Appendix 2

AUTHOR'S SUMMARY OF PROFESSIONAL ACCOMPLISHMENTS

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Wrocław 2016

1. Name and surname

Gabriela Statkiewicz-Barabach

2. Academic degrees, including the year of obtaining and the theses' titles

2003	MSc

Faculty of Fundamental Problems of Technology, Wroclaw University of Technology (field of study: Technical Physics, specialization: Biomedical Engineering-Biomedical Optics). MSc thesis title: *"Research on the properties of photonic crystal fibers,"* promoter: prof. Wacław Urbańczyk.

2007	PhD

Institute of Physics, Wroclaw University of Technology (branch of science: Physical Sciences, discipline: Physics). Doctoral thesis title: *"Experimental investigation of microstructured fibers for sensing applications,"* promoter: prof. Wacław Urbańczyk.

3. Information concerning the previous employment at academic institutions

2007 - 2009	research assistant at Wroclaw University of Technology, Faculty of Fundamental Problems of Technology, Institute of Physics.
2009-2014	research associate at Wroclaw University of Technology, Faculty of Fundamental Problems of Technology, Institute of Physics.
since 2014	research associate at Wroclaw University of Technology, Faculty of Fundamental Problems of Technology, Department of Optics and Photonics.

4. Indication of the academic achievement resulting from Article 16 Paragraph 2 of the Act of 14 March 2003 on Academic Degrees and Academic Title and on Degrees and Title in Arts (Law Journal No. 65, item 595 as amended)

4.1. The title of academic achievement

As an academic achievement, in accordance with the above-mentioned act, I indicate a series of publications on the subject of: **"Selected properties of the fibers structures with an axial modulation of refractive index."**

4.2. Publications included as part of the academic achievement

Below is presented a series of 10 publications printed in peer-reviewed scientific journals from ISI Master Journal List related to fiber optics, which concern the fabrication methods and the properties of waveguide structures with an axial modulation of refractive index, such as intermodal fiber interferometers, long period gratings, polarization gratings and Bragg gratings in birefringent and non-birefringent silica and polymer optical fibers. The declarations of co-authors stating their individual contributions into the presented series of publications are included in Appendix 4.

The series of 10 publications constituting the habilitation dissertation:

1. **G. Statkiewicz-Barabach,** K. Tarnowski, D. Kowal, P. Mergo, W. Urbańczyk, "Fabrication of multiple Bragg gratings in microstructured polymer fibers using a phase mask with several diffraction orders," Opt. Express **21**, 8521-8534 (2013).
Impact factor: 3.525

2. **G. Statkiewicz-Barabach**, D. Kowal, P. Mergo, W. Urbańczyk, "Comparison of growth dynamics and temporal stability of Bragg gratings written in polymer fibers of different types," J. Opt. **17**, 085606 (9pp) (2015).
Impact factor: 2.059

3. **G. Statkiewicz-Barabach**, D. Kowal, M. Szczurowski, P. Mergo, W. Urbańczyk, "Hydrostatic pressure and strain sensitivity of long period grating fabricated in polymer microstructured fiber," IEEE Photon. Technol. Lett. **25**, 496-499 (2013).
Impact factor: 2.176

4. D. Kowal, **G. Statkiewicz-Barabach**, P. Mergo, W. Urbańczyk, "Microstructured polymer optical fiber for long period gratings fabrication using an ultraviolet laser beam," Opt. Lett. **39**, 2242-2245 (2014).
Impact factor: 3.292

5. **G. Statkiewicz-Barabach**, A. Anuszkiewicz, W. Urbańczyk, J. Wójcik, "Sensing characteristics of rocking filter fabricated in microstructured birefringent fiber using fusion arc splicer," Opt. Express **16**, 17258-17268 (2008).
Impact factor: 3.880

6. A. Anuszkiewicz, **G. Statkiewicz-Barabach**, T. Borsukowski, J. Olszewski, T. Martynkien, W. Urbańczyk, P. Mergo, M. Makara, K. Poturaj, T. Geernaert, F. Berghmans, H. Thienpont, "Sensing characteristics of the rocking filters in microstructured fibers optimized for hydrostatic pressure measurements," Opt. Express **20**, 23320-23330 (2012).
Impact factor: 3.546

7. **G. Statkiewicz-Barabach**, J. Olszewski, P. Mergo, W. Urbańczyk, "Higher-order rocking filters induced mechanically in fibers with different birefringence dispersion," App. Opt. **53**, 1258-1267 (2014).
Impact factor: 1.784

8. **G. Statkiewicz-Barabach**, P. Mergo, W. Urbańczyk, "Rocking filter induced mechanically in a highly birefringent microstructured polymer fiber," Appl. Opt. **53**, 7729-7734 (2014).
Impact factor: 1.784

9. **G. Statkiewicz-Barabach**, J. Olszewski, M. Napiórkowski, G. Gołojuch, T. Martynkien, K. Tarnowski, W. Urbańczyk, J. Wójcik, P. Mergo, M. Makara, T. Nasiłowski, F. Berghmans, H. Thienpont, "Polarizing photonic crystal fiber with low index inclusion in the core," J. Opt. **12**, 075402-075408 (2010).
Impact factor: 1.662

10. **G. Statkiewicz-Barabach**, J. P. Carvalho, O. Frazão, J. Olszewski, P. Mergo, J. L. Santos, W. Urbańczyk, "Intermodal interferometer for strain and temperature sensing fabricated in birefringent boron doped microstructured fiber," App. Opt. **50**, 3742-3749 (2011).
Impact factor: 1.748

4.3. Description of the scientific goals of the above-mentioned publications, the obtained results and their possible applications

The research that I have conducted, whose results were published in a series of publications constituting a habilitation dissertation, had an experimental character and was concentrated on the current topics related to fiber optics. It was specifically focused on the fabrication methods as well as the properties of waveguide structures obtained by an axial modulation of the refractive index in birefringent and non-birefringent silica and polymer optical fibers, which are intended for potential applications in optical telecommunication and metrology. A number of methods allowing for fabrication long period gratings and polarizing gratings in silica and polymer microstructured and conventional optical fibers, including electric arc method for silica fibers, He-Cd laser beam method for polymer fibers, thermo-mechanical method for polymer fibers and the method based on a periodic force for polymer and silica fibers, were developed. An efficient way for fabricating higher-order Bragg gratings, in the visible range in polymer optical fibers with the phase mask and He-Cd laser, was also developed. Moreover, measurements of transmission and metrological properties of fabricated structures, including analysis of the growth dynamics, long-term stability and sensitivity to temperature, hydrostatic pressure ad elongation, were carried out. The obtained results confirm the possible applications of structures with an axial modulation of refractive index as a sensors to measurements of single physical parameter (temperature, elongation, hydrostatic pressure) or several parameters simultaneously. Such a structure can also be used in the future in telecommunications systems as a selective mirrors, multiplexers, attenuators and switches.

The dissertation was divided into four parts which discuss the ways of fabrication, selected properties and possible applications of the structures with an axial modulation of refractive index, including Bragg gratings, long period gratings, polarization gratings and intermodal interferometers.

4.3.1. Introduction

Among the structures with an axial modulation of refractive index most frequently used in practical applications, the largest group constitutes Bragg gratings, long period gratings, and the rocking filters, in which the axial changes of refractive index are of periodic character. The electromagnetic wave propagating in the fiber can be described as a combination of modes guided in the core and radiative modes guided in the cladding. In case when the electromagnetic wave propagating in the fiber is not distorted (that is in case of absence of axial modulation of refractive index), the core and cladding modes propagate completely independently without any interaction. However, in the fiber with axial periodic modulation of refractive index there occur resonant couplings between the modes fulfilling the phase matching condition [1]. The most frequently used method to analyze the fiber structures with axial modulation of refractive index is the coupled-mode theory, in which the propagation constant and the amplitude of the modes moving in opposite or same directions are calculated through solving a set of coupled differential equations. Most frequently it is assumed that for a specified light wavelength only two modes fulfil the phase matching condition and due to that fact they can couple with each other (i.e. the optical power is transferred from one mode to the other).

Bragg grating is a structure with periodically modulated refractive index in the core of an optical fiber. An electromagnetic wave propagating in the optical fiber with the inscribed Bragg grating

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[1] S. A. Vasil'ev, O. I. Medvedkov, I. G. Korolev, A. S. Bozhkov, A. S. Kurkov, and E. M. Dianov, "Fiber gratings and their applications," *Quantum Electron.* **35,** 1085 (2005).

undergoes scattering triggered by the refractive index modulation. When the phase difference between the waves scattered from the consecutive structural elements equals a multiple of 2π, the effect is a strong back reflection. A homogeneous Bragg grating with the period of Λ (the wavelength order) inscribed in a single mode fiber reflects light of wavelength λ_B , which fulfills the so-called phase-match condition (Bragg condition):

$$i\lambda_B = 2n_{eff}\Lambda, \tag{1}$$

where: i is the grating order, λ_B is called the Bragg wavelength, and n_{eff} is the effective refractive index of the mode[1-4]. Depending on the length of reflected Bragg wave, the grating period ranges from 400 nm to 2600 nm.

The period of long period gratings is significantly larger and amounts from 100 μm to 1000 μm. In such structures, the coupling occurs between the core mode and cladding modes of different orders propagating in the same direction. Owing to the fact that cladding modes are strongly absorbed by the polymer coating, the effect of coupling is visible in the transmission spectrum as sharp resonant loss with a center matching the resonant wavelength. A homogeneous long period grating with the period of Λ inscribed in a single mode fiber couples light of wavelength λ_{LPG} fulfilling the phase matching condition:

$$i\lambda_{LPG} = (n_{eff}^{co} - n_{eff}^{cl})\Lambda = \Delta n_{eff}\Lambda, \tag{2}$$

where: i is the resonance order, Δn_{eff} is the difference between the effective refractive indices of the core and cladding modes [1,3,4].

A rocking filter is a special type of long period grating fabricated in birefringent optical fiber in which the local changes in fiber geometry lead to a minor rotation (twist) of the polarization axes of the optical fiber [2,6,7]. In such types of gratings the coupling occurs between the orthogonally polarized core modes LP_{01}^x and LP_{01}^y. In the transmission spectrum of such gratings, with polarizers aligned in parallel to the polarization axes of the fiber at its input and output, there is a visible power loss in the transmission spectrum of the initially excited mode, while for the crossed polarizers, there is a clearly visible peak in the transmission spectrum of the initially non-excited mode. In this case, the phase matching condition can be defined as:

$$i\lambda_{RF} = \Lambda B(\lambda), \tag{3}$$

where: i is the resonance order, λ_{RF} denotes the resonance wavelength of the rocking filter, Λ is the grating period, $B(\lambda)$ is the phase birefringence of the optical fiber understood as the difference between the effective refractive indices of the fundamental modes of orthogonal polarizations.

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[2] R. Kashyap, *Fiber Bragg Gratings*, Academic Press, 1999.

[3] A. Othonos, K. Kalli, *Fiber Bragg Gratings, Fundamentals and Applications in Telecommunications and Sensing*, Artech House Optoelectronics Library, 1999.

[4] T. Erdogan, "Fiber grating spectra", J. Lightwave Technol., **15**, 1277-1294 (1997)

[5] A. M. Vengsarkar, P. J. Lemaire, J. B. Judkins, V. Bhatia,T. Erdogan, and J. E. Sipe, "Long-period fiber gratings as band-rejection filters," J. Lightwave Technol. **14**, 58-65 (1996).

[6] R. H. Stolen, A. Ashkin, W. Pleibel, and J. M. Dziedzic, "In-line fiber-polarization rocking rotator and filter," Opt. Lett. **9**, 300-302 (1984).

[7] K. O. Hill, F. Bilodeau, B. Malo, and D. C. Johnson, "Birefringent photosensitivity in monomode optical fiber: Application to external writing of rocking filters," Electron. Lett. **27**, 1548–1550 (1991).

[8] J. Villatoro, V. P. Minkovich, V. Pruneri and G. Badenes, "Simple all-microstructured-optical-fiber interferometer built via fusion splicing," Opt. Express **15**, 1491–1496 (2007).

[9] J. Villatoro, V. Finazzi, G. Badenes and V. Pruneri, "Highly sensitive sensors based on photonic crystal fiber," J. Sens. **2009,** 747803 (2009).

Intermodal fiber interferometers can be considered as structures with an axial modulation of the refractive index as well [8,9]. The working principle of an intermodal interferometer, e.g. a Mach-Zehnder in-fiber interferometer, exploits the effect of power coupling from the core mode to the higher-order modes or cladding modes in the first coupling point (for example through the local tapering of the fiber) and the recombination of both modes in the second coupling point. Then, it is possible to observe an interference of both modes at the output of the fiber in the form of spectral interference fringes.

The structures with an axial modulation of the refractive index can be fabricated both in silica fibers (the fabrication methods are already well-known) as well as in polymer fibers (the fabrication methods are in the initial development phase). Polymer optical fibers possess certain drawbacks compared to silica fibers, such as significant attenuation, strong water absorptions, significantly smaller thermal resistance, and difficulties in combining them with standard silica fibers. However, polymer fibers also have numerous advantages which enable unique applications of such fibers as well as the polymer structures with an axial modulation of refractive index. An unquestionable advantage of the polymer optical fibers over the silica fibers is greater elasticity (Young's modulus for PMMA amounts to approximately 3 GPa, whereas for silica glass to 73 GPa) as well as greater elongation range. Another advantage is the biocompatibility of PMMA which allows for the application of polymer optical fibers for example in medicine and biology. Polymers possess also an unique feature when it comes to the way of doping. Contrary to the silica optical fibers, it is possible to change the local properties of the polymer optical fiber (e. g. increase its photosensitivity) through diffusion of certain materials.

The wide application area of structures with axial modulation of refractive index, in particular Bragg gratings, can be divided into two groups. The first group is connected with the applications in optical telecommunication, where Bragg gratings are used for compensation of chromatic dispersion, as optical multiplexers/demultiplexers, for flattening the gain spectrum of EDFA amplifiers, as mirrors in fiber optic lasers and for stabilization of laser diode wavelengths. The second area of applications is related to the optical metrology. Bragg gratings as well as long period gratings and rocking filters can be applied for the measurements of various physical parameters including temperature, strain, hydrostatic pressure, bending, refractive index and others.

The main goal of the research conducted by the author was to develop and optimize the methods of fabrication of various types of waveguide structures with an axial modulation of refractive index in birefringent and non-birefringent silica and polymer optical fibers. The most important results were included in the series of publications constituting a habilitation dissertation, which focuses on fabrication methods and properties of Bragg gratings, long period gratings, rocking filters and intermodal interferometers, together with possible applications of such structures in optical telecommunication and metrology.

4.3.2. Bragg gratings

The first part of the publication series consists of two papers describing the fabrication method of Bragg gratings in polymer optical fibers as well as the studies of growth dynamics of polymer Bragg gratings , their long-term stability, and the effect of temperature and humidity on the reflection spectrum.. The studies reported in the first two papers were conducted by the author within the research project Operational Program Innovative Economy no. POIG.01.01.02-02-002/08 entitled

"The use of nanotechnology in advanced materials - microstructured polymer optical fibers," financed from the EU funds.

The most important result of the publications:

[1] **G. Statkiewicz-Barabach**, K. Tarnowski, D. Kowal, P. Mergo, W. Urbańczyk, "Fabrication of multiple Bragg gratings in microstructured polymer fibers using a phase mask with several diffraction orders," Opt. Express **21**, 8521-8534 (2013).

was to demonstrate for the first time the possibility to inscribe Bragg gratings in microstructured polymer optical fibers simultaneously for a number of wavelengths located in the visible and infrared range. Owing to the fact that polymer optical fibers made of poly(methyl methacrylate) (PMMA) possess smaller attenuation in the visible range, development of the method allowing for fabrication of Bragg gratings operating in this particular range of wavelengths is crutial importance. Due to a shorter period of gratings with the primary Bragg wavelength in the visible range, their inscription in an optical fiber is a more difficult than the inscription of gratings with the Bragg wavelength at 1555 nm. This makes the possibility of fabricating higher-order gratings an in interesting alternative for obtaining the structures operating in the visible range. Within the work [1], a special system was developed for fabrication of Bragg gratings in polymer optical fibers with the phase mask and He-Cd laser of 30 mW power, emitting at 325 nm. The existence of additional diffraction orders, apart from ±1st primary ones, in the diffraction spectrum of the phase mask used for the inscription of Bragg gratings (with a period of Λ), leads to the formation of the so-called Talbot interference pattern in the space behind the mask. Owing to the effect of polymer photosensitivity, this complex intensity distribution of the light field behind the phase mask is reproduced in the core of an optical fiber as an axial modulation of the refractive index with a period of Λ, $\Lambda/2$, $\Lambda/3$ etc. It leads to the formation of higher-order gratings reflecting light of different wavelengths than the primary Bragg wavelength. Paper [1] also includes a presentation of numerical simulations of the inscription process of higher-order gratings which analyze the possible interferences between waves diffracted into different orders. It allowed to find a credible link between the higher-order Bragg gratings and the peaks observed in the reflection spectrum of the inscribed periodic structure. For example, in the reflection spectrum of Bragg grating presented in [1] inscribed with the use of a phase mask with a period of Λ=1052 nm, for which 0th, ±1st, ±2nd, ±3rd diffraction orders are formed behind the phase mask, three Bragg peaks are visible, respectively at λ_B=1555 nm, $2\lambda_B/3$=1040 nm, and $\lambda_B/2$=782 nm, which correspond to the axial modulation of the refractive index with a period of $\Lambda/2$, $\Lambda/3$, $\Lambda/4$. Two additional peaks at $2\lambda_B/5$ and $\lambda_B/3$ corresponding to the modulation of the refractive index with a period of $\Lambda/5$ and $\Lambda/6$, whose existence was predicted by the numerical simulations, were not visible in the reflection spectra of the gratings inscribed in polymer microstructured fibers. The third diffraction order, which is essential for the formation of the fringe field with such a modulation periodicity, presumably undergoes too high scattering on the cladding microstructure.

Paper [1] also presents the characteristic features of the reflection spectra of Bragg gratings fabricated in non-annealed microstructured polymer optical fibers and their evolution during the inscription process. The change in Bragg wavelength and the peak's height versus the irradiation time and after the irradiation is finished, for all three peaks visible in the reflection spectrum, was demonstrated. During the inscription, the shift of all three peaks towards shorter wavelengths was observed. This effect is related to the change in the refractive index as well as the temperature-induced fiber shrinkage during the irradiation, which leads to a gradual reduction of the period of the grating being formed in the fiber. This effect is caused by relaxation of the stress frozen in the fiber during drawing process. After switching off the UV laser, all peaks shift towards longer wavelengths, which is a result of the fiber cooling. However, part of the frozen-in stress is released at increased temperature causing permanent shrinkage of the gratting, which after switching off the laser and stabilization of the peak's position is visible as permanent shift of the Bragg wavelength towards the shorter wavelengths. The longer the irradiation time of the grating, the greater is the observed permanent shift of Bragg wavelength.

The Bragg wavelength shift is the greatest for the primary peak at λ_B=1555 nm, whereas the smallest for the peak at $\lambda_B/2$=782 nm. The Bragg peak's height in the reflection spectrum increases with the irradiation time. Having attained the maximum height, a decrease of peak height is visible when the grating continues to be exposed to irradiation. The quickest saturation is observed for the peak at $\lambda_B/2$=782 nm, whereas the slowest saturation for the peak at λ_B=1555 nm. The primary peak attains the greatest height, whereas the peak at $2\lambda_B/3$=1040 nm is always the smallest (which is probably caused by a stronger scattering of the third diffraction order). The dependence of the dynamics of the Bragg grating growth on the orientation of the microstructured fiber with respect to the irradiation beam is visible as well.

The measured response of higher-order gratings to temperature changes was also presented in [1]. The gratings were subjected to heating in a number of successive cycles with a gradually increasing range of temperature. A hysteresis increasing with the maximal heating temperature caused by releasing of the frozen-in stress was observed. As a result, after each temperature cycle there was a permanent shift of the Bragg peaks towards shorter wavelengths. The height of all peaks was subtly changing during the successive temperature cycles up to 80°C. At the temperature above 80°C in the last measurement cycle, a quick decrease of the height of all Bragg peaks until their complete disappearance was visible. Moreover, at the temperature above 80°C, a significant shift of all the Bragg peaks towards shorter wavelengths wasobserved. It was caused by a quick shrinkage of the fiber resulting from stress relieving in high temperature. In contrast to Bragg gratings inscribed in silica optical fibers, the change in refractive index resulting from a thermo-optic effect in Bragg gratings inscribed in polymer fibers has a greater impact on the Bragg wavelength shift than the thermal expansion which results in negative sign of the temperature sensitivity for all peaks. The change in Bragg wavelength is greater during the heating of the grating. Additionally, the sensitivity of the grating decreases in the successive cycles and in the last cycle (up to 90°C) it equaled, in the linear part of the characteristics, -59 pm/°C for the λ_B peak, -40.9 pm/°C for the $2\lambda_B/3$ peak, and - 31.1 pm/° for the $\lambda_B/2$ peak. It allows for applications of the gratings inscribed in polymer fibers for temperature measurements within a range of up to 80°C with a good resolution of 0.02-0.03°C (assuming the Bragg wavelength measurement resolution of the order of 1 pm).

> My contribution to work [1] included the development of the method of Bragg gratings inscription in polymer optical fibers, the fabrication of higher-order Bragg gratings in microstructured polymer fibers, the analysis of the inscription process of higher-order Bragg gratings, the interpretation of research results as well as the participation in the preparation of the manuscript. I estimate my percentage contribution to work [1] to be 60%.

The second work:

[2] **G. Statkiewicz-Barabach**, D. Kowal, P. Mergo, W. Urbańczyk, "Comparison of growth dynamics and temporal stability of Bragg gratings written in polymer fibers of different types," J. Opt. **17**, 085606 (9pp) (2015).

presents the research results concerning the growth dynamics of Bragg gratings in two different polymer fibers, that is in a microstructured fiber made of pure PMMA as well as in a step-index PMMA fiber with a core made of PMMA/PS copolymer. The detailed analysis of the inscription dynamics of gratings demonstrated for the first time in [2] enables to understand the processes occurring during the exposure of different types of polymer fibers to the UV light and, in consequence, the selection of optimal conditions for the gratings inscription.

Before the inscription process, both fibers were heated for 5 h at the temperature of 85°C. The heating causes release of residual stress frozen-in during the fiber drawing, which directly results in the improvement of quality of the Bragg peaks and a better temporal stability of the fabricated gratings. It was reported in [2] that the growth dynamics of Bragg gratings in the fibers with a core made of PMMA/PS copolymer is considerably different than in the fibers made of pure PMMA, which is connected with an increased UV absorption in polystyrene. It was observed that the inscription of gratings in fibers with polystyrene core is more than two times faster than in a PMMA fiber. Additionally, a large difference in the dynamics of changes in the FWHM of Bragg peaks was reported in both fibers. This parameter started to be registered from the moment the Bragg peak's height reached 3 dB in the reflection spectrum. For the gratings inscribed in the fiber made of pure PMMA, it remained practically unchanged during the whole inscription process, whereas for the gratings inscribed in the fibers with a PMMA/PS core a sudden increase of peak's width was observed after a longer irradiation of the fiber. In case of fibers with a core made of PMMA/PS copolymer, it is possible to indicate three phases of the grating growth. The first phase (type I gratings) is characterized by the increase of peak's height and a practically unchanged FWHM. In the second phase (mixed gratings) the peak's height is still rising at a similar rate that in the first phase, however, a sudden increase of the peak's FWHM from 0.6 nm to approximately 2.0 nm is also visible. In the third phase (type II gratings) the Bragg peak's height reaches the saturation level, whereas the peak's FWHM is still on the increase. The sudden increase of the gratings' FWHM and the creation of mixed and II type gratings in the fibers with a PMMA/PS core are caused by the structural changes of the material in the core area. It is connected with an increased UV absorption in polystyrene, which is one of the components of the core. In the gratings inscribed in the optical fibers made of pure PMMA, the broadening of the Bragg peak is not observable, owing to a similar UV absorption in the core and cladding region. A longer irradiation of the PMMA fiber causes only a deformation of the fiber's surface. A greater FWHM of the Bragg peaks (approximately 1.0 nm) of the gratings inscribed in the microstructured fibers is caused by the presence of a cladding microstructure responsible for scattering of the UV beam, which leads to the deterioration of reproduction quality of the light intensity pattern arising in the space behind the phase mask in the core of an optical fiber.

Moreover, the long-term stability of all types of gratings inscribed in the fiber with the PMMA/PS core as well as gratings inscribed in the microstructured fiber made of pure PMMA was analyzed in [2]. The behavior of the gratings was monitored for approximately 8 months from the moment of their fabrication. It was observed that type I gratings are unstable in time. The Bragg peak's height for these gratings immediately starts to decrease after the irradiation is finished and sometimes their complete disappearance can be observed. The speed of the degradation process of type I gratings depends on the moment the inscription process is stopped. The shorter the irradiation time of type I grating, the quicker the degradation of the spectrum of the fabricated grating. A similar temporal stability characterizes mixed gratings, with the difference that the Bragg peak's height for these gratings does not decrease so significantly that in case of type I gratings. The best temporal stability characterizes type II gratings. In this case, the peak's height versus time is practically unchanged. A good temporal stability characterizes also gratings in microstructured fibers made of pure PMMA inscribed until the Bragg peak's height reaches saturation level. It was also demonstrated in [2] that changes in air humidity are responsible for the visible drifting of the Bragg peaks during monitoring of the gratingstemporal stability.

> My contribution to work [2] included the fabrication of higher-order Bragg gratings in microstructured PMMA polymer fibers and step-index PMMA/PS fibers, the analysis of the growth dynamics of Bragg gratings in both fibers, the interpretation of research results as well as the preparation of the manuscript. I estimate my percentage contribution to work [2] to be 80%.

4.3.3. Long period gratings

The second part of the publication series consists of two papers [3,4] describing the fabrication methods as well as the properties of long period gratings in microstructured polymer optical fibers. Two different methods of the fabrication of long period gratings were developed. The fabricated gratings were analyzed for the long-term stability as well as the sensitivity to various external factors. The research reported in [3,4] was conducted within the project Operational Programme Innovative Economy no. POIG.01.01.02-02-002/08 entitled "The use of nanotechnology in advanced materials - microstructured polymer optical fibers," financed from the EU funds.

The third work:

[3] **G. Statkiewicz-Barabach**, D. Kowal, M. Szczurowski, P. Mergo, W. Urbańczyk, “Hydrostatic pressure and strain sensitivity of long period grating fabricated in polymer microstructured fiber,” IEEE Photon. Technol. Lett. **25**, 496-499 (2013).

reports on fabrication of long period gratings in microstructured polymer fibers with the use of thermo-mechanical method. This method is based on a mechanical inducement of a periodic structure in a polymer optical fiber at increased temperature, which leads to the creation of periodic axial modulation of the effective refractive index of the guided modes. Therefore, a grooved plate with a period of 1 mm heated by two Peltier elements was used. The aim of the first experiments was to find optimal parameters of inscription (applied force, temperature) which allow to fabricate gratings with the best characteristics, such as low transmission losses occurring during the inscription of the grating, high resonance losses, low FWHM of the resonance as well as good long-term stability. Attempts were made to inscribe the grating within the temperature range from 60°C (at which PMMA becomes ductile) to 115°C (the temperature corresponding to the glass transition point of PMMA). It was found that the optimal temperature for the mechanical inducement of long period gratings in a single mode microstructured fiber made of PMMA equals approximately 70°C. Work [3] demonstrated the typical characteristics of the fabricated gratings with a resonant coupling to cladding modes in the visible range (694 nm), the resonance depth amounting to approximately 11 dB, and with transmission losses lower than 1 dB. Experimental results concerning the metrological properties of the fabricated long period gratings were also demonstrated. The measurements of hydrostatic pressure sensitivity were carried out in three cycles successively up to 3 , 5 and 7 MPa, returning to the atmospheric pressure (0.1 MPa) after each cycle. In the studied measurement range a linear and positive response of the grating was registered (the resonance wavelength was shifting towards longer wavelengths with the increasing pressure $d\lambda/dp=2.29$ nm/MPa). In the last measurement cycle a slight hysteresis was visible, i.e., the resonance wavelength was not returning to the initial value after the decrease of the pressure. The influence of pressure on the resonance depth of the grating was relatively small. For the pressure of 7 MPa, the resonance depth decreased by approximately 1.5 dB. After the pressure was decreased, the resonance depth returned to the initial value.

The fabricated gratings were also subjected to elongation in five measurement cycles: 0-2.1, 0-4.8, 0-7.5, 0-11.5, and 0-16.8 mstrain. Owing to short time intervals between the successive measurement cycles, approximately 5-10 min, a small hysteresis was observed in all the cycles. After the grating was stretched to 16.8 mstrain, the resonance wavelength returned to the initial value only after 6 h from the moment the measurements were finished, which however shows that the elongation value causing permanent deformation of the polymer material had not been exceeded. The response of the grating to strain was linear and negative in all measurement cycles (the resonance wavelength was shifting towards shorter wavelengths with the elongation of the fiber). By averaging independently the experimental results obtained for elongation and loosening of the fiber, the strain sensitivity was determined respectively for increasing ($d\lambda/d\varepsilon=-1.418$nm/mstrain) and decreasing strain ($d\lambda/d\varepsilon=-1.363$ nm/mstrain). The elongation of the fiber had also an impact on the resonance depth of the grating. It was initially increasing up to 16 dB which indicates that the inducement of the periodic structure in the polymer material was too strong. After the value of approximately 8 mstrain was exceeded, the resonance depth started to decrease and it equaled only 7 dB for a fiber stretched to 16.8 mstrain. However, the resonance depth was returning to its initial shape after loosening of the fiber. The properties of the gratings were monitored for 72 days. During that time, their transmission characteristics did not significantly change which shows that the thermo-mechanical method may be used to fabricate long period gratings with good temporal stability. A number of gratings fabricated in similar conditions were also subjected to temperature changes. The response of the long period grating to temperature changes has non-linear character with clearly visible hysteresis. This effect is connected both with the relaxation of frozen-in stress caused by increased temperature as well as with the changes of water content in the polymer.

The research results presented in [3] indicated for the first time that the long period gratings inscribed in polymer optical fibers with the use of thermo-mechanical method can be successfully applied for hydrostatic pressure and strain measurements. A relatively simple and cheap method of fabrication of such gratings as well as their good long-term stability can become a trigger to intensify the research on long period gratings fabricated in polymer optical fibers, which has been in a preliminary phase so far. However, the limitations of such structures are worth mentioning, namely their low resistance to temperature. The research results showed that after the heating of the grating to the temperature of 60°C, the resonance depth decreased and at the temperature of 70°C it completely disappeared.

My contribution to work [3] included the fabrication of long period gratings in a microstructured polymer fiber with the use of thermo-mechanical method, the performance of measurements of hydrostatic pressure and strain sensitivity of the fabricated grating, the interpretation of research results as well as the preparation of the manuscript. I estimate my percentage contribution to work [3] to be 65%.

In the fourth work:

[4] D. Kowal, **G. Statkiewicz-Barabach**, P. Mergo, W. Urbańczyk, "Microstructured polymer optical fiber for long period gratings fabrication using an ultraviolet laser beam," Opt. Lett. **39**, 2242-2245 (2014).

a fabrication of long period gratings in polymer fibers with the use of point-by-point technique was demonstrated. Each point of the grating was separately irradiated with a focused He-Cd laser beam (λ=325 nm). The developed method exploits the phenomenon of polymer photosensitivity which is a result of the irradiation with a UV beam. In [4] the inscription process of long period gratings in a microstructured fiber made of pure PMMA in a microstructured fiber with increased photosensitivity was compared The fiber specially developed for this purpose, contains an external cladding layer whose photosensitivity was increased due to doping with trans-4-stilbenemethanol (TSB), which is an organic compound characterized by strong absorption connected with a photoinduced conformational transition from *trans* to *cis* (photoisomerization). During the fabrication of the gratings, the external cladding of the optical fiber undergoes strong deformation caused by an increased UV absorption and consequently by a local increase of the fiber temperature. The deformations of the cladding, which occur in this way, are transferred onto the microstructure and the core of an optical fiber, which change the effective refractive index of the propagating mode. Work [4] presents the transmission characteristics of an exemplary long period grating inscribed in a fiber with a photosensitized external cladding with a resonance depth of 20 dB and composed of 10 irradiated points with a period of Λ=1 mm. The irradiation time of a single point equaled 42 s and was three times shorter than the irradiation time applied in case of the gratings inscription in pure PMMA fibers. Moreover, the number of points required to fabricate a grating in the fiber with a photosensitized cladding is significantly smaller than for gratings fabricated in the fiber made of pure PMMA which additional shortens the inscription time. The application of the fiber with a doped cladding also allowed to decrease the level of transmission losses in comparison to the gratings inscribed in pure PMMA fibers. The loss decrease is related to the fact the irradiation of photosensitive fiber causes mostly the deformation of the external layer of the cladding while in case of the pure PMMA fibers the whole microstructure is deformed. In work [4] the response of the fabricated gratings to temperature and their long-term stability were analyzed as well. It was found that the gratings inscribed in the fiber with increased photosensitivity possess better temperature resistance and long-term stability in comparison to the gratings fabricated with the use of thermo-mechanical method.

My contribution to work [4] included the development UV laser based system system for the inscription of long period gratings in microstructured polymer optical fibers as well as the fabrication of first gratings. I estimate my percentage contribution to work [4] to be 35%.

4.3.4. Polarization gratings

The third part of the cycle consists of four publications concerning the fabrication methods and the properties of rocking filters, also known as polarization gratings, and one publication concerning polarizing optical fibers. The research described in publications [5-9] was conducted within a number of projects, including: Operational Program Innovative Economy no. POIG.01.01.02-02-002/08, Grant of the Ministry of Science and Higher Education no. N N505 560439, EU FP6 (NEMO-Network of Excellence), EU FP7 (PHOSFOS-STREP project).

In the fifth work:

[5] **G. Statkiewicz-Barabach**, A. Anuszkiewicz, W. Urbańczyk, J. Wójcik, "Sensing characteristics of rocking filter fabricated in microstructured birefringent fiber using fusion arc splicer," Opt. Express **16**, 17258-17268 (2008).

the possibility of fabrication of rocking filters with a resonance depth of over 20 dB through a periodic twisting of birefringent microstructured silica fiber in a fusion splicer was demonstrated. Phase modal birefringence is a strongly dispersive parameter, therefore the coupling between the modes with orthogonal polarizations can be obtained for various wavelengths, which was demonstrated for the first time in work [5]. The grating described in this article had three resonances, respectively at 855 nm, 1271 nm, and 1623 nm, which correspond quite well with the positions of the resonances predicted by the phase matching condition. Small differences in the calculated and experimentally observed positions of the resonances are connected with the fluctuation of the microstructured fiber geometry, which translates into the changes in birefringence along the fiber length, as well as with the additional birefringence induced by twisting the fiber. Work [5] also presented the results concerning sensitivity to temperature, hydrostatic pressure, and strain of the fabricated gratings. It aslo demonstrated a relation between the sensitivity of the grating and the polarimetric sensitivity of the birefringent fiber itself and its group modal birefringence. A very low temperature sensitivity of the grating, which equals only 1.77 pm/K for the first resonance, is an important experimental result reported in [5]. Such a low temperature sensitivity of the grating is connected with a low sensitivity of the fiber used for its fabrication, which was obtained by an appropriate selection of the fiber geometry and absence of doped inclusions. In a fiber with a homogeneous composition, thermal stress induced by the difference in thermal expansion coefficients of the cladding and the core does not occur. Another important result demonstrated in [5] is the extremely high sensitivity to hydrostatic pressure which amounts to 6.14 nm/MPa for the first resonance of the grating. As a consequence, the ratio of the pressure sensitivity to the temperature sensitivity is record high in comparison to other periodic structures (K_p/K_T=3500 K/MPa), which enables such gratings to become excellent devices for hydrostatic pressure measurements without the need for temperature compensation. The possibility of using rocking filters fabricated in microstructured polymer optical fibersr sensing purposes was also patented: G. Statkiewicz-Barabach, A. Anuszkiewicz, W. Urbańczyk, J. Wójcik, Patent. Poland, No. 217208, etitled *A method of measurement of physical parameters and a photonic sensor for the measurement of physicalparameters* : Int. Cl. G01D 5/353, G01L 11/02, G01B 11/16. Appl. No. 385819 of 05.08.2008. Publish. 30.06.2014.

> My contribution to work [5] included the development of the fabrication method of rocking filters with the use of a fusion slicer as well as the fabrication of higher-order rocking filters in

birefringent microstructured silica fiber, conducting part of the measurements of the sensitivity to temperature, hydrostatic pressure, and strain, the interpretation of results as well as the preparation of the manuscript. I estimate my percentage contribution to work [5] to be 55%.

In the sixth work:

[6] A. Anuszkiewicz, **G. Statkiewicz-Barabach**, T. Borsukowski, J. Olszewski, T. Martynkien, W. Urbańczyk, P. Mergo, M. Makara, K. Poturaj, T. Geernaert, F. Berghmans, H. Thienpont, "Sensing characteristics of the rocking filters in microstructured fibers optimized for hydrostatic pressure measurements," Opt. Express **20**, 23320-23330 (2012).

another method of the fabrication of rocking filters with the use of a CO_2 laser was demonstrated. The characteristics of two exemplary gratings with a resonance depth exceeding 20 dB fabricated in microstructured silica fibers of different geometry and the detailed analysis of the impact of temperature and hydrostatic pressure on the shifts of resonance wavelengths were also presented in [6]. The response of both gratings to the pressure had an opposite sign and was so strong (for the applied pressure of around p=9 MPa the shift of the resonance wavelength equaled approximately 300 nm for the first-order resonance in the first grating and 800 nm for the third-order resonance in the second grating for the applied pressure of around p=7 MPa) that it was possible to observe a deviation from the linear dependence of the resonace position on the applied pressure. The observed nonlinearity of the grating response is connected with the nonlinear dependence of the fiber polarimetric response to hydrostatic pressure as well as the nonlinear dependence of the group modal birefringence upon wavelength. The grating pressure sensitivity determined in the linear parts of the characteristics was record high and equaled 43.4 nm/MPa (within the pressure range from 0.1 to 3 MPa) for the first resonance of the first grating up to -178 nm/MPa (within the pressure range from 7.4 to 10 MPa) for the fourth resonance of the second grating. Moreover, the response of the first grating to temperature was very small and equaled -0.49 pm/K (in the range from 20 to 150°C) for the first resonance, whereas it had an opposite sign and amounted to 0.61 pm/K for the fourth resonance. It is therefore expected that the grating with the resonance at the wavelength of approximately 1.3 μm would have zero temperature sensitivity. In case of the second grating, the temperature sensitivity was higher and equaled -79 pm/K for the third resonance. The increase of temperature sensitivity is connected with the fact that the silica fiber possesses a germanium-doped core, which is responsible for the appearance of temperature-induced stress related to different thermal expansion coefficients of the pure and doped silica. Owing to the use of specially designed optical fibers with increased polarimetric sensitivity to hydrostatic pressure for the fabrication of rocking filters, a record high hydrostatic sensitivity with an extremely low temperature sensitivity, which additionally can be lowered with the use of pure silica fiber, was demonstrated in [6] for the first time. Such structures can be successfully applied in optical metrology for hydrostatic pressure measurements with up to 0.6 mbar resolution.

My contribution to work [6] relied on partial measurements of the phase and group modal birefringence, the temperature and hydrostatic pressure sensitivity of birefringent microstructured silica fibers and the sensitivity of the rocking filters fabricated in these fibers. I estimate my percentage contribution to work [6] to be 25%.

In the seventh work:

[7] **G. Statkiewicz-Barabach**, J. Olszewski, P. Mergo, W. Urbańczyk, "Higher-order rocking filters induced mechanically in fibers with different birefringence dispersion," App. Opt. **53**, 1258-1267 (2014).

the possibility of fabrication of higher-order rocking filters in birefringent silica optical fibers with the use of mechanical inducement method was demonstrated for the first time. What is more, detailed experimental and simulation studies concerning the influence of the force and its direction on the transmission characteristics of higher-order rocking filters fabricated in a microstructured silica fiber and a standard silica fiber with an elliptical core were presented. The dispersion of phase modal birefringence and, as a consequence, the spectral dependence of beat length in microstructured and conventional optical fibers is significantly different. In case of a microstructured optical fiber, the beat length decreases with wavelength which causes that lower-order resonances appear for shorter wavelengths. For a standard elliptical core fiber it is the opposite, i. e. the beat length increases with wavelength thus causing that lower order resonance appear for longer wavelengths.

The gratings were induced mechanically with the use of periodic force acting on the birefringent fiber. The applied force generates additional birefringence which is added to the intrinsic birefringence of the fiber. It leads to a minor rotation of the principal polarization axes of the optical fiber and, as a consequence, to the partial coupling of modes with orthogonal polarizations. The method of mechanical inducement of the rocking filters is reversible, i. e. after the force is removed, the fiber returns to its initial state and the grating disappears. The effect of the applied point-like force on the coupling coefficient between the orthogonally polarized modes was analyzed in the first place. In the microstructured fiber, the fraction of power coupled from the initially excited mode to the mode with orthogonal polarization increases in response to the increasing force. For the angle of force close to 45° with respect to the symmetry axis of the fiber, the coupling coefficient between the polarization modes reaches its maximum value. In case of a microstructured fiber, the coupling coefficient is strongly dependent on the wavelength and, in case of an elliptical core fiber, it is practically wavelength independent.The dispersion of coupling coefficient between the polarization modes has great impact on the spectral characteristics of the mechanically-induced rocking filters. In case of microstructured fibers, there is a clearly visible dependence of the resonace depth upon the wavelength, in contrast to the gratings induced in an elliptical core fiber. Similarly as in the case of point-like force, it is possible to observe the effect of the applied force on the depth of resonances in both fibers. Initially, together with the increasing force, the resonance depth also increases and after exceeding a certain value of force, corresponding to the maximum coupling, it starts to gradually decrease until complete disappearance. The disappearance of coupling between the polarization modes in a rocking filter observed for a certain value of applied force is caused by a back coupling of the whole power to the initially excited mode. Owing to a significant dispersion of coupling coefficient in a microstructured fiber, the force required to reach maximum coupling of power from one mode to the other strongly depends on the resonance order. In case of an elliptical core fiber, for which the coupling coefficient is practically wavelength independent, the force required to obtain maximum resonance depth changes slightly versus the resonance order. Additionally, in both fibers there is a clearly visible dependence of maximum resonance depth upon resonance order, i.e., the higher the resonance order, the smaller its depth. This effect is connected with random fluctuations of the grating period or with an uneven distribution of force in different coupling points, which leads to slight random changes in phase shift between the polarization modes in the successive segments of the grating. In [7] an analysis of the influence of the force on the additionally induced birefringence was conducted as well. A negative or a positive change in birefringence, which translates into a shift of resonances towards the shorter or longer wavelengths, is dependent on the angle of the applied force with respect to the symmetry axis of the fiber and is greatest for 0° and 90° angles. Experimental results presented in [7] were compared with the results of numerical calculations based on Jones formalism.

> My contribution to work [7] included the development of a system for the fabrication of mechanically-induced rocking filters, the fabrication of higher-order rocking filters in a birefringent microstructured silica fiber and in a standard elliptical core fiber, conducting part of the measurements of the fibers beat length and the coupling coefficient, the analysis of the influence of force on the resonances of the gratings, the interpretation of results and the partial preparation of the manuscript. I estimate my percentage contribution to work [7] to be 52%.

In the eighth work:

[8] **G. Statkiewicz-Barabach**, P. Mergo, W. Urbańczyk, "Rocking filter induced mechanically in a highly birefringent microstructured polymer fiber," Appl. Opt. **53**, 7729-7734 (2014).

the possibility of fabrication of mechanically-induced rocking filters in microstructured polymer fibers was presented for the first time. The increased hydrostatic pressure sensitivity of the rocking filters in comparison to long period gratings and Bragg gratings and, moreover, the biocompatibility of polymer optical fibers, allow for metrological applications of such structures in medicine and biology. Work [8] demonstrated that the gratings induced in microstructured polymer fibers possess similar properties to the gratings in microstructured silica fibers. Among others, it is possible to fabricate higher-order gratings, due to the fact that the beat length in polymer optical fiber is strongly dispersive. The coupling coefficient is also strongly dispersive, which translates into clear dependence of the resonance depth upon resonances order. For an exemplary grating presented in work [8] (14 coupling points, grating period of 8 mm, and overall load of 1200 g) the first-order resonance of depth of 22 dB was observed at the wavelength of approximately 740 nm, whereas the second-order resonance of depth of only 5 dB was visible at the wavelength of 1100 nm. Similarly as in the case of gratings induced in silica fibers, also in polymer fibers the maximum resonance depth was dependent on the resonance order.

> My contribution to work [8] included the development of a system for the fabrication of mechanically-induced rocking filters, the fabrication of a rocking filters in a birefringent microstructured polymer fiber, the analysis of the influence of force on the grating resonances, the interpretation of the obtained results and the preparation of the manuscript. I estimate my percentage contribution to work [8] to be 80%.

The possibility of applying rocking filters as fully fiber-optic measurement elements is limited by the necessity of using polarizers at the input and output of the birefringent optical fiber with a fabricated grating. This problem can be solved by splicing to the birefringent fiber with rocking filter segments of polarizing fibers, which will become a substitute of output polarizers. Polarizing optical fibers, in which one of the polarization modes is strongly attenuated and the second one propagates without significant losses, had been already known, however, their spectral application range had been relatively small (approximately 300 nm). In case of higher-order rocking filters, the spectral range, in which higher-order resonances are visible, is significantly broader. It became a motivation to search for new geometries of polarizing microstructured optical fibers with significantly enlarged single-polarization propagation range.

The ninth work:

[9] **G. Statkiewicz-Barabach**, J. Olszewski, M. Napiórkowski, G. Gołojuch, T. Martynkien, K. Tarnowski, W. Urbańczyk, J. Wójcik, P. Mergo, M. Makara, T. Nasiłowski, F. Berghmans, H. Thienpont, "Polarizing photonic crystal fiber with low index inclusion in the core," J. Opt. **12**, 075402-075408 (2010).

reports on experimental studies two microstructured polarizing fiber made of silica glass. The two fibers have been fabricated byUMCS. They possess two large air holes located in the near vicinity of the core and an additional boron-doped inclusion with a lower refractive index placed in the center of the core. Such optical fibers are characterized by two polarization bandwidths, located respectively in the short and long wavelength ranges. Moreover, bending of the fiber leads to a broadening of the polarization bandwidth even up to over 600 nm, that is twice as much as it had been reported to date. The experimental results presented in [9] have been confirmed by the numerical simulations based on the finite element method. It is expected that further optimization of the fiber structure and greater precision of its fabrication will allow to obtain even wider polarization bandwidth.

> My contribution to work [9] included the performance of polarization losses measurements in polarizing microstructured silica fibers, the interpretation of experimental results and in part preparation of the manuscript. I estimate my percentage contribution to work [9] to be 45%.

4.3.5. Intermodal interferometers

In the last work:

[10] **G. Statkiewicz-Barabach**, J. P. Carvalho, O. Frazão, J. Olszewski, P. Mergo, J. L. Santos, W. Urbańczyk, "Intermodal interferometer for strain and temperature sensing fabricated in birefringent boron doped microstructured fiber," App. Opt. **50**, 3742-3749 (2011).

the working principle as well as the properties of an intermodal fiber-optic interferometer fabricated in a birefringent microstructured fiber were presented. It is worth mentioning that I am currently continuing the research on such structures within the Iuventus Plus Grant of the Minister of Science and Higher Education (P2014 044573), entitled „Intermodal fiber interferometers in microstructured silica and polymer optical fibers for sensing applications." Work [10] presented a new type of intermodal Mach-Zehnder interferometer which was fabricated with the use of CO_2 laser in a two-mode birefringent silica fiber. The working principle of this interferometer uses the phenomenon of coupling between the polarization fundamental modes and higher-order modes which occurs at two fiber tapers located 11.7 mm apart. In order to make the intermodal coupling efficient, a special microstructured optical fiber with a boron doped inclusion in the core was developed and fabricated. Moreover, owing to high birefringence of the optical fiber, spectral interference fringes observed at the output of the interferometer were modulated by a polarimetric differential signal. In the output spectrum, the fringes arising from the intermodal interference averaged over orthogonal polarizations and the slowly changing envelope determined by the birefringence difference between the core and higher-order modes were visible. Such a structure of output signal creates a possibility to monitor the changes in position of individual interference fringes as well as the changes in their contrast which are observed in response to the change of physical parameters acting on the interferometer. In work [10] measurement results of the temperature and strain sensitivity of the interferometer, respectively within the range from 20 to 700°C and from 0 to 1.7 strain, were reported as well. The sensitivity of the interferometer connected with the shift of fringes and the change in their contrast amounts to - 2.51 nm/mstrain, - 0.0256 1/mstrain for the elongation, and 16.7 pm/°C and 5.74×10^{-5} 1/°C for the temperature. It allows to apply the proposed interferometer for a simultaneous measurement of both parameters. It is worth mentioning that in comparison to periodic structures, such as Bragg gratings and long period gratings, the proposed interferometer is characterized by simple construction and easy fabrication.

> My contribution to work [10] included the fabrication of intermodal fiber interferometer in a birefringent microstructured silica fiber with a boron doped core, the measurements of group modal birefringence as well as the difference between group refractive indices of the fundamental and higher-order modes, the interpretation of obtained results and the preparation of the manuscript. I estimate my percentage contribution to work [9] be 50%.

4.4. Academic and research plans for the following years

In the nearest future my research work will still be concentrated on the structures with an axial modulation of the refractive index. In particular, within the currently realized Iuventus Plus project, I intend to improve the fabrication technology of the **intermodal fiber interferometers** in microstructured silica and polymer optical fibers. In order to obtain optimal metrological parameters of the fabricated interferometers, I am planning to develop and test various types of interferometers, i.e., based on long period gratings, fiber tapering, collapsing of selected air holes, or transversal shift of the segments of a two-mode fiber spliced with single mode lead-in fibers. The optimized parameters will be the interferometer length, transversal shift of the spliced-in optical fiber, the width and length of the fiber tapers guaranteeing good intermodal coupling and, at the same time, low transmission losses. Various types of birefringent optical fibers will be tested, including, among others, optical fibers with low temperature sensitivity, high hydrostatic pressure sensitivity as well as various types of long period gratings inscribed in such fibers.

I am also planning to continue the research aiming to optimize the process of inscription of **Bragg gratings and long period gratings** in polymer fibers as well as the analysis of the metrological properties of such structures. A deeper understanding of the photosensitivity phenomenon, which in case of polymer fibers has not been fully explained, deserves special attention. In literature there is an indication of a number of possible mechanisms responsible for the changes of the refractive index of PMMA during irradiation with the UV beam, such as photodegradation, photopolymerization, cross linking, or photoisomerization. Reports presented in literature do not ultimately explain the photosensitivity mechanism of polymer fibers, especially for a wavelength of 325 nm used to fabricate Bragg gratings and long period gratings. Even the reports concerning the sign of change in the refractive index due to irradiation with the UV beam are contradictory. According to the observations that I have conducted, the change in the refractive index induced by the irradiation with the UV beam is negative and most likely caused by photodegradation of the polymer. Moreover, my research demonstrates that, similarly to silica fibers, also in polymer fibers the occurring reduction of residual stress frozen-in the optical fiber during elongation, is an important factor influencing the modulation of the refractive index during the irradiation with the UV beam.

5. Description of other academic and research achievements

5.1. Author's bibliometric data on 05/01/2016

The number of publications in journals from ISI Master Journal List:	31
The number of publications after obtaining PhD s:	24
Cumulative *Impact Factor* (according to *Journal Citation Report*)	81,145
Hirsch Index (according to *Web of Science, Science Citation Index*)	14
Total number of citations (according to *Web of Science, SCI*)	601
Number of citations without self-citations (according to *Web of Science, SCI*)	504

5.2. The course of the research work to date

5.2.1. Description of scientific activity before obtaining the doctoral degree

I am a graduate of the Faculty of Fundamental Problems of Technology at the Wrocław University of Technology. I finished Master's degree studies in Technical Physics with a major in Biomedical Engineering - Biomedical Optics in 2003. As part of my Master's thesis entitled *"Research on the properties of photonic crystal fibers"* accomplished under prof. Wacław Urbańczyk's supervision, I familiarized myself with the experimental methods applied for the characterization of optical fibers, including the methods used for the measurement of modal birefringence.

Immediately after finishing Master's degree studies, I started doctoral studies in the Fiber Optics Group supervised by prof. Wacław Urbańczyk. The research which I conducted within the scope of my doctoral dissertation was of experimental character and concerned the current issues connected with microstructured optical fibers. My work resulted in the creation of a number of original measurement methods as well as in conducting systematic experimental research on index-guided microstructured optical fibers and photonic bandgap fibers. It included the spectral measurements of phase and group modal birefringence, the measurements of strain, hydrostatic pressure, and temperature sensitivity as well as the measurements of polarization parameters and the characterization of Bragg gratings inscribed in microstructured optical fibers. An important element of my dissertation was complex research on spectral behavior of phase and group modal birefringence conducted for a wide range of microstructured optical fibers, both index-guided as well as photonic bandgap fibers. The obtained results demonstrated strong dispersive character of modal birefringence in index-guided optical fibers and a parabolic dependence of birefringence upon wavelength in photonic bandgap optical fibers, with a minimum birefringence located in the near vicinity of the bangap center [A.1, A.2, A.4, A.5]. I also demonstrated that temperature sensitivity in index-guided microstructured optical fibers is strongly dispersive and, in consequence, may be equal to zero at certain wavelength, which is very important for designing of fiber-optic sensors [A.3, A.6, A.7]. An important result of the dissertation was also demonstrating that polarimetric sensitivity to hydrostatic pressure, in index-guided microstructured fibers is much greater than in conventional , birefringent optical fibers (e.g. bow-tie) applied as pressure and strain sensors [A.3, A.6]. I also demonstrated that microstructured optical fibers with special construction can be applied as broadband fiber-optic polarizers [A.22,A.23]. The initial research on the properties of Bragg gratings inscribed in birefringent microstructured fibers demonstrated the applicability of such structures for a simultaneous measurement of temperature and hydrostatic pressure through the use of reflections for both polarization modes [A.18, A.24, A.28].

The results of my work over the period of 2003-2007 were published in 7 articles in peer-reviewed scientific journals as well as in 26 conference proceedings. During that time, I actively participated in the implementation of the project of the State Committee for Scientific Research, as well as in European research projects, including the European Network of Excellence on Micro-Optics (NEMO), Cost Action P11, and 2 bilateral agreements with Flanders and the Czech Republic. During the course of the doctoral studies, I participated in 3 internships ,at the Vrije Universiteit Brussel as well as in one at the Technical University of Ostrava.

My didactic activity during the doctoral studies overlapped with my academic interests and included classes in the Laboratory of General Physics, calculus on general physics, and classes in the Laboratory of Optical Measurements and the Laboratory of Fiber Optics. During the doctoral studies, I also actively participated in activities promoting the Wrocław University of Technology and the Institute of Physics among school children and youth. I was engaged, in experimental demonstrations within the Lower Silesian Science Festival and physics demonstrations conducted at elementary schools. I also participated in TARED education fair as well as conducted a seminar, promoting degree programs at the Faculty of Fundamental Problems of Technology at the Comprehensive High School in Lubań. During the doctoral studies, I was a member of SPIE which is an international professional organization. I was also a board member of the , SPIE Student Chapter in Wrocław and a vice president of the Chapter over the period of 2006-2007. I am also the winner of the first scholarship program within the Integrated Operational Program for Regional Development for doctoral students of the Wroclaw University of Technology.

My doctoral dissertation entitled *„Experimental investigation of microstructured fibers for sensing applications"* and defended on 25 September 2007 received the Rector's Award.

5.2.2. Description of scientific activity after obtaining the doctoral degree

After finishing doctoral studies on 6 October 2007, I was employed as a research assistant, at the Institute of Physics at the Faculty of Fundamental Problems of Technology, Wroclaw University of Technology and continued my research work in the Fiber Optics Group. It was concentrated on the research on transmission and sensing properties of microstructured optical fibers. One of the more interesting results was demonstrating that the group modal birefringence in a microstructured optical fiber with a GeO_2-doped elliptical inclusion in the core changes sign and crosses zero at, certain wavelength [B.1]. Moreover, the optimization of the geometry of microstructured optical fibers allows to improve their sensing properties significantly. In particular, it is possible to obtain zero temperature sensitivity for any wavelength [B.4] as well as extremely high sensitivity to hydrostatic pressure [B.7] and strain [B.8]. Apart from silica optical fibers, the area of my experimental research also included polymer optical fibers, which are characterized by a significantly greater deformation range connected with a smaller Young's modulus than silica glass. In work [B.5] the susceptibility of polymer optical fibers to various external parameters was determined as well as the systematic measurements of the differential piezooptic coefficient $\Delta C = C_2 - C_1$ (where C_1 and C_2 are piezooptic coefficients) in PMMA fibers elongated with different strain rates were reported [B.6]. The obtained experimental values of ΔC were within the range of $(-4.5 \div -1.5) \times 10^{-12}$ Pa^{-1} and were increasing in a non-linear way versus applied strain. Moreover, an important result presented in work [B.6] was the demonstration of the linear dependence of ΔC on the residual intrinsic birefringence of the fiber, which is related to the stress frozen-in during the fiber drawing process.

Over the recent years, my research has been focused on the development of fabrication technology of structures with an axial modulation of the refractive index in silica and polymer optical fibers, the measurements of their properties and the search for their possible applications. The obtained results were presented in details in the previous sections of this summary, due to the fact that the results of this research make the main contribution to my habilitation dissertation. The publications which are not included into the dissertation report on the method of improving the long period gratings inscription by using the polymer fibers with increased photosensitivity obtained by diffusion of azobenzene from the solution in methanol [B.14]. In publications [B.2, B.9] metrological properties of Bragg gratings inscribed in microstructured silica optical fibers were presented. The use of unique metrological properties of microstructured optical fibers (such as very low or even zero temperature sensitivity for certain wavelengths and, at the same time, high sensitivity to other parameters) in combination with easy inscription of Bragg gratings was the subject of PHOSFOS ("Photonic Skins for Optical Sensing") European Strep project in which I have recently participated. The aim of this project was to develop a new type of sensor for the simultaneous measurement of hydrostatic pressure and temperature based on Bragg gratings inscribed in specially designed microstructured fibers. The optical fibers together with the gratings are submerged in a polymer coating creating a peculiar "skin" enabling to record changes of pressure or lateral force simultaneously in numerous places. This type of sensor can be successfully applied in medical monitoring devices, in automotive and aviation industry as well as in robotics and civil engineering industry.

An important issue in the context of metrological applications is the possibility of simultaneous measurement of two or more physical parameters. One of the solutions to this problem is the application of rocking filters with a number of resonances or long period gratings fabricated in a birefringent fiber. The resonances of long period gratings are then separated, due to polarization, which enables the analysis of the shift of both resonances [B.10]. Another solution is the fabrication of an intermodal in-fiber interferometer e.g., a Mach-Zehnder interferometer, which was described in the main part of the dissertation or a Sagnac interferometer in an optical fiber with high birefringence [B.3]. It is worth adding that in recent years I have also been co-operating with the Cardiology Department of the Provincial Medical Center in Opole. The co-operation concerned the study of the connection between the heart rate variability (HRV) and heart rate (HR) and allowed to identify a significant difference in the dependence between these factors in women and men as well as to select patients after a heart attack who were at risk of various types of death. The obtained results were published in three publications [B.11-B.13].

In the period after obtaining the doctoral degree, I published 24 co-authored papers in scientific journals from ISI Master Journal List, 18 papers in conference proceedings and obtained one national patent [C.1]. During that time, I actively participated in the implementation of a number of national and European research projects and in two bilateral agreements with Portugal.

After the doctoral studies, I was a supervisor of 3 Master's theses and 7 Engineer's theses and an assistant promoter of 1 doctoral thesis. I am also the Head of two didactic laboratories of Optical Measurements and Optical Technologies. I also engaged in the organization of international conferences and scientific meetings and actively participated in actions popularizing education among school children and youth. I am a member of OSA international organization. I am also the winner of a number of scholarships for young scientists.

5.2.3. Other publications

5.2.3.1. Academic publications in scientific journals from the Journal Citation Reports (JCR) database before obtaining the doctoral degree

	Publication	Impact Factor
A.1	**G. Statkiewicz**, T. Martynkien, W. Urbańczyk, "Measurements of modal birefringence and polarimetric sensitivity of the birefringent holey fiber to hydrostatic pressure and strain", Optics Communications **241**, 339–348 (2004). 50% conducting the measurements, data analysis, manuscript preparation	1.581
A.2	M. Szpulak, **G. Statkiewicz**, J. Olszewski, T. Martynkien, W. Urbańczyk, J. Wójcik, M. Makara, J. Klimek, T. Nasiłowski, F. Berghams, and H. Thienpont "Experimental and theoretical investigations of the birefringent holey fiber with triple defect", Applied Optics **44**, 2652-2658 (2005). 35% conducting a part of the measurements, participation in the manuscript preparation	1.637
A.3	T. Nasiłowski, T. Martynkien, **G. Statkiewicz**, M. Szpulak, J. Olszewski, G. Gołojuch, W. Urbańczyk, J. Wójcik, P. Mergo, M. Makara, F. Berghmans, H. Thienpont, "Temperature and pressure sensitivities of the highly birefringent photonic crystal fiber with core asymmetry", Applied Physics B -Lasers and Optics**81**, 325-331 (2005). 10% conducting a part of the measurements	2.056
A.4	**G. Statkiewicz**, T. Martynkien, W. Urbańczyk, "Measurements of birefringence and its sensitivity to hydrostatic pressure and elongation in photonic bandgap hollow core fiber with residual core ellipticity", Optics Communications **255**, 175–183 (2005). 50% conducting the measurements, data analysis, manuscript preparation	1.456
A.5	P. Hlubina, M. Szpulak, L. Knyblova, **G. Statkiewicz**, T. Martynkien, D. Ciprian, W. Urbańczyk, „Measurement and modelling of dispersion characteristics of a two-mode birefringent holey fiber", Measurement Science&Technology**17**, 626–630 (2006). 10% conducting a part of the measurements	1.228
A.6	T. Martynkien, M. Szpulak, **G. Statkiewicz-Barabach,** G. Gołojuch, J. Olszewski, W. Urbańczyk, J. Wójcik, P. Mergo, M. Makara, T. Nasiłowski, F. Berghmans, H. Thienpont, "Measurements of sensitivity to hydrostatic pressure and temperature in highly birefringent photonic crystal fibers", Optical and Quantum Electronics **39**, 481-489 (2007). 5% conducting a part of the measurements	0.718
A.7	T. Martynkien, **G. Statkiewicz-Barabach**, M. Szpulak, J. Olszewski, G. Gołojuch, W. Urbańczyk, J. Wójcik, P. Mergo, M. Makara, T. Nasiłowski, F. Berghmans, H. Thienpont, "Measurements of polarimetric sensitivity to temperature in birefringent holey fibers," Measurement Science&Technology **18**, 3055-3060 (2007).	1.297

	10% conducting a part of the measurements	

5.2.3.2. Conference publications before obtaining the doctoral degree

A.8	**G. Statkiewicz**, W. Urbańczyk, W. J. Bock, J. Wójcik,“ Pomiar czułości włókien różnych typów na ciśnienie hydrostatyczne”, in proceedings of IX Conference on Optical Fibers and Their Applications, pp. 765-769, 9-11.10.2003, Krasnobród, Poland. 80% conducting a part of the measurements, data analysis, manuscript preparation
A.9	**G. Statkiewicz**, M. Szpulak, W. Urbańczyk, J. Wójcik, K. Poturaj, J. Klimek, „Pomiary właściwości fotonicznego włókna dwójłomnego z eliptycznym rdzeniem,” in proceedings of Congress of Metrology, pp. 209-212, 6-9.09.2004 Wrocław, Poland. 70% conducting the measurements, data analysis, manuscript preparation
A.10	T. Martynkien, M. Szpulak, **G. Statkiewicz**, W. Urbańczyk, J. Wójcik, P. Mergo, M. Makara, “Pressure sensitivity of the birefringent photonic crystal fiber with triple defect”, in proceedings of SPIE: Photonics Crystal Materials and Nanostructures, Vol. 5450, pp. 550–556, 27–29.04.2004, Strasbourg, France. 15% conducting a part of the measurements
A.11	W. Urbańczyk, M. Szpulak, **G. Statkiewicz**, T. Martynkien, J. Olszewski, “Sensing capabilities of the birefringent holey fibers”, in proceedings of IEEE: 6th International Conference on Transparent Optical Networks and European Symposium on Photonic Crystals, Vol. 1, pp. 91–94, 4–8.07.2004 Wrocław, Poland. 20% conducting a part of the measurements, data analysis
A.12	**G. Statkiewicz**, M. Szpulak, J. Olszewski, T. Martynkien, W. Urbańczyk, J. Wójcik, K. Poturaj, P. Mergo, “Birefringent holey fiber with triple defect”, in proceedings of IEEE: 6th International Conference on Transparent Optical Networks and European Symposium on Photonic Crystals, Vol. 2, pp. 350–354, 4–8.07.2004, Wroclaw, Poland. 60% conducting the measurements, data analysis, manuscript preparation
A.13	J. Olszewski, T. Nasilowski, M. Szpulak, **G. Statkiewicz**, T. Martynkien, W. Urbańczyk, J. Wójcik, P. Mergo, M. Makara, F. Berghmans, H. Thienpont, “Analysis of birefringent doped-core holey fibers for Bragg gratings”, in proceedings of SPIE: 17th International Conference on Optical Fibre Sensors, Vol. 5855, pp. 351–354, 23–27.05.2005, Bruges, Belgium. 5% data analysis
A.14	T. Martynkien, M. Szpulak, M. Kieryk, **G. Statkiewicz**, J. Olszewski, W. Urbańczyk, J. Wójcik, P. Mergo, M. Makara, T. Nasilowski, F. Berghmans, H. Thienpont, “Temperature sensitivity in birefringent photonic crystal fiber with triple defect”, in proceedings of SPIE: 17th International Conference on Optical Fibre Sensors, Vol. 5855, pp. 912–915, 23–27.05.2005, Bruges, Belgium. 15% conducting a part of the measurements
A.15	**G. Statkiewicz**, T. Martynkien, W. Urbańczyk, “Experimental characterization of the photonic bandgap holey fiber with residual core ellipticity”, in proceedings of IEEE: of 7th International Conference on Transparent Optical Networks, Vol. 2, pp. 303–306, 3–7.07.2005, Barcelona, Spain. 50% performance of the measurements, data analysis, manuscript preparation
A.16	W. Urbańczyk, T. Martynkien, M. Szpulak, **G. Statkiewicz**, J. Olszewski, J. Wójcik, “Photonic crystal fibers for sensing applications”, in proceedings of SPIE: International Congress Optics and Optoelectronics: Photonic Crystals and Fibers, Vol. 5950, pp. 595014, 28.08–2.09.2005, Warszawa, Poland. 15% conducting a part of the measurements

A.17	J. Olszewski, T. Nasilowski, M. Szpulak, **G. Statkiewicz**, T. Martynkien, W. Urbańczyk, J. Wójcik, P. Mergo, M. Makara, F. Berghmans, H. Thienpont, „Theoretical investigations of birefringent holey fiber of new construction", in proceedings of SPIE: International Congress Optics and Optoelectronics: Photonic Crystals and Fibers, Vol. 5950, pp. 59501W, 28.08–2.09.2005, Warszawa, Poland. 5% data analysis
A.18	C. Caucheteur, H. Ottevaere, T. Nasilowski, K. Chah, **G. Statkiewicz**, W. Urbańczyk, F. Berghmans, H. Thienpont, P. Mégret, "Superimposed Bragg gratings written into polarization maintaining fiber for monitoring micro-strains", in proceedings of SPIE: International Congress Optics and Optoelectronics: Optical Fibers: Applications; Vol. 5952, pp. 59520M, 28.08–2.09.2005, Warszawa, Poland. 10% conducting a part of the measurements
A.19	P. Hlubina, **G. Statkiewicz**, T. Martynkien, W. Urbańczyk, "Dispersion measurements of the birefringent holey fiber by interferometric methods," in proceedings of Photonics, Devices, and Systems III, vol. 6180, pp. 618017-1 - 618017-6, 8-11.06.2005, Prague, Czech Republic. 25% conducting a part of the measurements
A.20	T. Martynkien, **G. Statkiewicz**, M. Szpulak, J. Olszewski, W. Urbańczyk, J. Wójcik, P. Mergo, M. Makara, T. Nasilowski, F. Berghmans, H. Thienpont, "Measurements of hydrostatic pressure and temperature sensitivity in birefringent holey fibers," in proceedings of SPIE: Photonic Europe: Photonic Crystal Materials and Devices III, Vol. 6182, pp. 61822P, 3.04–7.04.2006, Strasbourg, France. 35% conducting a part of the measurements, data analysis
A.21	P. Hlubina, M. Szpulak, L. Knyblova, D. Ciprian, T. Martynkien, **G. Statkiewicz**, W. Urbańczyk, "Experimental and theoretical analysis of dispersion characteristics of two-mode birefringent holey fiber", in proceedings of SPIE: Photonic Europe: Photonic Crystal Materials and Devices III, Vol. 6182, pp. 61822G, 3.04–7.04.2006, Strasbourg, France. 5% conducting a part of the measurements
A.22	W. Urbańczyk, M. Szpulak, **G. Statkiewicz**, T. Martynkien, J. Olszewski, J. Wójcik, P. Mergo, M. Makara, T. Nasilowski, F. Berghmans, H. Thienpont, „Polarizing properties of photonic crystal fibers", in proceedings of IEEE: 8th International Conference on Transparent Optical Networks, Vol. 2 pp. 59-63, 18.06-22.06.2006, Nottingham, UK. 20% conducting a part of the measurements
A.23	**G. Statkiewicz**, M. Szpulak, T. Martynkien, W. Urbańczyk, J. Wójcik, M. Makara, P. Mergo, T. Nasilowski, F. Berghmans, H. Thienpont, "Polarizing photonic crystal fibers for different operation range", in proceedings of SPIE: XV Czech-Polish-Slovak Optical Conference Wave and Quantum Aspects of Contemporary Optics, Vol. 6609 pp. 2732-2735, 11–15.09.2006, Liberec, Czech Republic. 40% conducting a part of the measurements, data analysis, manuscript preparation
A.24	J. Wójcik, P. Mergo, M. Makara, K. Poturaj, T. Nasilowski, H. Thienpont, F. Berghmans, W. Urbańczyk, M. Szpulak, **G. Statkiewicz**, J. Olszewski, „High birefringent photonic crystal optical fiber for Bragg gratings inscriptions", in proceedings of SPIE: X Conference on Optical Fibers and Their Applications, Vol. 6608, pp. 66080P, 4-7.10.2006, Krasnobród, Poland. 5% conducting a part of the measurements
A.25	T. Nasilowski, **G. Statkiewicz**, M. Szpulak, J. Olszewski, G. Gołojuch, T. Martynkien, W. Urbańczyk, P. Mergo, M. Makara, J. Wójcik, J. Van Erps, J. Vlekken, Ch. Chojetzki, F. Berghmans, H. Thienpont, "Sensing applications of photonic crystal fibres", in proceedings of SPIE: X Conference on Optical Fibers and Their Applications, Vol. 6608, pp. 660802-16, 4-7.10.2006, Krasnobród, Poland.

	20% conducting a part of the measurements, data analysis
A.26	P. Hlubina, D. Ciprian, J. Trojkova, **G. Statkiewicz**, T. Martynkien, W. Urbańczyk, “Interferometric techniques used to measure speciality optical fibers,” in proceedings of Symposium on Photonics Technologies for 7th Framework Program, pp. 107-110, 12-14.10.2006, Wrocław, Poland. 15% conducting apart of the measurements
A.27	T. Martynkien, **G. Statkiewicz**, M. Szpulak, J. Olszewski, W. Urbańczyk, J. Wójcik, P. Mergo, M. Makara, T. Nasiłowski, F. Berghmans, H. Thienpont, “Measurements of temperature sensitivity in index-guided highly birefringent photonic crystal fiber,” in proceedings of 18th International Optical Fiber Sensors Conference, paper ThE65, 23-27.10.2006, Cancun, Mexico. 15% conducting a a part of the measurements, data analysis
A.28	T. Nasilowski, **G. Statkiewicz-Barabach**, M. Szpulak, J. Olszewski, T. Martynkien, W. Urbańczyk, P. Mergo, M. Makara, J. Wójcik, J. Van Erps, J. Vlekken, Ch. Chojetzki, F. Berghmans, H. Thienpont, “Sensing properties of Bragg grating in highly birefringent and single mode photonic crystal fiber”, in proceedings of SPIE: Europe Optics and Optoelectronics, Vol. 6588, pp. 65880I-1-65880I-10, 16 – 19.04.2007, Prague, Czech Republic. 15% conducting a part of the measurements, data analysis
A.29	P. Hlubina, M. Szpulak, D. Ciprian, J. Trojková, **G. Statkiewicz-Barabach**, T. Martynkien, W. Urbańczyk, “Theoretical and experimental analysis of waveguiding in a two-mode birefringent holey fiber”, in proceedings of SPIE: Europe Optics and Optoelectronics, Vol. 6588, pp. 65880K-1-65880K-9, 16–19.04.2007, Prague, Czech Republic. 15% conducting a part of the measurements
A.30	T. Martynkien, J. Olszewski, M. Szpulak, G. Gołojuch, **G. Statkiewicz-Barabach**, W. Urbańczyk, J. Wójcik, P. Mergo, M. Makara, T. Nasiłowski, F. Berghmans, H. Thienpont, “Investigation of birefringence of the fundamental and the higher order modes in index guiding photonic crystal fiber”, in proceedings of SPIE: Europe Optics and Optoelectronics, Vol. 6588, pp. 658810-1-658810-6, 16–19.04.2007, Prague, Czech Republic. 5% conducting a part of the measurements
A.31	P. Hlubina, D. Cyprian, J. Trojkova, **G. Statkiewicz-Barabach**, T. Martynkien, W. Urbańczyk, “Specialty optical fibers measured by interferometric techniques”, in proceedings of SPIE: Europe Optics and Optoelectronics, Vol. 6588, pp. 658811-1-658811-7, 16-19.04.2007, Prague, Czech Republic. 10% conducting a part of the measurements
A.32	W. Urbańczyk, T. Martynkien, M. Szpulak, **G. Statkiewicz-Barabach**, J. Olszewski, G. Gołojuch, J. Wójcik, P. Mergo, M. Makara, T. Nasilowski, F. Berghmans, H. Thienpont, “Photonic crystal fibers: new opportunities for sensing,” in proceedings of SPIE: Third European Workshop on Optical Fiber Sensors, Vol. 6619, pp. 66190G, 4 – 6.07.2007, Neapol, Italy. 10% conducting a part of the measurements
A.33	T. Nasiłowski, F. Berghmans, T. Geernaert, K. Chah, J. Van Erps, **G. Statkiewicz-Barabach**, M. Szpulak, J. Olszewski, G. Gołojuch, T. Martynkien, W. Urbańczyk, P. Mergo, M. Makara, J. Wójcik, Ch. Chojetzki, H. Thienpont, “Sensing with photonic crystal fibres,” in proceedings of IEEE International Symposium on Intelligent Signal Processing, pp. 815-820, 3-5.10.2007, Alcala de Henares, Spain. 5% conducting a part of the measurements

5.2.3.3. Academic publications in scientific journals from the Journal Citation Reports (JCR) database after obtaining the doctoral degree

	Publication	Impact Factor
B.1	T. Martynkien, M. Szpulak, **G. Statkiewicz-Barabach**, J. Olszewski, A. Anuszkiewicz, W. Urbańczyk, K. Schuster, J. Kobelke, A. Schwuchow, J. Kirchhof, H. Bartelt, “Birefringence in microstructure fiber with elliptical GeO_2 highly doped inclusion in the core,” Optics Letters **33**, 2764-2766 (2008). 10% conducting a part of the measurements	3.772
B.2	T. Geernaert, T. Nasiłowski, K. Chah, M. Szpulak, J. Olszewski, **G. Statkiewicz-Barabach**, J. Wójcik, K. Poturaj, W. Urbańczyk, M. Becker, M. Rothhardt, H. Bartelt, F. Berghmans, H. Thienpont “Fiber Bragg gratings in germanium-doped highly birefringent microstructured optical fibers,” IEEE Photonics Technology Letters**20**, 554-556 (2008). 5% conducting a part of the measurements	2.173
B.3	O. Frazão, S. O. Silva, J. M. Baptista, J. L. Santos, **G. Statkiewicz-Barabach**, W. Urbańczyk, J. Wójcik, “Simultaneous measurement of multiparameters using a Sagnac interferometer with polarization maintaining side-hole fiber,” Applied Optics **47**, 4841-4848 (2008). 10% conducting a part of the measurements	1.763
B.4	T. Martynkien, A. Anuszkiewicz, **G. Statkiewicz-Barabach**, J. Olszewski, G. Gołojuch, M. Szczurowski, W. Urbańczyk, J. Wójcik, P. Mergo, M. Makara, T. Nasiłowski, F. Berghmans, H. Thienpont, “Birefringent photonic crystal fibers with zero polarimetric sensitivity to temperature,” Applied Physics B-Lasers and Optics **94**, 635-640 (2009). 5% conducting a part of the measurements	1.992
B.5	M. Szczurowski, T. Martynkien, **G. Statkiewicz-Barabach**, W. Urbańczyk, D. J. Webb, “Measurements of polarimetric sensitivity to hydrostatic pressure, strain and temperature in birefringent dual-core microstructured polymer fiber,” Optics Express **18**, 12076-12087 (2010). 10% conducting a part of the measurements	3.753
B.6	M. Szczurowski, T. Martynkien, **G. Statkiewicz-Barabach**, W. Urbańczyk, L. Khan, D. J. Webb, “Measurements of stress-optic coefficient in polymer optical fibers,” Optics Letters **35**, 2013-2015 (2010). 10% conducting a part of the measurements	3.318
B.7	T. Martynkien, **G. Statkiewicz-Barabach**, J. Olszewski, J. Wójcik, P. Mergo, T. Geernaert, C. Sonnenfeld, A. Anuszkiewicz, M. Szczurowski, K. Tarnowski, M. Makara, K. Skorupski, J. Klimek, K. Poturaj, W. Urbańczyk, T. Nasiłowski, F. Berghmans, H. Thienpont, „Highly birefringent microstructured fibers with enhanced sensitivity to hydrostatic pressure,” Optics Express **18**, 15113-15121 (2010). 5% conducting a part of the measurements	3.753
B.8	T. Tenderenda, K. Skorupski, M. Makara, **G. Statkiewicz-Barabach**, P. Mergo, P. Marc, L. R. Jaroszewicz, T. Nasiłowski, “Highly birefringent dual-mode microstructured fiber with enhanced polarimetric strain sensitivity of the second order mode,” Optics Express **20**, 26996-27002 (2012). 10% conducting a part of the measurements	3.546

B.9	S. Sulejmani, C. Sonnenfeld, T. Geernaert, P. Mergo, M. Makara, K. Poturaj, K. Skorupski, T. Martynkien, **G. Statkiewicz-Barabach**, J. Olszewski, W. Urbańczyk, C. Caucheteur, K. Chah, P. Mégret, H. Terryn, J. Van Roosbroeck, F. Berghmans, H. Thienpont, "Control over the pressure sensitivity of Bragg grating-based sensors in highly birefringent microstructured optical fibers," IEEE Photonics Technology Letters **24**, 527-529 (2012). 5% conducting a part of the measurements	2.038
B.10	J. P. Carvalho, A. Anuszkiewicz, **G. Statkiewicz-Barabach**, J. M. Baptista, O. Frazão, P. Mergo, J. L. Santos, W. Urbańczyk, "Long period gratings and rocking filters written with a CO2 laser in highly-birefringent boron-doped photonic crystal fibers for sensing applications," Optics Communications **285**, 264-268 (2012). 25% conducting a part of the measurements, data analysis	1.438
B.11	J. Sacha, S. Barabach, **G. Statkiewicz-Barabach**, K. Sacha, A. Müller, J. Piskorski, P. Barthel, G. Schmidt, „How to select patients who will not benefit from ICD therapy by using heart rate and its variability?," International Journal of Cardiology **168**, 1655-1658 (2013). 5% data analysis	6.175
B.12	J. Sacha, S. Barabach, **G. Statkiewicz-Barabach**, K. Sacha, A. Müller, J. Piskorski, P. Barthel, G. Schmidt, „How to strengthen or weaken the HRV dependence on heart rate - description of the method and its perspectives," International Journal of Cardiology **168**, 1660-1663 (2013). 5% data analysis	6.175
B.13	J. Sacha, S. Barabach, **G. Statkiewicz-Barabach**, K. Sacha, A. Müller, J. Piskorski, P. Barthel, G. Schmidt, „Gender differences in the interaction between heart rate and its variability - how to use it to improve the prognostic power of heart rate variability," International Journal of Cardiology **171**, e42-e45 (2014). 5% data analysis	4.036
B.14	D. Kowal, **G. Statkiewicz-Barabach**, P. Mergo, W. Urbańczyk, „Inscription of long period gratings using an ultraviolet laser beam in the diffusion-doped microstructured polymer optical fiber," Applied Optics **54**, 6327-6333 (2015). 20% data analysis	1.784

5.2.3.4. Conference publications after obtaining the doctoral degree

B.15	W. Urbańczyk, T. Martynkien, M. Szpulak, **G. Statkiewicz-Barabach**, A. Anuszkiewicz, J. Olszewski, G. Gołojuch, M. Szczurowski, J. Wójcik, P. Mergo, M. Makara, T. Nasiłowski, F. Berghmans, H. Thienpont, ”Photonic crystal fibers for sensing applications”, in proceedings of IEEE: Winter Topical Meeting Series, pp. 196-197, 14–16.01.2008, Sorrento, Italy. 15% conducting a part of the measurements, data analysis,
B.16	**G. Statkiewicz-Barabach**, A. Van Hoeken, M. Mikołajczyk, W. Urbańczyk, "Measurement of the chromatic dispersion in birefringent microstructured fibers by spectral interferometry", in proceedings of SPIE: XI Conference on Optical Fibers and Their Applications Vol. 7120, pp. 71200B, 31,01-2.02.2008, Białowieża, Poland. 85% conducting the measurements, data analysis, manuscript preparation

B.17	A. Anuszkiewicz, **G. Statkiewicz-Barabach**, T. Martynkien, W. Urbańczyk, P. Mergo, M. Makara, J. Wójcik, "Measurement of modal birefringence and temperature sensitivity of birefringent holey fibers", in proceedings of SPIE: XI Conference on Optical Fibers and Their Applications, Vol. 7120, pp. 71200A, 31,01-2.02.2008, Białowieża, Poland. 30% conducting a part of the measurements, data analysis,
B.18	T. Martynkien, A. Anuszkiewicz, **G. Statkiewicz-Barabach**, W. Urbańczyk, J. Wójcik, P. Mergo, M. Makara, T. Nasilowski, H. Terryn, F. Berghmans, H. Thienpont, "Highly birefringent holey fibers with zero polarimetric sensitivity to temperature", in proceedings of SPIE: Photonic Europe: Photonic Crystal Fibers II, Vol. 6990, pp. 699011-1-699011-5, 9-10.04.2008, Strasbourg, France. 15% conducting a part of the measurements
B.19	**G. Statkiewicz-Barabach**, A. Anuszkiewicz, W. Urbańczyk, J. Wójcik, "Rocking filters fabricated in birefringent photonic crystal fiber", in proceedings of SPIE: 16th Polish-Slovak-Czech Optical Conference on Wave and Quantum Aspects of Contemporary Optics, Vol. 7141, pp. 71410I, 8-12.09.2008, Polanica Zdrój, Poland. 60% conducting a part of the measurements, data analysis, manuscript preparation
B.20	T. Martynkien, **G. Statkiewicz-Barabach**, W. Urbańczyk, J. Wójcik, "Highly birefringent microstructured fibers for sensing applications", in proceedings of SPIE: 16th Polish-Slovak-Czech Optical Conference on Wave and Quantum Aspects of Contemporary Optics, Vol. 7141, pp. 714108, 8-12.09.2008, Polanica Zdrój, Poland. 35% conducting a part of the measurements, data analysis
B.21	G. Gołojuch, **G. Statkiewicz-Barabach**, M. Szpulak, J. Olszewski, T. Martynkien, W. Urbańczyk, J. Wójcik, P. Mergo, M. Makara, T. Nasiłowski, F. Berghmans, H. Thienpont, "Polarizing photonic crystal fiber with boron doped inclusion in the core", in proceedings of MOC '08: Technical Digest of the Fourteenth Microoptics Conference, pp. 328-329, 25-27.09.2008, Brussels, Belgium. 35% conducting a part of the measurements, data analysis
B.22	M. Kadulová, P. Hlubina, D. Ciprian, **G. Statkiewicz-Barabach**, W. Urbańczyk, J. Wójcik, "Birefringence dispersion in elliptical-core fibers measured over a broad wavelength range by interferometric techniques", in proceedings of SPIE: Optics + Optoelectronics, Photonic Crystal Fibers III, Vol. 7357, pp. 73570C, 20-23.04.2009, Prague, Czech Republic. 15% conducting a part of the measurements, data analysis
B.23	P. Hlubina, D. Ciprian, M. Kadulova, **G. Statkiewicz-Barabach**, W. Urbańczyk, "Broadband measurement of dispersion in a two-mode birefringent holey fiber by spectral interferometric techniques", in proceedings of SPIE: Optics+Optoelectronics, Photonic Crystal Fibers III, Vol. 7357, pp. 73570A, 20-23.04.2009, Prague, Czech Republic. 15% conducting a part of the measurements, data analysis
B.24	J. P. Carvalho, **G. Statkiewicz-Barabach**, A. Anuszkiewicz, J. M. Baptista, O. Frazão, J. Wójcik, J. L. Santos, W. Urbańczyk, "Sensing characteristics of long period gratings and rocking filters based on highly birefringent boron-doped photonic crystal fiber fabricated by a CO_2 laser", in proceedings of SPIE: Photonics Europe, Photonic crystal fibers IV, Vol. 7714 pp. 771403-1 - 771403-9, 12-16.04.2010. Brussels, Belgium. 35% conducting a part of the measurements, data analysis
B.25	M. Szczurowski, T. Martynkien, **G. Statkiewicz-Barabach**, L. Khan, D. J Webb, Ch. Ye, J. Dulieu-Barton, W. Urbańczyk, "Measurements of stress-optic coefficient and Young's modulus in PMMA fibers drawn under different conditions", in proceedings of SPIE: Photonics Europe, Photonic crystal fibers IV, Vol. 7714, pp. 77140G-1 - 77140G-8, 12-16.04.2010, Brussels, Belgium. 15% conducting the measurements

B.26	A. Anuszkiewicz, **G. Statkiewicz-Barabach**, J. Wójcik, W. Urbańczyk, “Rocking filter in microstructured birefringent fiber for hydrostatic pressure measurements”, in proceedings of SPIE: Optics & Photonics, Vol. 7781, pp. 77810R, 1-5.08.2010, San Diego, USA. 35% conducting the measurements, data analysis
B.27	M. Szczurowski, T. Martynkien, **G. Statkiewicz-Barabach**, W. Urbańczyk, D. J. Webb, “Polarimetric sensitivity to hydrostatic pressure and temperature in birefringent dual-core microstructured polymer fiber”, in proceedings of SPIE: Fourth European Workshop on Optical Fibre Sensors, Vol. 7653, pp. 76530D-1 - 76530D-4, 8–10.09.2010, Porto, Portugal. 15% conducting the measurements
B.28	**G. Statkiewicz-Barabach**, J. P. Carvalho, O. Frazão, J. Olszewski, P. Mergo, J. L. Santos, W. Urbańczyk, “Modal interferometric sensor based on a birefringent boron-doped microstructured fiber”, in proceedings of SPIE: International Conference on Applications of Optics and Photonics, Vol. 8001, pp. 80011K-1 - 80011K-6, 3-7.05.2011, Braga, Portugal. 50% conducting a part of the measurements, data analysis, manuscript preparation
B.29	T. Nasiłowski, K. Skorupski, M. Makara, **G. Statkiewicz-Barabach**, P. Mergo, P. Marc, L. Jaroszewicz, “Very high polarimetric sensitivity to strain of second order mode of highly birefringent microstructured fibre”, in proceedings of SPIE: 21st International Conference on Optical Fiber Sensors, Vol. 7753, pp. 775330-1 - 775330-4, 15-19.05.2011, Ottawa, Canada. 15% conducting the measurements
B.30	A. Anuszkiewicz, **G. Statkiewicz-Barabach**, T. Borsukowski, J. Olszewski, T. Martynkien, D. Kowal, W. Urbańczyk, P. Mergo, M. Makara, K. Poturaj, T. Geernaert, F. Berghmans, H. Thienpont, “Rocking filter in microstructured fiber for high resolution hydrostatic pressure measurements”, in proceedings of SPIE: 22nd International Conference on Optical Fiber Sensors, OFS-22, Vol. 8421, pp. 84210W-1 - 84210W-4, 15-19.10.2012, Beijing, China. 25% conducting the measurements, data analysis
B.31	**G. Statkiewicz-Barabach**, D. Kowal, P. Mergo, W. Urbańczyk, “Fabrication of higher order Bragg gratings in microstructured polymer fibers”, in proceedings of SPIE: Fifth European Workshop on Optical Fibre Sensors, Vol. 8794, pp. 879403-1 - 879403-4, 19-22.05.2013, Kraków, Poland. 75% conducting the measurements, data analysis, manuscript preparation
B.32	**G. Statkiewicz-Barabach**, D. Kowal, P. Mergo, W. Urbanczyk, “Experimental investigation of growth dynamics of higher order Bragg gratings in polymer fibers,” in proceedings of 22nd International Conference on Plastic Optical Fibers, POF 2013, pp. 5-8, 11-13.09.2013, Buzios, Brazil. 80% conducting the measurements, data analysis, manuscript preparation

5.3. Inventions as well as utility models and industrial designs which obtained patent protection and were exhibited at international or national exhibitions or fairs

C.1	**G. Statkiewicz-Barabach**, A. Anuszkiewicz, W. Urbańczyk, J. Wójcik, Patent Number PL217208-B1. Method for measuring physical quantities and the photonic sensor for measuring of physical quantities: Int.Cl. G01D 5/353, G01L 11/02, G01B 11/16. Application details PL385819, 05 Aug 2008, Publication Date 30 June 2014. 40% conducting a part of the measurement, data analysis, preparation of the patent application

5.4. Supervision of international and national research projects as well as participation in such projects

	Type of project	Title of the project	Implementation period	Participation in the project
1.	Grant MNiSW, Iuventus plus, (IP2014 044573) Supervisor: dr G. Statkiewicz-Barabach	Intermodal interferometers in silica and polymer microstructured fibers for sensing applications	2015-2017	Leader
2.	Bilateral Agreement between Portugal and Poland MNiSW	Bragg and long period gratings in polymer fibers for sensing applications	2015-2017	Polish side Coordinator
3.	POIG 01.01.02-02-002/08 UE Supervisor: prof. W. Urbańczyk	Microstructured polimer fibers	2011-2014	Executor
4.	Bilateral Agreement between Portugal and Poland MNiSW	Novel microstructured fiber for sensing applications	2008-2010	Executor
5.	Grant MNiSW N N505 560439 Supervisor: prof. W. Urbańczyk	Long period gratings in photonic crystal fibers for metrology applications	2010-2013	Executor
6.	The Seventh Framework Programme EU Grant 224058 Supervisor: prof. W. Urbańczyk	Photonic Skins for Optical Sensing PHOSFOS	2008-2011	Executor
7.	Cooperation in Science and Technology COST, Action 299 Supervisor: prof. W. Urbańczyk	Optical Fibres for New Challenges Facing the Information Society	2008-2010	Executor
8.	The Sixth Framework Programme EU Network of Excellence for Micro-Optics Supervisor: prof. W. Urbańczyk	Network of Excellence for Micro-Optics NEMO	2004-2009	Executor
9.	Cooperation in Science and Technology COST, Action P11 Supervisor: prof. W. Urbańczyk	Physics of linear, non-linear and active photonics crystals - Birefringent and polarizing photonic crystal fibers for applications in optical metrology	2005-2007	Executor
10.	grant KBN PB Nr 2 P03B 024 24 Supervisor: prof. W. Urbańczyk	Microstructured fiber optics for measurement applications	2003-2006	Executor
11.	Bilateral Agreement between Czech Reoublic and Poland MNiSW	Characterization, modeling and applications of photonic crystal fibers, 2 agreements	2004-2007	Executor

12.	Bilateral Agreement between Flanders (Belgium) and Poland MNiSW	Micro-optics structures for applications in photonics, 2 agreements	2004-2007	Executor

5.5. International and national awards for scientific activity

1. Scholarship of the Ministry of Science and Higher Education for Outstanding Young Scientists, 2012-2015.
2. Award for the best oral presentation at the 22nd International Conference on Plastic Fibers (POF 2013), Buzios, Brazil, 2013.
3. The Young Staff 2015 Plus Scholarship within the EU Operational Program Human Capital, 2011-2012.
4. Scholarship within MASTER subsidy of the Foundation for Polish Science for prof. Wacław Urbańczyk, 2010-2012.
5. Scholarship within the Operational Program Human Capital (The Young Staff, 2nd and 3rd edition), the Wroclaw University of Technology, 2010-2011.
6. START Scholarship of the Foundation for Polish Science, 2010.
7. The Rector of the Wroclaw University of Technology's Award for the doctoral dissertation, "Experimental investigation of microstructured fibers for sensing applications," 2008.
8. Distinction of the Scientific Council of the Institute of Physics at the Wroclaw University of Technology for the doctoral dissertation, 2007.
9. Scholarship within the program: Operational Program for Regional Development (OPRD) - scholarships for the best doctoral students of the Wroclaw University of Technology, 2006-2007.

5.6. Papers delivered at international and national scientific conferences

1. *Measurements of the properties of birefringent photonic fiber with an elliptical core,* a presentation at the Congress of Metrology, 6–9.09.2004, Wrocław, Poland.
2. *Measurements of modal birefringence of photonic fibers*, a presentation at the 2nd Students' Science Conference at the Wroclaw University of Technology, 17–18.05.2004, Wrocław, Poland.
3. *Polarizing photonic crystal fibers for different operation range*, a presentation at the 15th Czech-Polish-Slovak Optical Conference on Wave and Quantum Aspects of Contemporary Optics, 11-15.09.2006, Liberec, the Czech Republic.
4. *Rocking filters fabricated in birefringent photonic crystal fiber*, a presentation at the 16th Polish-Slovak-Czech Optical Conference on Wave and Quantum Aspects of Contemporary Optics, 8-12.09.2008, Polanica Zdrój, Poland.
5. *Broadband microstructured fiber polarizer*, a presentation at a meeting within the European project: NEMO's General Scientific Networking Meeting and Access Meeting, 11-12.05.2009, Wrocław, Poland.
6. *Properties of rocking filters inscribed in microstructured optical fibers*, a presentation at POC 2009, the Polish Optical Conference, 27.06-1.07.2009, Będlewo, Poland.
7. *Gratings in polymer fibers*, a presentation at the 14th Polish Conference on Optical Fibers and

their Applications, 8-12.10.2012, Nałęczów, Poland.

8. *Fabrication of Bragg gratings in standard and microstructured polymer fibers doped with different photosensitive compounds*, a presentation at the 19th Polish-Slovak-Czech Optical Conference on Wave and Quantum Aspects of Contemporary Optics, 8-12.09.2014, Wojanów, Poland.
9. *Experimental investigation of growth dynamics of higher order Bragg gratings in polymer fibers*, a presentation at the 22nd International Conference on Plastic Optical Fibers, POF 2013, Buzios, Brazil.
10. *Experimental investigation of Bragg gratings growth dynamics in polymer fibers of different types*, a presentation at the SPIE Optics + Optoelectronics 2015 conference, Prague, the Czech Republic.

6. Information on didactic and popularization achievements and on international cooperation

6.1. Participation in organizing committees of international and national scientific conferences

1. Meeting of the members of COST Action 299, Wrocław, 9-11.09.2009, a member of organizing committee.
2. Meeting of the European Network of Excellence - NEMO's General Scientific Networking Meeting and Access Meeting, Wrocław, 11-12.05.2009, a member of organizing committee.
3. The 16th Polish-Slovak-Czech Optical Conference on Wave and Quantum Aspects of Contemporary Optics, Polanica Zdrój, 8-12.09.2008, a member of organizing committee.
4. OPERA Symposium: Symposium on Photonics Technologies for the 7th Framework Program, Wrocław, 12-14.10.2006, a member of organizing committee.

6.2. Membership in international and national organizations and scientific associations

1. OSA member since 2010.
2. Vice President of SPIE Student Chapter at Wroclaw University of Technology, 2006-2007.
3. SPIE member, 2005-2007.

6.3. Didactic and popularization achievements

1. Representation of the Institute of Physics,Faculty of Fundamental Problems of Technology at TARED education fair (2004, 2006).
2. Participation in the Lower Silesian Science Festival (2004, 2006, 2010).
3. Participation in the Great Festival of Physics (2005).
4. Popularization of degree programs at the Faculty of Fundamental Problems of Technology - a seminar at a comprehensive high school (2006), Open Days (2012).
5. Popularization of physics at elementary schools - physics shows (2007).
6. Didactic activity promoting natural sciences among school children and youth (2007, 20011, 2012).

7. Activity in the SPIE Student Chapter in Wrocław (2003-2007), as a vice president (2006-2007).
8. Didactic classes: classes (Physics 1), laboratory classes (Physics 2, Physical Optics, Introduction to Physical Optics, Engineering Optics, Optical Measurements, Optical Fibers, Optical Technologies), diploma theses, engineering projects.
9. Preparation and launching of new courses: Engineering Optics (laboratory classes) and Introduction to Physical Optics (laboratory classes) as well as the development of instructions and the launching of classes in laboratory of Engineering Optics and Introduction to Physical Optics. Heading of the Optical Measurements and the Optical Technologies Laboratories.
10. A lecture delivered during the Summer School on Recent Advances in Optics and Photonics, 27-29.06.2012, Porto, Portugal, the title of the lecture: *"Fiber long period gratings and rocking filters: characteristics and applications"*.

6.4. Academic supervision of students

Supervision of 3 master theses and 7 engineering theses in 2010-2015.

6.5. Academic supervision of doctoral students in the character of a promoter or an assistant promoter

MSc. Dominik Kowal, promoter prof. Wacław Urbańczyk (2012-2016), dissertation title: *Periodic structures in optical polymer fibers*, WPPT Wroclaw University of Technology (assistant promoter).

6.6. Internships at international or national research or academic centers

1. IX–X. 2009–INESC Institute for Systems and Computer Engineering, Porto, Portugal.
2. X.2008 – Department of Physics, Technical University Ostrava, the Czech Republic.
3. VI–VIII.2008– Department of Applied Physics and Photonics, Vrije Universiteit Brussel, Belgium.
4. X.2007. – Department of Physics, Technical University Ostrava, the Czech Republic.
5. XI.2006. – Department of Physics, Technical University Ostrava, the Czech Republic.
6. V–VII.2006 – Department of Applied Physics and Photonics, Vrije Universiteit Brussel, Belgium.
7. III–V, IX.2005 – Department of Applied Physics and Photonics, Vrije Universiteit Brussel, Belgium.

6.7. Reviewing international and national projects

Reviews of two applications to the Program Ventures, Foundation for Polish Science, 2010-2011.

6.8. Reviewing publications in international and national scientific journals

Reviews of about 10 publications in scientific journals:

1. Optics Letters
2. Optics Express
3. Applied Optics
4. Optica Applicata
5. Review of Scientific Instruments
6. Sensors&Actuators: B Chemical
7. Journal of Electromagnetic Waves and Applications

6.9. Cooperation with national and international research centers

1. Laboratory of Optical Fiber Technology at UMCS, Lublin, duration of co-operation: since 2003, type of cooperation: joint publications, joint projects, patents.
2. Technical University of Ostrava, Department of Physics (Ostrava, the Czech Republic), duration of cooperation: since 2006, type of cooperation: short-term internships, joint publications.
3. Vrije Universiteit Brussel, Department of Applied Physics and Photonics (Brussels, Belgium), duration of cooperation: since 2004, type of cooperation: short-term internships, joint publications.
4. INESC (Porto, Portugal), duration of cooperation: since 2008, type of cooperation: short-term internship, joint publications.
5. IPHT, Institute of Photonic Technology (Jena, Germany), duration of cooperation: since 2007, type of cooperation: joint publications.
6. Photonics Research Group, Aston University (Birmingham, UK), duration of cooperation: since 2009, type of cooperation: joint publications.
7. Cardiology Department of the Provincial Medical Center in Opole, duration of cooperation: since 2010, type of cooperation: joint publications, presentations at conferences.

Gabriela Statkiewicz-Barabach