (Invited Paper)** [9816-13]
- 9816 0E **Supermode interference in dual-core hole-assisted fiber for sensing** [9816-17]

- 9816 0F **Influence of high temperatures on optical fibers coated with multilayer protective coatings** [9816-20]
- 9816 0G **Design and manufacturing of band-rejection filters based on long period gratings for applications in next generation access networks** [9816-25]
- 9816 0H **Tail of the joint distribution of the first order PMD parameters** [9816-26]
- 9816 0I **Solar cyclic tests of optical fiber components working in ammonia and high temperatures** [9816-28]
- 9816 0J **The effect of core shape on the modal properties of the hollow core fiber** [9816-32]
- 9816 0K **Near field light intensity distribution analysis in bimodal polymer waveguide** [9816-33]
- 9816 0L **Thermal properties photonic crystal fiber transducers with ferromagnetic nanoparticles** [9816-35]
- 9816 0M **All fiber interferometric Bragg peak shift demodulation** [9816-38]
- 9816 0N **Dispersion engineering in soft glass photonic crystal fibers infiltrated with liquids (Invited Paper)** [9816-81]
- 9816 0O **Temperature sensitivity of photonic crystal fibers infiltrated with ethanol solutions** [9816-83]

SESSION 4 PHOTONIC SENSORS AND DEVICES

- 9816 0P **Correlation-based methods in calibrating an FBG sensor with strain field non-uniformity (Invited Paper)** [9816-6]
- 9816 0Q **Multimode interference in sensor applications** [9816-7]
- 9816 0R **Neural network fusion and inversion model for NDIR sensor measurement** [9816-8]
- 9816 0S **Experimental investigation of temperature influence on nonlinear effects in microstructured fibers** [9816-10]
- 9816 0T **Planar waveguide sensor of ammonia** [9816-12]
- 9816 0U **Aging influence on sensing properties of porous silica films sensitized to ammonia** [9816-14]
- 9816 0V **Modeling of multi-cavity Fabry-Perot optical fiber sensors** [9816-16]
- 9816 0W **Theoretical investigation of temperature optical sensor setup with spectrally adjusted fiber Bragg gratings** [9816-21]
- 9816 0X **All-fiber 1 x 7 optical power splitter** [9816-29]
- 9816 0Y **The influence of CO₂ gas sensor parameters on its operation characteristic** [9816-30]
- 9816 0Z **Fiber optic gyroscope based on the registration of the spatial interference pattern** [9816-77]

SESSION 5 PHOTONICS APPLICATIONS, IMAGE PROCESSING

- 9816 10 **Precise numerical modeling of next generation multimode fiber based links (Invited Paper)**
[9816-11]
- 9816 11 **Application of UDWDM technology in FTTH networks** [9816-15]
- 9816 12 **Measurement of the thickness of the lens with the use of all fiber low-coherence interferometer** [9816-19]
- 9816 13 **Seven-core active fibre for application in telecommunication satellites** [9816-34]
- 9816 14 **Experimental study of steel welded joints localization using fiber Bragg grating strain sensor**
[9816-37]
- 9816 15 **Improvement of quality and reliability of electric power supply using the supply transformer with under load tap change device** [9816-39]
- 9816 16 **Coordination in serial-parallel image processing** [9816-41]
- 9816 17 **Method of anti-aliasing with the use of the new pixel model** [9816-43]
- 9816 18 **Recognition system of unauthorized changes in rows of vehicle motion** [9816-47]
- 9816 19 **Application of a modified evolutionary algorithm for the optimization of data acquisition to improve the accuracy of a video-polarimetric system** [9816-59]
- 9816 1A **Blur recognition using second fundamental form of image surface** [9816-61]
- 9816 1B **The adaptive control system of acetylene generator** [9816-66]
- 9816 1C **Pressure transducer of the on the basis of reactive properties of transistor structure with negative resistance** [9816-72]
- 9816 1D **Optical switching technologies: problems and proposed solution** [9816-78]

SESSION 6 BIOPHOTONICS

- 9816 1E **Diagnostic efficiency of Mueller-matrix polarization reconstruction system of the phase structure of liver tissue (Invited Paper)** [9816-48]
- 9816 1F **Photodynamic therapy with laser scanning mode of tumor irradiation** [9816-49]
- 9816 1G **Computer system for forecasting surgery on the eye muscles** [9816-50]
- 9816 1H **Methods and means of measuring control and diagnostics of biological tissues in vivo based on measurements of color coordinates and multispectral image** [9816-51]
- 9816 1I **Changes of color coordinates of biological tissue with superficial skin damage due to mechanical trauma** [9816-52]

- 9816 1J **Classification of CT-brain slices based on local histograms** [9816-53]
- 9816 1K **Laser photoplethysmography in integrated evaluation of collateral circulation of lower extremities** [9816-54]
- 9816 1L **Method of expression of certain bacterial microflora mucosa olfactory area** [9816-57]
- 9816 1M **Control and minimization of allergenic plants impact on bronchial asthma morbidity, based on spatial-temporal data model** [9816-58]
- 9816 1N **The method of multispectral image processing of phytoplankton processing for environmental control of water pollution** [9816-71]
- 9816 1O **Design of decision support system when undertaking medical-diagnostic action** [9816-73]
- 9816 1P **Diagnostic opto-electronic system for measuring physical and biological characteristics of the skin in vivo** [9816-75]
- 9816 1Q **Multispectral televisional measuring control of the ecological state of waterbodies on the characteristics macrophytes** [9816-79]

SESSION 7 HIGH PERFORMANCE AND SMART COMPUTING

- 9816 1R **Modification of fractal coding algorithm by a combination of modern technologies and parallel computations** [9816-42]
- 9816 1S **The use polynomials as a possible variant analytical processing of logic-time functions** [9816-45]
- 9816 1T **Method of glitch reduction in DAC with weight redundancy** [9816-55]
- 9816 1U **Solving problems on base of concepts formalization of language image and figurative meaning of the natural-language constructs** [9816-56]
- 9816 1V **Method of correcting of the tracking ADC with weight redundancy conversion characteristic** [9816-60]
- 9816 1W **Information technology of clustering problem situations in computing and office equipment** [9816-62]
- 9816 1X **Evaluation of the impact of uncontrolled parametric perturbations on stability of automatic systems with logical control units** [9816-64]
- 9816 1Y **User behavioral model in hypertext environment** [9816-65]
- 9816 1Z **Algorithm for decision support as the tool for control system of industries with variable assortment of products** [9816-67]
- 9816 20 **Synthesis of the control algorithm of cyclicity for branched technological process** [9816-68]
- 9816 21 **Decision making algorithm for development strategy of information systems** [9816-69]

- 9816 22 **Optimization of hierarchical management of technological processes** [9816-70]
- 9816 23 **Evaluation of the adequacy of interval model of control systems ranked configurations (Invited Paper)** [9816-80]

Authors

Numbers in the index correspond to the last two digits of the six-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first four digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

Anders, Krzysztof, 13
Asambay, Azat, 15
Askarova, Nursanat, 1N, 1Z
Avrunin, Oleg G., 1G, 1J, 1L
Azarov, Oleksiy D., 1T, 1V
Balzan, Igor V., 15
Bayas, Marcia M., 19, 22
Bazarova, Madina, 17, 21
Bendak, Andrii V., 0C
Bereś-Pawlik, Elżbieta, 0J, 0W
Bienkowska, B., 0E
Bisikalo, Oleg V., 1U
Blahut, Marek, 0Q
Buczyński, Ryszard, 03, 0N, 0O
Buda, Antonina H., 18
Budnicki, Dawid, 0E, 0X, 12
Bunyak, Yuriy, 1A
Burlibay, Aron, 1B, 1L, 1O, 1V
Bykov, Mykola M., 23
Canadas Martinez, Inmaculada, 0F, 0I
Cao Long, Van, 0N, 0O
Chepurna, Oksana, 1F
Chernyak, Olexander I., 1T
Chruściel, M., 08
Chu Van, Lanh, 0N, 0O
Cięszczyk, Sławomir, 0P, 0R, 1U
Demko, Pavlo Yu., 0C
Derman, Galyna Y., 21
Dłubek, Michał, 0G
Dorosz, Dominik, 05, 06, 07
Dorosz, Jan, 03, 07
Dubovoi, Vladymyr M., 16, 20
Dubovoy, B. M., 22
Duda, Marina E., 16
Dudnyk, Oleksandr V., 1V
Dussembayeva, Shynar, 1I, 1P
Dybka, Kamil, 0G
Fidelus, Janusz D., 0F, 0I
Filatova, Anna E., 1O
Filipowicz, Marta, 13
Gamaleia, Nikolai, 1F
Grabko, Volodymyr V., 15
Grajewski, Karol, 0N
Gromaszek, Konrad, 1B, 1G, 1Q, 1X, 1Y, 22
Guł, K., 0K
Harasim, Damian, 14
Herzog, T., 0K
Holdynski, Z., 0S
Imanbek, Baglan, 1H, 1M, 1W
Ivashchuk, Viacheslav, 1Z
Izai, Vitalii Yu., 0B, 0C
Izydorczyk, Weronika, 0T
Jaroszewicz, L. R., 08, 0L
Jeleń, Piotr, 05, 06
Jóźwik, Michalina, 0E, 0M, 0S, 12
Kacejko, Piotr, 04
Kaduk, Oleksandr V., 1V
Kalizhanova, Aliya, 1G, 1S
Karasiński, Paweł, 0D, 0T
Karpierz, Mirosław, 0N, 0X
Kashaganova, Gulzhan, 0C, 0Z, 1T
Kassymkhanova, Dana, 1S, 21
Kasztelaniec, Rafał, 0O
Kholin, Vladimir, 1F
Kisala, Piotr, 19, 1D, 1J, 1K, 1W, 1Z
Kisieleska, A., 0L
Klapouschak, Andrii Yu., 1K
Klimczak, Mariusz, 0O
Kochanowicz, Marcin, 05, 06, 07
Kökényesi, Sandor, 0B
Kotakowska, Agnieszka, 0F, 0X
Komada, Paweł, 0B, 0C, 0R, 0Z, 1P
Kotyra, Andrzej, 18, 1A, 1I, 1N, 21
Kovaliuk, D. O., 1B
Kovaliuk, Oleg O., 1B
Kozachuk, Anastasia, 1N, 1Q
Kozbakova, Ainur, 16
Kozhemiako, Andrii V., 18
Kozhemiako, Volodymyr P., 1S
Kozhukhar, Oleksander T., 1P
Kozlovskaya, Tatiana I., 19, 1K
Kukharenko, Dmitriy V., 1G
Kuklińska, M., 0F
Kupershtejn, Leonid M., 18
Kúš, Peter, 0C
Kussambayeva, Nazym, 1C, 1E
Kutsyk, Mykhailo M., 0B
Kvaternyuk, S. Olena, 1H, 1I
Kvaternyuk, Sergii, 1H, 1N, 1Q
Kvyetnyy, Roman N., 1A, 1R
Lach, Zbigniew T., 0H
Ladaniuk, Anatolii, 1Z
Lamperski, Jan, 11
Le Van, Hieu, 0N, 0O
Licenko, Hennadii L., 1D
Lipiński, Stanisław, 0F, 0I, 0Y, 12
Lischuk, Denis V., 18
Lisý, Vladimir, 0C

Lozun, Alla V., 1R
 Maciak, Erwin, 0A
 Madry, Mateusz, 0W
 Makara, Ivanna V., 1P
 Makara, Mariusz, 0E, 0X, 13
 Makauz, Ivan I., 0B
 Maksymiuk, L., 10
 Marć, P., 08, 0L
 Martyniuk, Tatiana B., 18
 Matolin, Vladimir, 0C
 Melnyk, Olexander V., 17
 Mergo, Paweł, 03, 0E, 0S, 0X, 13
 Miluski, Piotr, 05, 06, 07
 Mokanyuk, Olexander, 1H, 1I
 Mokin, Vitaliy B., 1M
 Moskvín, Oleksii M., 1Y
 Moskvina, Svetlana M., 1X
 Murashchenko, Olexander G., 1T
 Murawski, Michał, 0E, 0S, 0X, 13
 Napierała, Marek, 0X, 0Y, 12, 13
 Nasiłowski, Tomasz, 0E, 0F, 0I, 0M, 0S, 0X, 0Y, 12, 13
 Nikitenko, Olena D., 2I
 Nosova, Yana V., 1L
 Nursanat, Askarova, 18
 Orakbaev, Yerbol, 1J
 Osadchuk, Alexander V., 1C
 Osadchuk, Iaroslav A., 1C
 Ostrowski, Łukasz, 0E, 0S, 0X, 13
 Pavlov, Sergii V., 17, 19, 1E, 1F, 1J
 Pavlov, Volodymyr S., 1K
 Petrishyn, S. I., 1W
 Petruk, Vasil, 1H, 1N, 1Q
 Piramidowicz, Ryszard, 13
 Pniwski, Jacek, 0N
 Popov, Viacheslav, 1F
 Poturaj, Krzysztof, 0E, 0X, 13
 Povoroznyuk, Anatolii I., 1O
 Procek, Marcin, 0A
 Przybysz, N., 0L
 Pteruk, Vail, 1I
 Pura-Pawlikowska, P., 08
 Pustelny, Tadeusz, 09
 Pylypenko, Inna V., 20
 Pytel, Anna, 0E, 0X
 Radchenko, Kostiantyn O., 1E
 Ragin, Tomasz, 05, 06
 Raimy, A., 23
 Ramaniuk, Aleksandr, 0N
 Ráti, Yosyp Y., 0B
 Rodriguez Garcia, José, 0F, 0I
 Rogoziński, Roman, 0T, 0U
 Romaniuk, Ryszard S., 02, 03, 16, 19, 1A, 1D, 1H, 1I, 1K, 1N
 Romanyuk, Olexander N., 17
 Romanyuk, Sergii O., 17, 1G
 Rovira, Ronald, 19
 Sachaniuk-Kavets'ka, Natalia V., 1S
 Sagymbekova, Azhar, 1K, 1Z
 Sailarbak, Saltanat, 1Q, 1Y, 20
 Sakhno, Andrii M., 0Z
 Sander, Sergii V., 1K
 Savchuk, T. O., 1W
 Shegebaeva, Jibek, 22
 Shton, Irina, 1F
 Shushlyapina, Natalia O., 1L
 Sitarz, Maciej, 05, 06
 Smailov, Nurzhigit, 0B
 Smailova, Saule, 1W, 23
 Śmietana, Bartosz, 0G
 Smolarz, Andrzej, 15, 17, 1C, 1R, 1T, 1V
 Sofina, Olga Yu., 1A, 1R
 Stańczyk, Tomasz, 0F, 0I, 0Y
 Stasenka, Vladyslav A., 1E
 Stawska, Hanna, 0J
 Stefaniuk, Tomasz, 0N, 0O
 Stępczak, Piotr, 1I
 Stępień, Karol, 0M, 12
 Stępiak, G., 10
 Stolarczyk, Agnieszka, 0A
 Struk, Przemysław, 09
 Studenyak, Ihor P., 0B, 0C
 Studenyak, Viktor I., 0C
 Surtel, Wojciech, 1L, 1O
 Szarniak, Przemysław, 0G
 Szewczuk, Artur, 0Q
 Szostkiewicz, Łukasz, 0E, 0X, 13
 Szymański, Michał, 13
 Tenderenda, Tadeusz, 0E, 0F, 0I, 0M, 13
 Timchik, Sergii V., 1J
 Toygozhinova, Aynur, 1G
 Trippenbach, Marek, 0N, 0O
 Tuleshova, Azhar, 1A
 Tuzhanskyi, Stanislav Ye., 0Z
 Tymkovich, Maksym Yu., 1J
 Tyszkiewicz, Cuma, 0T, 0U
 Utreras, Andres J., 1D
 Vassilenko, Valentina B., 1K
 Vasyli'kiva, Olena S., 18
 Vorokhta, Mykhailo, 0C
 Voytsekhovich, Valerii, 1F
 Vuzh, Tatyana Y., 1M
 Wierzba, Paweł, 0V
 Wójcik, Grzegorz, 0E, 0X, 13
 Wójcik, Waldemar, 02, 03, 04, 16, 1E, 1F, 1H, 1M, 1S, 20, 23
 Wonko, R., 08
 Wysokiński, Karol, 0F, 0I, 0Y
 Yakenina, Lesya, 1I
 Yasynska, Victoria, 1N
 Yekenina, Lesya, 1H
 Yesmakhanova, Laura, 16, 23
 Yukhymchuk, Maria S., 1X
 Yussupova, Gulbahar, 19, 1D, 1U
 Zabolotna, Natalia I., 1E
 Zhailaubayev, Yerkin, 0B
 Zhassandykyzy, Maral, 1F, 1L, 1O
 Zhirnova, Oxana, 1R, 1X
 Ziolkowicz, A., 0E
 Żmojda, Jacek, 05, 06, 07

Conference Committee

Conference Chair

Waldemar Wojcik, Lublin University of Technology (Poland)

Honorary Committee

Wiesław L. Woliński, Warsaw University of Technology (Poland)
Zdzisław Jankiewicz, Institute of Electronic Materials Technology
(Poland), and Military University of Technology (Poland)
Zenon Hotra, Rzeszów University of Technology (Poland)

Scientific Committee

Waldemar Wójcik, Chairman, Lublin University of Technology (Poland)
Tomasz R. Woliński, Vice-Chairman, Institute of Electronic Materials
Technology (Poland)
Wacław Urbańczyk, Vice-Chairman, Wrocław University of
Technology (Poland)
Ryszard S. Romaniuk, Vice-Chairman, Warsaw University of
Technology (Poland)
Paweł Mergo, Secretary, Maria Curie-Skłodowska University (Poland)

Members

Krzysztof Abramski, Wrocław University of Technology (Poland)
Elżbieta Bereś-Pawlik, Wrocław University of Technology (Poland)
Wojtek J. Bock, Photonics Research Center, Université du Québec en
Outaouais (Canada)
Ryszard Buczyński, Institute of Electronic Materials Technology
(Poland)
Anna Cysewska-Sobusiak, Poznań University of Technology (Poland)
Andrzej W. Domański, Warsaw University of Technology (Poland)
Dominik Dorosz, Białystok University of Technology (Poland)
Jan Dorosz, Białystok University of Technology (Poland)
Vladimir Firago, Belarusian State University (Belarus)
Wojciech Gawlik, Jagiellonian University in Kraków (Poland)
Leszek R. Jaroszewicz, Military University of Technology
(Poland)
M. Sh. Junisbekov, Taraz State University named after M.Kh.Dulaty
(Kazakhstan)
Piotr Kisala, Lublin University of Technology (Poland)
Bohdan Kosmowski, Gdańsk University of Technology (Poland)
Andrzej Kotyra, Lublin University of Technology (Poland)
Andrzej Kowalski, Warsaw University of Technology (Poland)

Małgorzata Kujawińska, Warsaw University of Technology (Poland)
Zygmunt Łuczyński, Institute of Electronic Materials Technology
(Poland)
Tomasz Nasiłowski, InPhoTech (Poland)
Sergei Pavlov, Vinnitsa National Technical University (Ukraine)
Wiesław Podkościelny, Maria Curie-Skłodowska University
(Poland)
Tadeusz Pustelny, Silesian University of Technology (Poland)
Bohdan Stadnyk, Lviv Polytechnic National University (Ukraine)
B. Suleimenov, K.I. Satpaev Kazakh National Technical University
(Kazakhstan)
Paweł Szczepański, Warsaw University of Technology (Poland)
Tomasz Szoplik, University of Warsaw (Poland)
Mieczysław Szustakowski, Military University of Technology (Poland)
Hugo Thienpont, Université Libre de Bruxelles (Belgium)
Jan Wasylak, AGH University of Science and Technology (Poland)

Organizing Committee

Wiesław Podkościelny, Chairman, University of Maria
Curie-Skłodowska (Poland)
Paweł Komada, Vice-Chairman, Lublin University of Technology
(Poland)

Members

Lidia Czyżewska, University of Maria Curie-Skłodowska
(Poland)
Małgorzata Gil, University of Maria Curie-Skłodowska (Poland)
Andrzej Kotyra, Lublin University of Technology (Poland)
Andrzej Smolarz, Lublin University of Technology (Poland)

Session Chairs

Opening Plenary Session on Hot Topics in Optical Fiber Technology,
Jubilee Session

Waldemar Wójcik, Lublin University of Technology (Poland)

- 1 Optical Fibers and Planar Optical Waveguides
Tomasz R. Woliński, Warsaw University of Technology (Poland)
- 2 Material Engineering in Optical Fiber Technology
Tadeusz Pustelny, Silesian University of Technology (Poland)
Jan Wasylak, AGH University of Science and Technology (Poland)
- 3 Microstructural and Photonic Optical Fibers
Elżbieta Bereś-Pawlik, Wrocław University of Technology (Poland)

- 4 Optical Fiber Sensors I
Tomasz Nasiłowski, InPhoTech (Poland)
- 5 Nonlinear and Active Optical Fibers
Wacław Urbańczyk, Wrocław University of Technology (Poland)
- 6 Photonics Applications II
Andrzej Kotyra, Lublin University of Technology (Poland)
- 7 Optoelectronic Systems and Associated Technologies
Zdzisław Jankiewicz, Institute of Electronic Materials Technology (Poland), and Military University of Technology (Poland)

Poster session on Optical Fiber Technology
Wiesław L. Woliński, Warsaw University of Technology (Poland)
Zdzisław Jankiewicz, Institute of Electronic Materials Technology (Poland), and Military University of Technology (Poland)

Workshop on Optical Fiber Technology
Paweł Mergo, University of Maria Curie-Skłodowska (Poland)

Closing Plenary Session, Awards Ceremony, Conference Summary
Ryszard S. Romaniuk, Warsaw University of Technology (Poland)

Introduction

The symposium Optical Fibers and Their Applications 2015 is a forum of national science in this branch of photonics. The symposium hosts a number of guests from this geographical region, and especially from Ukraine, Belarus, and Kazakhstan. It is organized every year and a half by two major optical fiber technology and application centers located in Białystok at Białystok University of Technology and in Lublin at Maria Curie-Skłodowska University and Technical University of Lublin. The conference belongs to a bigger circle of national conferences on optoelectronics, optics, photonics, sensors and laser technology which are under a general patronage of professional community organizations such as Polish Ceramic Society, Photonics Society of Poland, Polish Optoelectronics Committee of the Association of Polish Electrical Engineers, and the Section of Optoelectronics in the Committee of Electronics and Telecommunications, Polish Academy of Sciences.

On 22 –25 September 2015, the sixteenth conference on “Optical Fibers and Their Applications” was held at the Energetyk Resort in Nałęczów, near Lublin. The accompanying school/workshop on Optical Fiber Technology was held in Lublin at UMCS OFT Laboratory on 21 September. These conferences have been organized since 1976 in the Jabłonna Village Palace near Warsaw and then in a two year cycle in Białowieża, now in Lipowy Most (by Białystok University of Technology, Professor Jan Dorosz, with emphasis on applications, especially non-telecom ones) and in Krasnobród, now in Nałęczów (by UMCS Lublin, the late Doctor Jan Wójcik, Professor J. Rayss, now Doctor W. Podkościelny and Doctor P. Mergo, and Lublin University of Technology, Professor W. Wójcik, with emphasis on technology and telecom applications). The first conference in Białowieża, focused on non-telecommunication application of optical fibers and was held in 1982. During this period, the conferences in Lublin and then Krasnobród, now in Nałęczów, were more focused on technology and metrology of optical fibers supplementing the application and construction topics covered in Białowieża. The conference series on Optical Fibers and Their Applications has been organized in this country for 40 years. It was initiated by the late professors: J. Groszkowski, A. Smoliński, A. Waksmundzki, M. Pluta, B. Paszkowski, Z. Szpigler, J. Wójcik, K. Holejko, J. Rayss, S. Sołta. Forty years ago, optical fiber technology began in Poland. This anniversary was celebrated at the conference with a memorial jubilee session. The conferences always gathered a national group of optical fiber and optoelectronics experts and a large number of students and some international guests.

The sixteenth conference was opened by Professor W. Wójcik in the presence of the Rector of UMCS University and the Dean of the Faculty of Chemistry of UMCS. National expertise in optical fibers was centered in recent years around several big organizations, some of them with international roots: Section of

Optoelectronics, Committee of Electronics and Telecommunications, Polish Academy of Sciences; Polish Committee of Optoelectronics, Association of Polish Electrical Engineers; and the Polish Chapter of SPIE – The International Society for Optics and Photonics. The latter organization was transformed in 2008 to the Photonics Society of Poland. These organizations cooperate with SPIE, IEEE Poland Section and Photonics Chapter, Section of Optics by Polish Physical Society, and the Polish Ceramic Society.

During the conference's opening ceremony Professor W. Wójcik related to everyone the history of OFTA Naęczów conferences. The national experts of guided wave, laser, and semiconductor optoelectronics meetings in Krasnobród, Naęczów, Białowieża, Lipowy Most, and Świnoujście (Laser Technology Symposium) managed to integrate their activities into the framework of numerable optoelectronics research programs carried out during these years. These were programs: national, central, departmental, priority, university, and recently also European that were realized through a number of international partnerships. Realization of these projects led to numerable scientific and technical achievements as well as they were underlying factors for establishing a number of photonic firms in this country and modernizing the teaching at technical universities.

The 2015 Naęczów conference gathered around 120 participants. More than 80 papers were presented in oral and poster sessions. The largest group of papers originated from such university centers active in optoelectronics as: Silesian University of Technology in Gliwice, Białystok, Warsaw and Lublin as well as UMCS in Lublin. The topical coverage of the symposium included: materials for optoelectronics – in particular materials for optical fiber technology, fabrication of optical fibers, components and sub-assemblies for optoelectronics, metrology of optical fibers, metrology of optoelectronic components and devices, applications of optical fibers, education in optoelectronics and photonics. A few plenary papers were presented that touched on very current and hot problems in optoelectronics.

The technological sessions of the symposium presented the works from three main national centers where optical fibers are pulled: the Faculty of Chemistry, University of Maria Curie Skłodowska in Lublin, the Faculty of Electrical Engineering at Białystok University of Technology, and the Institute of Electronic Materials Technology in Warsaw. A number of research centers in this country and internationally use these optical fibers for optical fiber sensors and photonic instrumentation devices. A large group of applications concern microstructural photonic optical fibers filled or impregnated with liquid crystals, which are highly nonlinear optical substances, much more nonlinear than glasses. This group of papers originated from the laboratories at Warsaw and Wrocław Universities of Technology. The fibers were manufactured at UMCS in Lublin and at ITME in Warsaw. There were also numerable application-oriented contributions from photonics innovative firms.

The symposium organizers have provided very favorable participation conditions for Ph.D. and M.Sc. students. As a result, they participated in the symposium in large numbers. The majority of the papers were presented by young researchers which supports the belief that this branch of technology is vivid and promising for future development. The Editors would like to thank Doctor Andrzej Smolarz from Lublin University of Technology for his devoted help as a technical editor of this volume of proceedings from the sixteenth conference on Optical Fibers and Their Applications, Nałęczów, 2015.

Ryszard S. Romaniuk
Waldemar Wójcik

