WARSAW UNIVERSITY OF TECHNOLOGY
Faculty of Electronics and Information Technology

Institute of Microelectronics and Optoelectronics

annual report 2018

WARSAW UNIVERSITY OF TECHNOLOGY
Faculty of Electronics and Information Technology

Institute of Microelectronics and Optoelectronics

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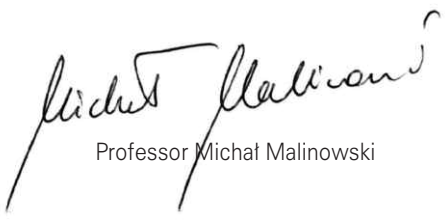
From the Director

This Annual Report summarizes the activities of the Institute of Microelectronics and Optoelectronics (IMiO) in the year 2018, with particular attention given to its research and educational potential. The Institute is a part of the Faculty of Electronics and Information Technology, the biggest faculty of the Warsaw University of Technology. Among six institutes constituting the Faculty, Institute of Microelectronics and Optoelectronics is the one most focused on advanced technologies of modern electronics and photonics.

It should be noted that the Institute has its roots deep in history. Although formally founded in 1970, it evolved from the Chair of Radio Engineering established in 1929 by Professor Janusz Groszkowski, who is often called "the father of Polish electronics". The Institute is linked with the beginnings of the Faculty of Electronics and Information Technology not only by the person of Prof. Groszkowski, who worked in IMiO until end of his career, but also by its location – part of the Institute is situated in the Building of Radio Engineering at the Warsaw University of Technology main campus where the Faculty started its operation in 1951 (as the Faculty of Communications). Currently, the Institute's Technology Centre is located there. It includes laboratories specializing in silicon processing (clean-room), hybrid technologies and assembly techniques, fibre optic and integrated optoelectronics, laser optoelectronics and characterization of new electronic and photonic materials. All 11 high-tech laboratories in the field of electronic and photonic technologies established as a result of the investments conducted in recent years within the Innovative Economy Operational Program framework have reached their full operational capacity and are extensively used to conduct advanced research and provide research services.

The present research activities of the Institute are concentrated in the area of microelectronics, nanoelectronics and photonics. These include in particular: VLSI systems, microelectronic and nanoelectronic semiconductor devices, hybrid circuits (e.g., microwave, optoelectronic), sensors, microsystems, lasers, active photonic materials, fiber optics and integrated photonics, electronic imaging and image processing. It is worth to emphasize that research activities of the Institute include modelling, CAD, manufacturing and versatile characterization. In the field of teaching, the Institute meets the challenges posed by the development of modern technology and information society. The educational offer (at all levels – B.Sc., M.Sc. and Ph.D.) reflects the main fields of the advanced electronics and photonics and, simultaneously, the main research expertise of the Institute. The Institute's involvement in distance learning studies of Electronics and Telecommunications is also worth mentioning, especially postgraduate studies in the domain of tools and techniques of virtual education that began in 2004. Several student laboratories in the area of electronics, microelectronics and photonics, located in the recently expanded wings of the Faculty building, have reached their full operational capacity in 2017, improving considerably the quality of the education offered by IMiO.

Moreover, I would like to thank all the colleagues working at IMiO for their constant commitment and effort to make the Institute an outstanding place to be.



Professor Michał Malinowski

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1. GENERAL INFORMATION

1.1. Board of Directors

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1.2. Organisation of the Institute and Areas of its Activities

The Institute of Microelectronics and Optoelectronics is a part of the Faculty of Electronics and Information Technology – the largest among all units of Warsaw University of Technology. At present, the Institute consists of four divisions with main competences covering the major areas of modern electronics and photonics. These are:

- Microelectronics and Nanoelectronics Devices Division;
- VLSI Engineering and Design Automation Division;
- Microsystem and Electronic Material Technology Division;
- Optoelectronics Division.

During almost fifty years of research, the Institute has built and developed its competence in:

- modelling of physical effects in modern semiconductor devices;
- advanced technologies of silicon-based microelectronics and photonics,
- non-standard dielectric layer deposition techniques;
- characterization of electronic materials and devices;
- designing and development of application specific VLSI circuits;
- design and technology of thick-film hybrid circuits, fabrication of thick-film microsystems;
- modelling and design of sensors and optical-waveguide microsystems;
- laser physics and laser technique;
- optical spectroscopy of solids;
- fiber-optic photonics, including fiber-optic communication, sensing as well as design and development of fiber lasers and amplifiers;
- design and development of photonic integrated circuits (PICs);
- 2-D and 3-D image processing systems, including monitoring systems;
- photovoltaics;
- microwaves, microwave photonics and microwave measurement techniques;
- new materials for high-temperature, high-power and high-frequency electronics;
- new materials for modern photonics.

The research activity is supported by a nu.mber of projects financed by National Science Centre and National Centre for Research and Development, projects funded within EU Framework Programmes, as well as industry funded.
The results are systematically published in a number of papers submitted to prestigious international scientific journals and presented at national and international conferences.

Parallel to scientific activity also the didactic offer of the Institute has been recently enriched, which resulted in establishing a completely new specialization – "Integrated Electronics and Photonics,"elaborated within the framework of the project "NERW PW Science-Education-Development-Cooperation" financed from Axis III Higher Education for the Economy and Development of the Operational Programme Science Education Development 2014–2020.

1.3. Microelectronics and Nanoelectronics Devices Division

The research carried out in the Microelectronics and Nanoelectronics Devices Division falls into three main areas, namely: technology, diagnostics and modelling of semiconductor structures, as well as applications of microcontrollers.

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Jakub Jasiński, Ph.D.	Assistant Professor
Andrzej Mazurak, Ph.D.	Assistant Professor
Sławomir Szostak, Ph.D.	Assistant Professor
Jakub Walczak, Ph.D.	Senior Lecturer
Agnieszka Zaręba, Ph.D.	Senior Lecturer

Junior academic staff

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Mirosław Puźniak, M.Sc.	Ph.D. Student
Małgorzata Szulkowska, M.Sc.	Ph.D. Student
Piotr Wiśniewski, M.Sc.	Ph.D. Student

Technical and administrative staff

Witold Ciemiewski
Kazimierz Dalbiak
Krzysztof Krogulski

To name a few examples of its research topics:

- Diagnostics and characterisation of properties of single and double insulating layers (gate stack including ultra thin oxide layers) by means of electrical measurements analysis;
- Wear-out and degradation processes in MOS structures (breakdown of dielectrics layers, hot carriers effects, radiation damage effects);
- Transport mechanism and quantum effects in MOS structures (transistor, tunnel diode) with ultra thin oxide;
- New materials (semiconductors and dielectrics) for microelectronics applications (e.g.: silicon carbide, gallium nitride, silicon-germanium, germanium);
- Theoretical studies on MOS-SOI (silicon-on-insulator) and Si:Ge (silicon-germanium) MOS structure physics (modelling of devices behaviour and modelling for characterisation and diagnostics);
- Nanoelectronic phenomena and devices (e.g. tunnel and resonance tunnel diodes and transistors, Coulomb blockade diode, single-electron transistors, memories);
- PECVD deposition of ultra thin dielectric layers for MOSFET gate dielectric (SiO_2, Si_3N_4, SiOxNy);
- Ultra shallow implantation from r.f. plasma;
- Very low temperature processing of test structures;
- Fabrication of ultrathin amorphous silicon layers by PECVD;
- Fabrication of double barrier (single and multilayer) structures and devices;
- MEMS/MOEMS processing;
- Silicon photonic devices fabrication.

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1.4. VLSI Engineering and Design Automation Division

The research carried out in the division falls into several main areas: development of IC design methodologies and tools, design of digital and analog integrated circuits for nonstandard demanding applications, investigations of new devices and circuits for future generations of microelectronic systems.

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Tomasz Borejko, Ph.D.	Assistant Professor
Zbigniew Jaworski, Ph.D.	Assistant Professor
Arkadiusz Łuczyk, Ph.D.	Assistant Professor
Krzysztof Siwiec, Ph.D.	Assistant Professor
Andrzej Wielgus, Ph.D.	Assistant Professor
Marek Niewiński, Ph.D.	Senior Lecturer
Adam Wojtasik, Ph.D.	Senior Lecturer

Junior academic staff

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Igor Butryn, M.Sc.	Ph.D. Student, Science Assistant
Marek Ciepłucha, M.Sc.	Ph.D. Student
Dominik Kasprowicz, Ph.D.	Assistant
Daniel Pietroń, M.Sc.	Ph.D. Student, Science Assistant
Szymon Reszewicz, M.Sc.	Ph.D. Student, Science Assistant
Łukasz Wiechowski, M.Sc.	Ph.D. Student, Science Assistant
Michał Wołodźko, M.Sc.	Ph.D. Student

Science research staff

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Tomasz Mrozek, M.Sc.	Assistant
Paweł Narczyk, M.Sc.	Assistant

Science research and technical staff

Jerzy Gempel, M.Sc.

Technical and administrative staff

Adam Borkowski, M.Sc.
Stanisław Jeszka, M.Sc.

Current research projects in the Division include:

- methodologies of integrated circuit design for manufacturability: application of statistical process and device simulation in IC design, investigations of spatial on-chip correlation of random process disturbances, analysis of layout sensitivity to spot defects,
- development of CAD tools for integrated circuit design and verification, with special emphasis on analog full custom ASICs design,
- design of digital, analog and mixed signal VLSI circuits for special applications such as innovative AD converters, data processing in physical experiments and medical equipment, RF front ends for wireless data transmission etc.,
- modeling and control of leakage currents in nanometer digital circuits,
- investigations and development of new VESTIC microelectronic technology.

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1.5. Electronic Materials and Microsystem Technology Division

The research activity of the Division concentrates on optoelectronics (e.g., measuring systems using fiber optic sensors), and hybrid technologies and the development of wide bandgap semiconductor technology in the design, modelling and manufacturing of microelectronic devices operating at high temperatures, including power semiconductor devices. Fundamental and applied research are carried out. Research groups are organised for defined tasks.

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Jerzy Kalenik, Ph.D.	Assistant Professor
Konrad Kiełbasiński, Ph.D.	Assistant Professor
Krystian Król, Ph.D.	Assistant Professor
Aleksander Werbowy, Ph.D.	Assistant Professor

Junior academic staff

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Magdalena Dominik, M.Sc.	Ph .D. Student
Maciej Kamiński, M.Sc.	Ph.D. Student, Constructor
Kinga Kondracka, M.Sc.	Ph.D. Student, Constructor
Agnieszka Martychowiec, M.Sc.	Ph.D. Student, Constructor
Anna Katarzyna Myśliwiec, M.Sc.	Ph.D. Student
Marcin Myśliwiec, M.Sc.	Ph.D. Student
Tomasz Stańczyk, M.Sc.	Ph.D. Student
Bartłomiej Stonio, M.Sc.	Ph.D. Student
Anastasiia Veklych, M.Sc.	Ph.D. Student
Michał Waśkiewicz, M.Sc	Ph.D. Student
Krzysztof Wilczyński, M.Sc	Ph.D. Student

Science research staff

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Marcin Koba, Ph.D, D.Sc.	Professor
Mariusz Sochacki, Ph.D., D.Sc.	Professor

Science research and technical staff

Ryszard Kisiel, Ph.D., D.Sc.
Norbert Kwietniewski, M.Sc.

Technical and administrative staff

Ryszard Biaduń
Katarzyna Kubicka

The main research areas are as follows:

- the use of graphene in the design of photodetectors for the far-infrared range with the electrical and optical characterization of graphene produced on different substrates, or a transferred onto the substrate;
- design, modelling, fabrication and characterization visible-blind UV photodetectors and radiation detectors based on wide bandgap semiconductors and heterostructures;
- the design, modelling, fabrication and characterization of power devices based on silicon carbide (SiC) technology including high voltage PiN diodes;
- the development of electrical characterization methods for the determination of energy distribution of traps in MOS and junction devices;
- designing, modelling and fabrication of microelectronic and optoelectronic devices using transparent dielectric and conductive oxides;
- fabrication and characterization of high-k dielectric layers;
- fabrication and investigation of the following optoelectronic devices: integrated passive and active light wave guiding

structures (modulators, bistable switches etc.) and fibre optic sensors;
- computer engineering for fibre optics;
- new Surface Mount Technologies (SMT) on rigid, semi-rigid and fully flexible printed circuit boards (PCBs);
- application of thin and thick film technology in hybrid devices and thick film sensors fabrication;
- investigation of the electronic structure, stability and optical properties of amorphous silicon and its devices (thin film transistors, solar cells, etc.);
- design, fabrication and characterization of multi-junction photovoltaic cells with high energy efficiency;
- design and monitoring of photovoltaic systems, strategy for development of photovoltaics;
- electronic packaging technology including power devices;
- plasma deposition of nanocrystalline diamond (NCD), diamond-like carbon (DLC) thin films and their application in fibre optic and waveguide sensing structures;
- development of state-of-the-art power supplies and advanced power electronics for renewable energy conversion and storage, e-mobility, electric drives and vehicles, smart buildings, smart grids, smart city and military applications based on silicon carbide and gallium nitride power devices.

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1.6. Optoelectronics Division

The activity of the Optoelectronics Division is concentrated on education as well as on various areas of optoelectronic research in the field of laser physics, new optical waveguide materials and structures, laser spectroscopy, laser construction and laser applications in medicine, air pollution monitoring, the technology of electronic imaging devices, digital image processing, propagative electronics and microwave photonics.
Photovoltaics laboratory, as a part of the Division, serves as a focal point for conducting and stimulating research and demonstration activities; educating students; organizing technical meetings, workshops, symposia and conferences; disseminating information and addressing environmental issues.

Head of the Division

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Jerzy Piotrowski, Ph.D.	Assistant Professor
Stanisław Stopiński, Ph.D.	Assistant Professor
Anna Tyszka-Zawadzka, Ph.D.	Assistant Professor
Piotr Witoński, Ph.D.	Assistant Professor
Krzysztof Madziar, Ph.D.	Senior Lecturer
Marek Sutkowski, Ph.D.	Senior Lecturer
Agnieszka Szymańska, Ph.D.	Senior Lecturer
Piotr Warda, Ph.D.	Senior Lecturer

Junior academic staff

Krzysztof Anders, M.Sc.	Assistant
Paweł Bortnowski, M.Sc.	Ph.D. Student
Dawid Budnicki, M.Sc.	Ph.D. Student
Sylwester Chojnowski, M.Sc.	Ph.D. Student
Piotr Garbat, Ph.D.	Assistant
Bartosz Janaszek, M.Sc.	Ph.D. Student
Anna Jusza, M.Sc.	Assistant
Marcin Kaczkan, Ph.D.	Assistant
Marcin Kieliszczyk, M.Sc.	Ph.D. Student
Paweł Komorowski, M.Sc.	Ph.D. Student
Marcin Kowalczyk, M.Sc.	Ph.D. Student
Małgorzata Kuklińska, M.Sc.	Ph.D. Student
Aleksandra Paśnikowska, M.Sc.	Ph.D. Student
Mateusz Słowikowski, M.Sc.	Ph.D. Student
Tadeusz Tenderenda, M.Sc.	Ph.D. Student

Science research staff

Andrzej Kaźmierczak, Ph.D,	Assistant Professor

Science research and technical staff

Maciej Juźwik, M.Sc.

Technical and administrative staff

Bartosz Fetliński, M.Sc.

The academic staff of the Division gives lectures in photonics, laser physics, laser technology, laser applications, laser spectroscopy, integrated optoelectronics and optical computing, digital image processing, propagative electronics and microwave photonics, all of which are accompanied by appropriate laboratory class activities.
The main research activity of the Division comprises:

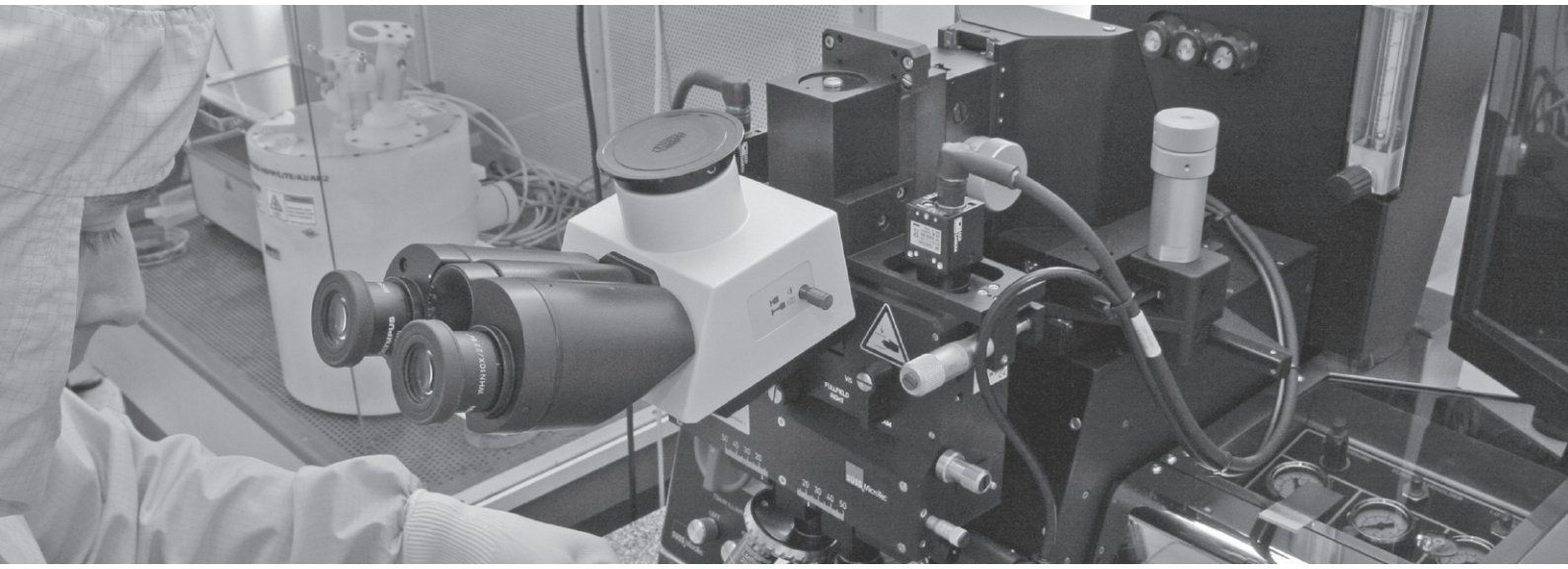
- solid state laser construction and their applications in materials processing;
- spectroscopic research of new laser materials, investigation of the excitation processes in rare earth doped dielectric materials, research of blue up-conversion laser structures, waveguide lasers;

- theoretical research of laser generation in planar, fibre and hollow waveguide gas lasers, analysis of light generation in DFB (distributed feedback) structures, photonic crystals structures and in lasers with non-linear optical elements, investigation of the statistical properties of the light generated in various laser structures;
- nano-optical structures and photonic band-gap materials;
- optimisation of the construction of ion gas lasers, investigation of the processes in discharge tube ceramic ion laser and laser operation in various cavity geometry, investigation of light generation in ion gas lasers for medical applications;
- spectroscopic and theoretical research of light generation in silicon photonic lasers;
- theoretical principles of image modelling, processing and analysis;
- application of image processing methods for diagnostic control and measurement systems in industry, medicine, research and commerce;
- image acquisition in polarization imaging systems and optical image processing;
- 3D Vision methods and algorithms;
- electro optic effects in liquid crystals and their applications to LCD and photo refractive phenomena in liquid crystals;
- an analysis of the oscillation conditions, frequency stabilisation and synthesis in microwave bands;
- measurement techniques of microwave circuits and devices parameters with emphasis on automation and computerisation of measurement methods;
- modelling and computer aided design of microwave devices and circuits;
- controlling of microwave circuits parameters by means of optical signals;
- investigations and modelling of optical-microwave frequency conversion processes;
- modelling of optically controlled microwave devices, as photodiodes, photo-varactors, phototransistors;
- modelling of optoelectronic and microwave devices for data transmission networks.

Optoelectronics Division

1.7. Statistical Data

SPECIFICATION	2017	2018	DIFFERENCE
Academic staff	**77**	**83**	**+6**
Tenured professors	9	8	-1
Professors	8	7	-1
Docent	1	1	0
Assistant professors	27	18	-9
Senior lecturers	2	8	+6
Assistants	2	5	+3
Ph.D. students	28	36	+8
Science research staff	**11**	**11**	**0**
Technical and Administrative staff	**18**	**24**	**+6**
Teaching activities	**77**	**69**	**-8**
Basic courses	39	37	-2
Advanced courses	16	16	0
Special courses	22	16	-6
Degrees awarded	**51**	**40**	**-11**
D.Sc. degrees	3	0	-3
Ph.D. degrees	2	4	+2
M.Sc. degrees	9	11	+2
B.Sc. degrees	37	25	-12
Research projects	**32**	**27**	**-5**
Granted by the University	11	8	-3
Granted by State Institutions	16	14	-2
Granted by International Institutions	5	5	0
Publications	**140**	**123**	**-17**
Sci.-tech. books	2	0	-2
Sci.-tech. papers in journals	48	46	-2
Sci.-tech. papers in conference proceedings	90	77	-13
Patents	**7**	**16**	**+9**
Reports	**84**	**65**	**-19**
Conferences	**35**	**35**	**0**
Awards	**14**	**5**	**-9**



Microelectronics and Nanoelectronics Devices Division

2. STAFF

2.1. Senior Academic Staff

Romuald B. Beck, M.Sc. ('76), Ph.D. ('82), D.Sc. ('96), Microelectronics, Electronics, Professor, full time, Head of Microelectronics and Nanoelectronics Devices Division ('04–), Leader of the Technology, Diagnostics and Modelling Group ('85–), Vice President of the Microelectronics Section of the Electronics and Telecommunication Committee of the Polish Academy of Sciences ('93–'08), Member od Programme Committee of: Diagnostics & Yield Conference ('88–), Member of the Faculty Council ('96–), Co-chairman ('03–), Chairman ('06); Member of Programme Committee of ELTE ('84, '04, '07, '13), Member of Technical Programme Committee ESSDERC ('05–'13), Senior Member of IEEE ('97–'06), Head of CEZAMAT Project Office ('08–'12), Vice-President for Scientific Affairs of CEZAMAT PW Ltd ('12–)., WUT Rector's Collective Award for Scientific Achievements ('06,'08,'12).

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Konrad Kiełbasiński, M.Sc. ('06), Ph.D. ('12) with distinction, Microelectronics, Electron Technology, Assistant Professor, full time, Microelectronics and Nanoelectronics Devices Division, WUT Rector's Collective Award for Scientific Achievements ('08,'13,'15), Silver Medal of Moscow Innovators Association Archimedes ('14), Innovator of Mazovian Voivodeship Award ('13), Award of Minister Science and Education for Young Scientist ('11), Scholarship in VENTURES Program by Foundation for Polish Science ('08), Member of IMAPS Poland Chapter ('07–).

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GE | Building of Electronics – ul. Nowowiejska 15/19
GG | WUT Main Building – Pl. Politechniki 1

Electronic Materials and Microsystem Technology Division

2.2. Junior Research Staff

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2.3. Science Research Staff

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2.4. Technical and Administrative Staff

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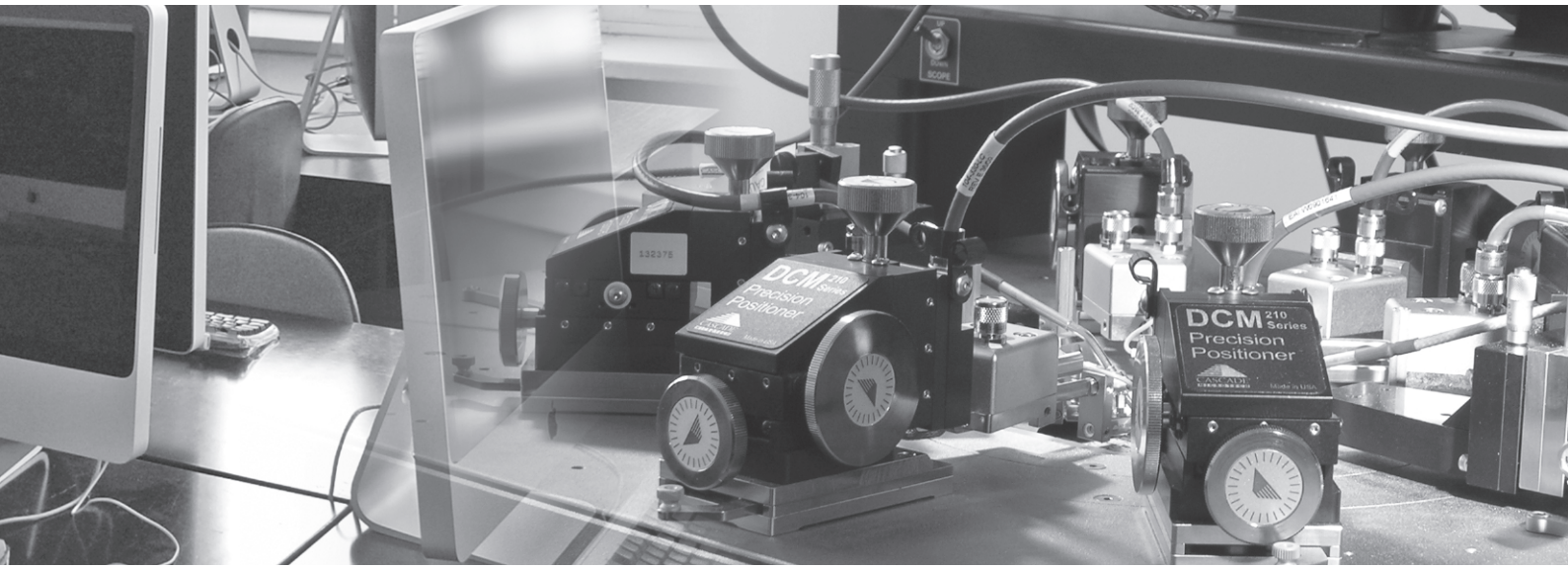


VLSI Engineering and Design Automation Division

3. TEACHING ACTIVITIES

3.1. Basic Courses

[Edu1] **Algorithms and Data Structures** (Algorytmy i struktury danych), **AISDE**, Adam Wojtasik

[Edu2] **Analog Circuit Design for VLSI Systems** (Projektowanie układów analogowych dla systemów VLSI) **PUAV**, Krzysztof Siwiec

[Edu3] **Application of Matlab in Calculation Methods** (Matlab w zastosowanych metodach obliczeniowych) **MZMO**, Krystian Król

[Edu4] **Computer-Aided Design of Printed-Board Circuits** (Projektowanie obwodów drukowanych), **PADS**, Jerzy Kalenik

[Edu5] **Digital Circuits** (Układy cyfrowe), **UCYF**, Elżbieta Piwowarska

[Edu6] **Electronic Elements and Circuits** (Elementy i układy elektroniczne), **ELIU**, Andrzej Pfitzner

[Edu7] **Electronic Elements and Circuits – Laboratory** (Elementy i układy elektroniczne – laboratorium), **ELIUL**, Andrzej Pfitzner

[Edu8] **Electronics 1** (Elektronika 1), **ELE1**, Lidia Łukasiak, Sławomir Szostak

[Edu9] **Electronics 2** (Elektronika 2), **ELE2**, Jakub Jasiński

[Edu10] **Equipment – Programming Synthesis of Digital Systems** (Synteza sprzętowo – programowa systemów cyfrowych), **SSP**, Elżbieta Piwowarska

[Edu11] **Fields and waves**, (Pola i fale), **POFA**, Jerzy Piotrowski

[Edu12] **Fundamentals of Circuit and System Technology** (Podstawy technologii układów i systemów), **PTUIS**, Romuald Beck

[Edu13] **Fundamentals of Lasers** (Lasery – kurs podstawowy), **LKP**, Paweł Szczepański

[Edu14] **Fundamentals of Microelectronics** (Podstawy mikroelektroniki), **PMK**, Andrzej Pfitzner

[Edu15] **Fundamentals of Microprocessor Techniques** (Podstawy techniki mikroprocesorowej), **TMIK**, Lidia Łukasiak

[Edu16] **Fundamentals of Microwave Engineering** (Podstawy techniki w.cz.), **TWCZ**, Jerzy Piotrowski

[Edu17] **Fundamentals of Plasmonics and Metamaterials** (Podstawy plazmoniki i metamateriałów), **PLAZ**, Janusz Parka

[Edu18] **Fundamentals of Photonics** (Podstawy fotoniki), **FOT**, Michał Malinowski

[Edu19] **Fundamentals of Solid State Electronics** (Elektronika ciała stałego), **ELCS**, Jan Szmidt, Witold Pleskacz

[Edu20] **Hybrid Systems** (Układy hybrydowe), **UKH**, Ryszard Kisiel

[Edu21] **Integrated Optoelectronics** (Optoelektronika zintegrowana) **OZT**, Michał Malinowski

[Edu22] **Introduction to Microsystems** (Wstęp do mikrosystemów), **WMS**, Andrzej Mazurak, Robert Mroczyński

[Edu23] **Introduction to Numerical Methods** (Wstęp do metod numerycznych), **WNUM**, Krystian Król

[Edu24] **Introduction to Programming** (Podstawy programowania), **PRM**, Marek Niewiński

[Edu25] **Introduction to the UNIX System** (Użytkowanie systemu UNIX), **USUX**, Andrzej Wielgus

[Edu26] **Ligthwave Telecommunication** (Telekomunikacja optofalowa), **TEOP**, Agnieszka Szymańska

[Edu27] **Meeting 1 – Fundamentals of Information Technology** (Zjazd 1 – Podstawy technologii informacyjnej), **ZJ1Z**, Krzysztof Madziar

[Edu28] **Meeting 4 – Advanced Course Laboratory** (Zjazd 4 – Zaawansowane laboratorium kierunkowe), **ZJ4Z**, Agnieszka Szymańska

[Edu29] **Methods of Image Acquisition and Processing for Photography** (Techniki rejestracji i obróbki obrazów w fotografii), **TROOF**, Marek Sutkowski

[Edu30] **Object Programming** (Programowanie obiektowe), **PROE**, Adam Wojtasik

[Edu31] **Operating Systems** (Systemy operacyjne), **SOE**, Andrzej Wielgus

[Edu32] **Optoelectronic Devices and Systems** (Elementy i systemy optoelektroniczne), **ESO**, Marcin Kaczkan

[Edu33] **Physical Fundamentals of Information Processing** (Fizyczne podstawy przetwarzania informacji), **FPPI**, Jan Szmidt, Bogdan Majkusiak

[Edu34] **Programming for mobile Apple iOS and MacOS X** (Programowanie dla systemów: mobilnego iOS oraz MacOS X), **APIOS**, Adam Wojtasik

[Edu35] **Programming microcontrollers in C language** (Programowanie mikrokontrolerów w języku C), **PMIK**, Sławomir Szostak

[Edu36] **Semiconductor Devices** (Przyrządy półprzewodnikowe), **PP**, Lidia Łukasiak, Andrzej Pfitzner

[Edu37] **Solid-State Physics** (Fizyka ciała stałego), **FCSM**, Jan Szmidt, Agnieszka Zaręba

3.2. Advanced Courses

[Edu38] **Advanced Semiconductor Structures** (Zaawansowane struktury półprzewodnikowe) **ZSP**, Tomasz Skotnicki

[Edu39] **Analog Integrated Circuit Design for VLSI Systems** (Projektowanie bloków analogowych dla systemów VLSI) **PSSA**, Tomasz Borejko

[Edu40] **Characterization of Materials for Microelectronics** (Charakteryzacja materiałów dla mikroelektroniki) **CHA**, Jan Szmidt, Aleksander Werbowy

[Edu41] **Computational Methods in Microelectronics and Photonics** (Metody obliczeniowe w mikroelektronice i fotonice), **MOBI**, Andrzej Pfitzner, Dominik Kasprowicz, Agnieszka Mossakowska-Wyszyńska

[Edu42] **Digital Image Processing** (Cyfrowe przetwarzanie obrazów), **CPOO**, Piotr Garbat

[Edu43] **Fiber-Optic Communication** (Komunikacja światłowodowa), **KOS**, Ryszard Piramidowicz

[Edu44] **Fundamentals of Nanoelectronics and Nanophotonics** (Podstawy nanoelektroniki i nanofotoniki), **NANO**, Bogdan Majkusiak, Paweł Szczepański

[Edu45] **Fundamentals of Photovoltaics** (Podstawy fotowoltaiki) **PFOT**, Michał Malinowski

[Edu46] **Introduction to Digital VLSI System Design** (Projektowanie scalonych systemów cyfrowych), **PSSC**, Zbigniew Jaworski

[Edu47] **Laboratory of Fundamentals of Nanoelectronics and Nanophotonics** (Pracownia podstaw nanoelektroniki i nanofotoniki), **PNAN**, Bogdan Majkusiak, Paweł Szczepański

[Edu48] **Lasers** (Lasery) **LAS**, Paweł Szczepański

[Edu49] **Microsystems Engineering** (Inżynieria mikrosystemów) **MIK**, Piotr Firek

[Edu50] **Nanotechnologies** (Nanotechnologie), **NAN**, Jan Szmidt, Aleksander Werbowy

[Edu51] **Photovoltaic Systems** (Systemy fotowoltaiczne), **SFOT**, Mateusz Śmietana

[Edu52] **Vision Monitoring Systems** (Systemy monitoringu wizyjnego) **SYMW**, Piotr Garbat

[Edu53] **VLSI System Design** (Projektowanie systemów scalonych w technice VLSI), **PSSV**, Wiesław Kuźmicz, Zbigniew Jaworski

3.3. Courses in English

[Edu54] **Electronics 1, EELE1**, Bogdan Majkusiak

3.4. Courses for other Faculties

[Edu55] **Electromagnetic Compatibility, Faculty of Management** (Kompatybilność elektromagnetyczna, Wydział Zarządzania), **KOMEL**, Jerzy Piotrowski

[Edu56] **Electronic Circuits and the Introduction to Microelectronics, Faculty of Management** (Układy elektroniczne i wstęp do mikroelektroniki, Wydział Zarządzania), **UEMIK**, Sławomir Szostak

[Edu57] **Electronic Devices, Faculty of Management** (Elementy elektroniczne, Wydział Zarządzania), **ELEME**, Lidia Łukasiak

[Edu58] **Electronics 1, Faculty of Mechatronics** (Elektronika 1, Wydział Mechatroniki), **ELE1**, Sławomir Szostak

[Edu59] **Electronics 2, Faculty of Mechatronics** (Elektronika 2, Wydział Mechatroniki), **ELE2**, Jakub Jasiński

[Edu60] **Energy Conditioning and Storage Laboratory, Faculty of Physics** (Laboratorium przetwarzania i magazynowania energii, Wydział Fizyki) **LPME**, Michał Malinowski

[Edu61] **Introduction to Microprocessor Systems, Faculty of Management** (Wstęp do systemów mikroprocesorowych, Wydział Zarządzania), **WSYMI**, Jakub Jasiński

[Edu62] **Laboratory of Nanotechnology, Faculty of Physics** (Laboratorium nanotechnologii, Wydział Fizyki), **NAN**, Robert Mroczyński

[Edu63] **Laboratory of Photonics, Faculty of Physics** (Laboratorium fotoniki, Wydział Fizyki), **FOT**, Ryszard Piramidowicz

[Edu64] **Laboratory of Physics 2, Faculty of Physics** (Laboratorium Fizyki 2, Wydział Fizyki), **FIZ2**, Janusz Parka

[Edu65] **Logic Circuits, Faculty of Management** (Układy logiczne, Wydział Zarządzania), **UKLO**, Piotr Firek

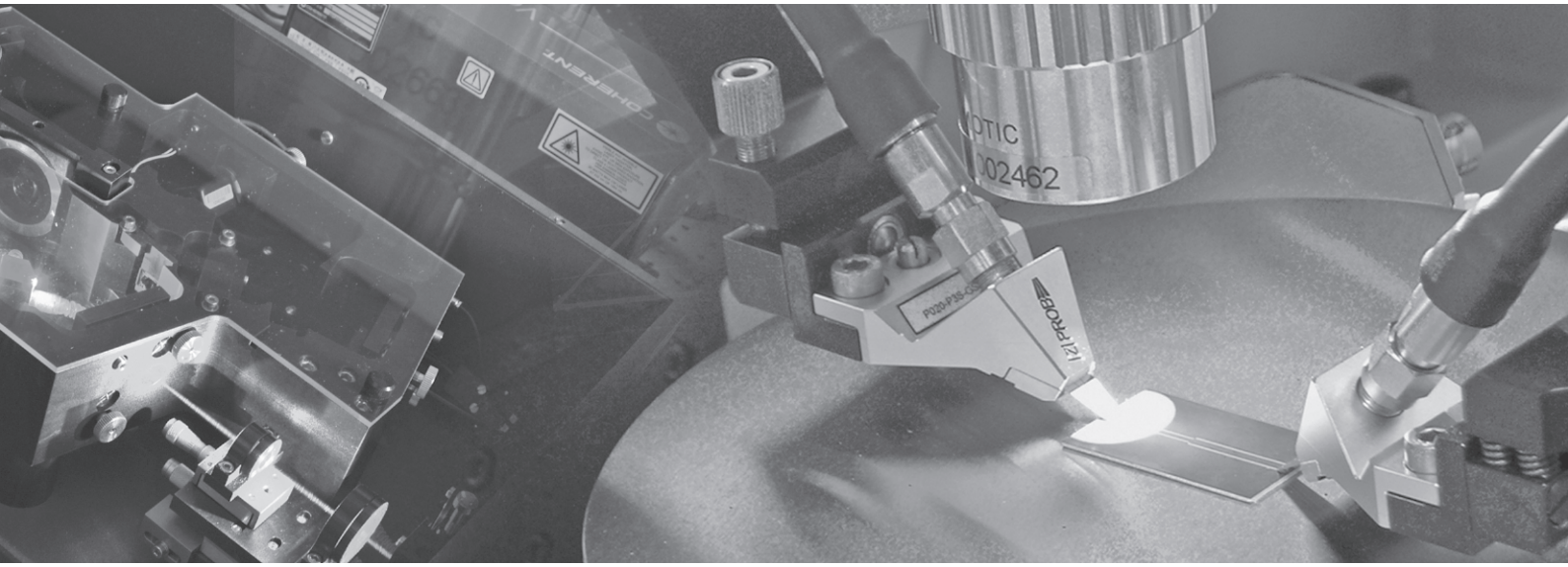
[Edu66] **Laser Technology, Faculty of Physics** (Technika Laserów, Wydział Fizyki), **TL**, Ryszard Piramidowicz

[Edu67] **Photonic Devices, Faculty of Management** (Elementy fotoniczne, Wydział Zarządzania), **ELFOT**, Ryszard Piramidowicz

3.5. Courses in English for other Faculties

[Edu68] **Optical Fiber Technology, Faculty of Mechatronics** (Techniki światłowodowe, Wydział Mechatroniki), **OFT**, Ryszard Piramidowicz

[Edu69] **Photographic Techniques in Image Acqusition, Faculty of Mechatronics** (Techniki fotograficzne w rejestracji obrazów, Wydział Mechatroniki), **PTIA**, Marek Sutkowski



Optoelectronics Division

4. RESEARCH PROJECTS

Project definitions and descriptions – prepared by Project Leaders.

4.1. Projects Granted by the University

[Pro1] **The Development of Design, Processing and Testing Methods of the Electronic Devices and Materials for Microelectronics and Optoelectronics** (Rozwój metod wytwarzania i badania materiałów oraz modelowania i charakteryzacji przyrządów w dziedzinie mikroelektroniki i optoelektroniki), project leaders: Paweł Szczepański and Michał Malinowski, May 2017–May 2018, **sub-projects:**

[Pro1.1] **Analysis and investigation of photonic materials, structures and systems** (Analiza i badania materiałów, struktur i układów fotonicznych), project leaders: Paweł Szczepański, co-workers: Agnieszka Mossakowska-Wyszyńska, Stanisław Jonak, Marcin Kaczkan, Ryszard Piramidowicz

The investigations conducted within this work are dedicated to:

- Luminescence characterization of bulk, nano, composite, as well as photovoltaic materials
- Design and investigation of fiber amplifiers and laser systems for IR and VIS spectral ranges, as well as application-specific photonic integrated systems (ASPICs)
- Complex theoretical analysis of passive and active tunable hyperbolic metamaterial aimed at practical realization and applications. Last efforts have been dedicated to development of effective medium model enabling dispersion characteristics shaping of multilayer structures composed of stimulus-sensitive materials characterized by various plasma resonances. Moreover, the existence of tunable birefringence suitable for thin film voltage-controlled polarization filters has been demonstrated.

[Pro1.2] **Functional verification of the digital integrated circuits – probabilistic model of the regression testing procedure** (Weryfikacja funkcjonalna cyfrowych układów scalonych – model probabilistycznego testowania regresyjnego), project leader: Andrzej Pfitzner; co-workers: Witold Pleskacz, Marek Ciepłucha and other members of the VLSI Engineering and Design Automation Division.

The main goal of the work is to propose an efficient regression testing strategy for the digital IC verification. It includes the development of the probabilistic model in order to estimate the digital simulation time required to fulfill the verification requirements. The verification completeness is defined as satisfying the pre-defined coverage metrics implemented according to the verification plan. The model will be implemented in the MATLAB environment. The provided results will allow for estimation of the verification effectiveness of the regression testing process and help to validate different regression testing strategies.

[Pro1.3] **Materials, technologies, structures and devices for sensorics, microsystems and power electronics** (Materiały, technologie, struktury i przyrządy dla sensoryki, mikrosystemów oraz energoelektroniki), project leader: Jan Szmidt, co-workers: Jerzy Krupka, Mateusz Śmietana, Marcin Koba, Mariusz Sochacki, Piotr Firek, Aleksander Werbowy, Magdalena Dominik, Maciej Kamiński, Kinga Kondracka, Norbert Kwietniewski, Aleksandra Paculska, Andrzej Taube, Michał Waśkiewicz, Natalia Kyc, Anna Myśliwiec, Zbigniew Rudkowski

Within the framework of the project several goals were achieved. Polymer-Si composites were investigated from the point of view of their potential microwave and far infra-red (IR) applications. Fiber-optic based microinterferometers with thin film coatings intended for studying biological materials were obtained and examined. Ion-sensitive field effect transistor (ISFET) structures were fabricated and characterized from the point of view of their potential applications in biological and medical sciences. Heterojunction ZnMgO/4H-SiC UV detecting diodes were fabricated and investigated. High efficiency power electronic converters for renewable energy resources were developed and studied.

[Pro1.4] **Technology and characterization of MOS/TFT structures with modern active materials** (Technologia i charakteryzacja struktur MOS/TFT z wykorzystaniem nowych typów warstw aktywnych), project leader: Robert Mroczyński, co-workers: R.B. Beck, W. Ciemiewski, K. Dalbiak, J. Jasiński, L. Łukasiak, B. Majkusiak, A. Mazurak, R. Mroczyński, S. Szostak, J. Walczak

This project is devoted to the technology and electrical/structural characterization of the new type of materials for the MOS/TFT structures. Active materials, i.e., charge-transport semiconductors, in the form of silicon nano-crystals (Si-NCs), Indium-Gallium-Zinc Oxide (IGZO) or other type of semiconductor, will be investigated. These materials can be successfully used in FET or TFT structures. The proposed work is experimental one. Dielectric materials with higher values of permittivity will be used as the gate dielectric layers in examined test structures. Dielectric layers will be fabricated by means of reactive magnetron sputtering method. There are planned electrical characterization of fabricated structures in order to the verification of the quality of proposed technology and the possible application of active materials in MOS/TFT structures.

[Pro1.5] **The use of 3D images in the process of improving the quality of imaging and testing of frequency mixers with reduced transformation losses based on microwave photonics systems** (Zastosowanie obrazów 3D w procesie poprawy jakości zobrazowania oraz badania mieszaczy częstotliwości o zredukowanych stratach przemiany bazujących na układach fotoniki mikrofalowej.), project leader: Janusz Parka, co-workers: Jerzy Woźnicki, Piotr Garbat, Krzysztof Madziar, Marek Sutkowski, Piotr Witoński, Jerzy Piotrowski, Agnieszka Szymańska, Jerzy Domański

Part 1. The scope of the research was to investigate multiple configurations of analog optical links (AOL) allowing to obtain RF frequency mixing. Major interest was put to determine the source of non-linearities – depending on the investigated AOL configuration – that was the source of the mixing effect – the intensity modulator non-linearities over different biasing conditions or the photodetector non-linearities. The proposed methodology of reduction of mixing losses was to introduce fiber amplifier (EDFA) into the AOL in order to reduce natural link attenuation, compensate effects of low modulation efficiency and in result obtain controlled level of the intermediate frequency at the output. Moreover, a scope was put to non-linear effects in the fiber – the Brillouin scattering – that in this case was considered as a parasitic effect.

Part 2. The aim of this work was study the usefulness of three-dimensional images in solving the problem of recovery missing fragments of images. As part of the work, two inpainting algorithms has implemented and analyzed: 1. Alg. PathMatch 2. Alg. Criminisi. Next, the possibilities of using additional depth information from depth cameras has explored. The results obtained on the test data set for various types of 3D cameras has been compared with ground truth data. The evaluation has been carried out on a set of synthetic and real data.

[Pro2] The Development of Design, Processing and Testing Methods of the Electronic Devices and Materials for Microelectronics and Optoelectronics (Rozwój metod wytwarzania i badania materiałów oraz modelowania i charakteryzacji przyrządów w dziedzinie mikroelektroniki i optoelektroniki), project leaders: Paweł Szczepański and Michał Malinowski, May 2018–May 2019, **sub-projects:**

[Pro2.1] **Development of the technology and characterization of materials for novel microelectronic, optoelectronic and photonic devices** (Rozwój technologii i charakteryzacji materiałów dla nowoczesnych przyrządów mikroelektroniki, optoelektroniki oraz fotoniki), project leader: Robert Mroczyński, co-workers: R.B. Beck, W. Ciemiewski, K. Dalbiak, J. Jasiński, L. Łukasiak, B. Majkusiak, A. Mazurak, S. Szostak, J. Walczak

This work is devoted to the development and optimization of technology of selected semiconductor, dielectric and conductive materials for application in novel microelectronic, optoelectronic and photonic devices. It is planned to perform investigations of particular active materials (charge transport) in the form of silicon nanocrystals (or other type of semiconductor), high-k dielectrics and conductive layers (e.g. Titanium Nitride – TiN). In order to characterization of developed technologies, test structures based on investigated materials will be fabricated. The obtained electrical and structural properties of examined devices and structures will be analyzed allowing the ultimate verification of the developed technologies and the feasibility of the application of investigated materials in novel semiconductor structures.

[Pro2.2] **Investigation of active materials, passive and active photonic structures and integrated circuits , optowaves systems and image processing** (Badanie materiałów aktywnych, pasywnych i aktywnych struktur fotonicznych oraz układów scalonych, systemów optofalowych i przetwarzania obrazu), project leaders: Paweł Szczepański, co-workers: Agnieszka Mossakowska-Wyszyńska, Stanisław Jonak, Marcin Kaczkan, Ryszard Piramidowicz, Anna Tyszka-Zawadzka, Stanisław Stopinski, Anna Jusza, Krzysztof Anders, Piotr Garbat, Krzysztof Madziar, Marek Sutkowski, Piotr Witoński, Jerzy Piotrowski, Agnieszka Szymańska, Piotr Warda, Michal Malinowski.

Researches include five following topics. The first one comprises the development of design and characterization methods of integrated photonic circuits. Especially passive and active systems developed on indium phosphide, silicon and polymer platforms are investigated along with their integration with electronic integrated circuits. The second topic includes analysis of spectroscopic properties of active materials and their potential applications for lasing, efficiency improvement of photovoltaic cells, and new class of luminophores. Moreover, the modelling of passive and active periodic structures, including metamaterials and photonic structures having PT-symmetry is developed. Particularly, the novel bulk and waveguide photonic tunable devices based on these structures, are analyzed. The next topic covers investigation of optowave systems for signal transmission. The influence of the system components on light polarization and signal transmission is considered. Finally, the methods of the image processing and image acquisition are developed.

[Pro2.3] **Materials, technologies, structures and devices for microelectronics and optoelectronics** (Materiały, technologie, struktury i przyrządy dla mikroelektroniki i optoelektroniki), project leader: Jan Szmidt, co-workers: Jerzy Krupka, Mateusz Śmietana, Marcin Koba, Mariusz Sochacki, Piotr Firek, Aleksander Werbowy, Magdalena Dominik, Maciej Kamiński, Kinga Kondracka, Norbert Kwietniewski, Aleksandra Paculska, Andrzej Taube, Michał Waśkiewicz, Natalia Kyc, Anna Myśliwiec, Zbigniew Rudkowski

Within the framework of the project several tasks are carried out. These include: analysis of factors causing photo-degradation of typical diesel fuels for contemporary diesel engines, development of the fast method of diesel fuel stability evaluation, optimization of the properties of selected oxide thin films for fiber-optic based sensors, fabrication and current-voltage measurements of ion-sensitive field effect transistors with graphene layer in the gate area, constructing measurement setups for semiconductor photodetectors and power devices characterization.

[Pro2.4] **Studies on the VeSFET device applications as sensor structure** (Badania tranzystora VeSFET pod kątem zastosowań czujnikowych), project leader: Andrzej Pfitzner; co-workers: Witold Pleskacz, Marek Ciepłucha and other members of the VLSI Engineering and Design Automation Division.

Preliminary feasibility study of sensor structures based on VESTIC (Vertical Slit Transistor based Integrated Circuit) architecture is focused on Vertical Slit Field-Effect Transistor (VeSFET). Unique geometry of the VeSFET device makes it possible to build sensor arrays and 3D integration. The evaluation of the electrical characteristics of this transistor from external factors based on numerical simulations is the main goal of the project. VeSFET structure seems to be a promising alternative to the present devices due to the full electrical symmetry of the twin gates. The area of one of them can be designed to accumulate electric charge depending on the chemical environment or radiation.

[Pro3] **Demonstrator of optoelectronic and microelectronic sensors for sailing applications** (Demonstrator czujników opto-elektronicznych i mikroelektronicznych o zastosowań w żeglarstwie) project leader: Krzysztof Anders, May 2018– March 2019

The main result of the project is the development of a fully functional demonstrator of a multi-functional sensor system powered by innovative photovoltaic panels, allowing the registration and analysis of measurement data such as yawning and rolling and acceleration associated with it, mast and sail deformation, distance from obstacles and other units, and additionally measuring the PM2.5 and PM10 dust content in the air. The development of such a system aims, among others, at support of sailing school lessons, the ability to monitor the construction of a yacht/sailing ship in order to avoid defects, the possibility of yacht monitoring by charter companies, the possibility of determining optimal sail settings in order to achieve the highest possible speed etc.

[Pro4] **Hybrid light sources based on praseodymium doped low-phonon fibers** (Hybrydowe źródła światła na bazie niskofononowych światłowodów domieszkowanych jonami prazeodymu) project leader: Krzysztof Anders, May 2017––March 2018

The main aim of the project is to develop lasers and ASE sources in the field of VIS-IR-MIR based on low-phonon glasses doped with praseodymium ions in hybrid configuration.

The scope of project covers development of coherent and non-coherent light sources (so-called ASE source – amplified spontaneous emission) working in VIS-IR-MIR spectral range.

The pigtailed pumping source as well as silica fiber resonator elements will be coupled to the fluorozirconate and chalcogenide fibers with developed glue-spliced technique creating a hybrid connection. Main researches will focus on obtaining laboratory systems for coherent and non-coherent light sources working at ca. 635 nm, 1.3 μm and 4.75 μm.

[Pro5] **Integrated optical gyroscope driven by an application specific integrated circuit** (Zintegrowany żyroskop optyczny sterowany specjalizowanym elektronicznym układem scalonym) project leader: Stanisław Stopiński, May 2017–March 2018

The project focuses on development of an integrated optical gyroscope. The main objective is to develop an application specific photonic integrated circuit that comprises a single-frequency ring laser system and an interferometric detection circuit. The design of the integrated gyro is compliant with an electronic driver, realized in a form of an application specific integrated circuit, developed in a standard CMOS technology. Both devices will be manufactured in the framework of multi-project wafer runs organized by commercial foundries. The photonic and electronic chips will eventually be flip-chip bonded and the performance of the developed gyro system will be evaluated.

[Pro6] **Microelectronic integrated circuit for photonic integrated gyroscope** (Specjalizowany elektroniczny układ scalony do sterowania zintegrowanym żyroskopem optycznym) project leader: Krzysztof Siwiec, May 2017–March 2018

Big progress has been made in fabrication of photonic integrated circuits (PIC), which creates new possibilities in the area of miniature sensors using optical effects. One of very promising applications is development of miniature gyroscope based on Sagnac effect. However, PICs do not offer so wide possibilities in the area of data processing both in analog and digital domain. Because of this the potential of PIC technology lies in the possibility to integrate it with microelectronic integrated circuits (IC).

The aim of this work was to design application specific integrated circuit (ASIC) implementing analog and digital signal processing and providing biasing and power management for the PIC gyroscope. The ASIC has been designed in AMS 0.35 μm CMOS technology and allows to amplify and measure frequency of the PIC gyroscope output signal. The dimensions and pinout of the developed ASIC allow to connect it with parallel the designed PIC with the flip-chip bonding technology. This experiment will allow to verify the possibilities of such integration technology.

[Pro7] **Miniaturized optical time domain reflectometer system** (Miniaturowy moduł reflektometru optycznego OTDR) project leader: Stanisław Stopiński, May 2018–March 2019

The project is focused on development of a novel, miniaturized optical time domain reflectometer system, compatible with portable devices such as smartphones or tablets. The device will be realized as an application specific photonic integrated circuit (ASPIC) in an indium phosphide generic integration technology. A proof-of-the-concept optical chip will be designed, manufactured and tested with respect of applicability in real measuring systems.

[Pro8] **New visible light sources – investigation of luminescent properties of glass materials doped with dysprosium or samarium ions** (Nowe źródła światła ma zakres widzialny – badanie właściwości luminescencyjnych materiałów szklanych domieszkowanych jonami dysprozu lub samaru) project leader: Anna Jusza, May 2018–March 2019

The main aim of this project is to investigate luminescent properties of dysprosium or samarium doped glasses. This kind of materials could offer potential emission and lasing in unique yellow spectral range – not available for convenient semiconductor light sources. Scope of the work covered manufacturing and versatile investigation of luminescent properties of glass materials activated with Dy^{3+} or Sm^{3+} ions. The study covered measurements and analysis of absorption, excitation and emission spectra together with fluorescent dynamic profiles of excited states for all samples.

4.2. Projects Granted by the Ministry of Science and Higher Education

[Pro9] **DIAMSEC – ultrasensitive sensing platform for rapid detection of epidemiological and pandemic threats** (DIAMSEC – ultraczuła platforma sensoryczna do szybkiej detekcji zagrożeń epidemiologicznych i pandemicznych), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Mateusz Śmietana, co-workers: Marcin Koba, Emil Pituła, December 2017–November 2020

The aim of the project is to develop and prepare for implementation an innovative sensing platform for rapid detection of pandemic and epidemic conditions. The project proposes a development of a technology for synthesis and modification of sensing structures based on thin films of diamond, titanium oxide, ITO and graphene towards medium-scale production of ultrasensitive tests for detection of viruses and pathogenic bacteria. DIAMSEC platform can be used directly by a patient, as well as to assist in diagnosis-making process for people in emergency rooms, small clinics, and doctors' offices, in ambulances to the scene of the accident in order to rapid diagnostics of patients. It can also be used to conduct screening tests towards detection of sources and avoid spreading of infectious diseases. Thanks to the universal approach it can be also used in veterinary medicine. Use of the platform DIAMSEC comparing to the currently used methods lead to a shorter measurement time, a reduction in amount required analyte, higher sensitivity and lower cost of a single test.

[Pro10] **Directed-energy laser weapon systems, Non-lethal laser weapon systems** (Laserowe systemy broni skierowanej energii, laserowe systemy broni nieśmiercionośnej), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Ryszard Piramidowicz, August 2015–June 2018

The project aims to develop a set of demonstrators of: solid state lasers for directed energy laser weapon systems; laser systems and technologies for directed energy laser weapon systems; detection and measurement systems; prevention and protection technology against directed energy laser weapon systems; non-lethal laser weapon systems.

The project will also result in identification of the risk associated with the use of non-lethal laser weapon and investigation the effects of laser weapon systems on construction materials, military devices and biological tissues.

[Pro11] **Innovative, hardware-software component, based on a dedicated integrated circuit and software to perform various cryptographic application, with the particular attention paid to electronic identification systems with the high level of confidence** (Innowacyjny komponent sprzętowo-programowy, wykorzystujący specjalizowany układ scalony oraz oprogramowanie, realizujący różne funkcje kryptograficzne, ze szczególnym uwzględnieniem zastosowań w systemach identyfikacji elektronicznej z wysokim poziomem pewności IDSoC), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Witold Pleskacz, co-workers: A. Łuczyk, L. Łukasiak, P. Szczepański, S. Reszewicz, A. Borkowski, M. Derlecki, J. Bęczkowski, September 2017 –August 2020

The aim of the project is to develop and manufacture an innovative single-chip secure processor – IDSoC. The developed system on chip will be composed of a proprietary application processor with an increased fault tolerance and security level. The processor will include a non-volatile memory area dedicated to storing both embedded software and sensitive user data, such as biometric data. Thanks to the appropriate error detection and correction systems as well as hardware encryption, the non-volatile memory will ensure data integrity and confidentiality. In addition, the integrated IDSoC system will be equipped with a set of peripherals for hardware cryptographic support. During the project, it is planned to develop a true random number generator (TRNG) and to carry out research on the possibility of the physical unclonable function (PUF) utilization for the purpose of identification and authentication. It is also anticipated to develop a set of sensors for the monitoring of the integrated circuit's environmental conditions (e.g. temperature, supply voltage, clock frequency). The mechanisms of the external interference detection in the system's physical structure will also be employed, which will significantly protect the system features against unauthorized access attempts and will prevent from the acquisition of sensitive data. The IDSoC system, to be developed during the project, might be utilized in the applications in which the storage and processing of sensitive data is required, e.g. in electronic identification systems (electronic identity card, e-passport). The inherent part of the IDSoC system will be its dedicated firmware, developed in the course of the project. The firmware will support and enable all the system's functions, most notably the electronic identification with high level of confidence and other advanced cryptographic procedures.

[Pro12] **Methods and means of protection and defense against high power microwave pulses** (Metody i sposoby ochrony i obrony przed impulsami HPM), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Mariusz Sochacki, co-workers: Jan Szmidt, Piotr Firek, December 2014–December 2020

The protection and defense system against high power microwave pulses will be equipped with limiting diodes. The protection semiconductor devices will be designed, manufactured and characterized in the Institute of Microelectronics and Optoelectronics. Wide bandgap semiconductors can be used in such kind of application, primarily the silicon carbide (SiC) wafers. The diodes will be characterized by means of current-voltage and capacitance-voltage measurements. Finally, the microwave properties of the devices will be studied, which is important especially in the context of their application in microwave transceiver circuits.

[Pro13] **Miniature, dual-frequency, system-on-a-chip for precise satellite navigation GPS/Galileo integrated with application processor dedicated to IoT devices with low power consumption** (Miniaturowy, dwuczestotliwościowy, jednoukładowy system scalony do precyzyjnej nawigacji satelitarnej GPS/Galileo zintegrowany z procesorem aplikacyjnym dedykowany do urzadzen IoT o niskim poborze mocy NaviSoC), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Witold Pleskacz, co-workers: P.Narczyk, K. Marcinek, T. Mrozek, I. Butryn, D. Pietroń, Ł. Wiechowski, November 2017–October 2020

The development concept of specialized microcontroller for precise satellite navigation meets the growing needs of many sectors of the world economy, where according to estimates 6–7% of European GDP depends on satellite navigation applications. The aim of the project is to develop, produce, test and demonstrate the dual-frequency, system-on-a-chip for precise GPS/Galileo satellite navigation. The system will be integrated with application processor and will allow for a significant increase in the accuracy of mobile devices. The consortium was established to realize this project. It consists of one scientific entity (Warsaw University of Technology) and the two entrepreneurs (ChipCraft Sp. z o.o. and Inowatronika – Tomasz Radomski).

Within the project NCBiR NR02-0096-10/2011 "Dual-mode blocks of the integrated circuit GALILEO and GPS signal receiver in nanometer CMOS technology for precise positioning of mobile objects" realized in 2011–2014, applicant has developed, produced and characterized integrated circuits forming the so-called chipset – three circuits of complete analogue path of the satellite navigation receiver, which can receive two frequency bands from both constellations

Galileo and GPS. Due to its size and the lack of the full integration on the one silicon die the technology did not extend beyond the area of laboratory demonstrations.

The miniaturization of the chipset will be achieved by development of NaviSoC system-on-a-chip by the ChipCraft company in cooperation with the Warsaw University of Technology and with the Inowatronika company. Experience of Warsaw University of Technology from the previous project mentioned above will be utilized. The developed technology will be examined and demonstrated in operational conditions, i.e. in IoT class devices (Internet-of-Things) produced in the course of this project thanks to the cooperation and exploiting experience of Inowatronika company.

[Pro14] **Nanophotonics with metal – group-IV-semiconductor nanocomposites: From single nanoobjects to functional ensembles (NaMSeN)** (NaMSeN – Nanofotonika bazująca na nanokompozytach metali i półprzewodników z grupy IV – od pojedynczych nanoobiektów do zespołów funkcjonalnych), V4-Japan Advanced Materials Joint Call of National Centre for Research and Development, Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Romuald Beck, February 2016–January 2019

The NaMSeN project aims to advance the field of group-IV semiconductor nano-structures in the new stage closer to photonic applications by overcoming intrinsic limitations of these materials (namely the low absorption cross section and emission rate due to the dominating indirect transitions) via formation of metal-semiconductor nanostructural composites and alloys (SiGe, heavy doping Si:B,P etc.) The enhancement of optical properties should be achieved mainly by exciton – plasmon coupling, Purcell effect and crystal lattice modification by strain. The project includes development of relevant technologies, theoretical models and characterization methods. The nano-composites will be studied on different scales from single nano-objects, microscopic ensembles up to test devices.

The project is matching the Joint Call theme of materials for electronics and energy harvesting by addressing applications to chemical and bio-sensing as well as light emitting devices. Bio-compatibility and degradability of nano-composites will be tested in living cells using single nano-particle luminescence imaging.

Top research group from all Visegrad countries and Japan are selected to form this project consortium with high potential for sustainable and fruitful collaboration.

[Pro15] **Nanostructured photonic crystal fibers for innovative few mode propagation** (Nanostrukturalne światłowody fotoniczne do kilkumodowej propagacji nowe generacji" w ramach programu „Nowoczesne technologie materiałowe" TECHMATSTRATEG), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Ryszard Piramidowicz, June 2018–May 2021

The aim of the project is to develop innovative few-modes materials, thanks to which it will be possible to use the last undeveloped area of multiplexing – spatial multiplexing. The project will develop nanostructured anisotropic photonic fibers with defined polarization properties, shaped dispersion and distribution of the mode field or strongly nonlinear properties allowing for few-mode propagation of the new generation.

[Pro16] **New integrated photonic passive optical network** (System WDM-PON w technologii fotoniki scalonej), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Ryszard Piramidowicz, October 2015–March 2018

The main aim of the project is development and investigation of a novel solution for optical access systems – WDM-PON system, based on photonic integrated circuits (PICs) as well as elaboration of the roadmap for implementation of such a solution in real systems of telecom operators. The scope of the project covers in particular designing, manufacturing, versatile characterization and evaluation of key transceiver PICs for WDM-PON access systems, as well as photonic components for application in its nodes. As a result – the demonstrator of the system with implemented PICs components will be developed, allowing determination of the technical and economic capabilities of deploying the proposed solution in real systems.

[Pro17] **Technologies of semiconductor materials for high power and high frequency electronics** (Technologie materiałów półprzewodnikowych dla elektroniki dużych mocy i wysokich częstotliwości WidePOWER), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Jan Szmidt, co-workers: Piotr Firek, Krystian Król, Aleksander Werbowy, Michał Waśkiewicz, Kinga Kondracka, Jakub Szarafiński, Andrzej Taube, Norbert Kwietniewski, Mariusz Sochacki, Kazimierz Dalbiak, Witold Ciemiewski, December 2017–November 2020

The overall aim of this project is to develop technology of silicon carbide (SiC) homoepitaxy and gallium nitride (GaN) heteroepitaxy towards production grade device epitaxial structures. Silicon carbide and AlGaN/GaN/SiC wafers for fabrication of 1.7 kV/3.3 kV devices and vertical HEMTs are expected as basic product for the implementation. Quality of the wafers will be verified by the fabrication of 1.7 kV PiN diode and VHEMTs that will be ready for the implementation in advanced power electronics. The processing of SiC PiN diode will be upgraded up to 3.3 kV devices to investigate main barriers of implementation in the case of high voltage bipolar SiC devices. Comprehensively characterized and certified epitaxial structures will be the subject of market analysis on the day of completion of the project in order to assess the competitiveness and scale of production giving real rate of investment return. The findings from the demonstration pilots of power converters and aviation band amplifiers will be widely published among companies and further stakeholders. The key performance measurement of these applications is that companies outside the consortium have specific knowledge to make better informed decisions about future R&D strategies and investments for the uptake of advanced power electronics. It will support the commercialization of wafers and devices efficiently.

[Pro18] **Tunable hyperbolic metamaterials for photonic devices of novel generation** (Przestrajalne metamateriały hiperboliczne na potrzeby nowej generacji przyrządów fotonicznych HYPERMAT), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Michał Malinowski, co-workers: Robert Mroczyński, Ryszard Piramidowicz, Anna Jusza, Krzysztof Anders, Anna Tyszka-Zawadzka, Bartosz Janaszek, Marcin Kieliszczyk, Bartosz Fetliński, December 2017–November 2020

The main objective of this project is to develop an innovative technology of tunable multilayer hyperbolic metamaterials (THMMs) operating in NIR and MIR frequency ranges. Such structures exhibit extraordinary features unprecedented in commercially available state-of-the-art photonic solutions, resulting from unusual dispersion characteristics which can be controlled by an external electric field. THMMs can be used as efficient, adaptive antireflective coatings (AR) or as tunable edge-filters in photonic components commercially offered by our large industrial partner, i.e., PCO S.A. The development of the technology of tunable hyperbolic metamaterials, demonstration of the proof of concept, and transfer of the technology to PCO S.A. could become the foundation for the technological platform of a novel class of photonic components, which would significantly enrich PCO S.A.'s commercial offer and become a strong impulse for the development of innovative national photonics industry, offering products globally. We expect that project results will contribute to the development of science related to nanotechnology and photonics. An intensive cooperation between Consortium partners will emerge to advance scientific leadership of the Polish scientific units as the leaders in the modeling, technology and characterization of photonic devices including nanostructures based on THMMs.

4.3. Projects Granted by the National Science Centre

[Pro19] **Active Tunable Hyperbolic Metamaterials** (Aktywne przestrajalne metamateriały hiperboliczne), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Bartosz Janaszek, co-worker: Marcin Kieliszczyk, July 2017–July 2020

The main objective of this project is to investigate Active Tunable Hyperbolic Metamaterial's properties. Full characterization of such structures requires not only performing a series of numerical simulations, but also derivation of theoretical models of light interaction with the considered structure. Theoretical analysis will cover classical as well as semi-classical approach allowing for obtaining crucial optical parameters, such as reflection, transmission and Photonic Density of States (PDOS). In particular, PDOS forms an especially useful framework for obtaining an effective gain of an active structure. Further investigations will include supporting calculations based on standard effective medium theory (EMT), nonlocal-effect-corrected EM, as well as transfer-matrix method (TMM). The crucial point of the analysis comprises complex numerical simulation based on Finite Difference Time Domain (FDTD) method. Such an approach allows for observation and investigation of wave propagation in any pre-defined medium, including periodical nanostructures, e.g. Active Tunable Hyperbolic Metamaterials.

[Pro20] **Conductive photonic structures for multiparametric bio-chemical diagnostics** (SONATA BIS Przewodzące struktury fotoniczne do wieloparametrycznej diagnostyki biochemicznej), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Mateusz Śmietana, May 2015–May 2019

The main objective of this project is to design, fabricate and characterize a platform of a new class of optical-fiber-based bio-sensor employing transparent and electrochemically active thin overlays. The obtained sensors will be additionally functionalized with organic bio-film and capable for simultaneous label-free optical and electrochemical measurement, or optical measurement of biochemical interactions taking place at sensor's surface for stimulated (controlled) electrochemical potential. Combination of these two optical and electrochemical systems within one sensing structure will allow for selective detection and multi-parameter analysis of bio-analytes reaching surface of the overlay.

[Pro21] **Investigation on interaction between bio-active media and electromagnetic field in photonic crystal fiber devices with suspended core** (OPUS Badanie oddziaływania struktur aktywnych biologicznie z polem elektromagnetycznym w układach światłowodów fotonicznych z zawieszonym rdzeniem), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Mateusz Śmietana, February 2015–February 2018

The primary goal of this research project is to design and characterize of a platform for a new class of bio-sensor enabling label-free detection of biological substance, based on measurement of interactions between electromagnetic field and biologically active layer, immobilized inside microchannels of a suspended-core fibre or also on its outer surface. The thesis of the research project is, that a label-free detection of biological compounds, based on a spatially confined interaction with E-M wave and with the binding layer on the inner surface of microchannels of a suspended-core microstructured fibre, may be a viable alternative to fluorescence label-based detection, as well as to plasmonic or waveguide-based sensing structures.

[Pro22] **Oxide nanostructures for electronics, optoelectronics and photovoltaics** (Nanostruktury tlenkowe do zastosowań w elektronice, optoelektronice i fotowoltaice), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Jan Szmidt, June 2013–June 2018

Aim of this project is explanation and description of complex electro-optical properties of a group of wide band gap oxide materials (Al_2O_3, HfO_2, ZrO_2, ZnO). Despite the fact that these materials are presently key elements of modern electronic (gate oxides, transparent electronics, memories), optoelectronic (transparent contacts) and photovoltaic (transparent contacts) devices, influence of growth conditions on their electrical and optical properties is still not clear.

By selecting growth conditions we can deposit both dielectric (isolating) and semiconducting layers, in the case of ZnO even with a metallic conductivity. Doped in a controlled way, grown at specific conditions, thin layers of ZnO should enable us construction of transparent contacts to wide band gap semiconductors (SiC, GaN). To achieve goals of the project we should answer several questions on the origin of shallow donors in ZnO, in particular role of hydrogen in these films (our present investigations question the fact that hydrogen is dominant shallow donor in our films), on the role played by vacancies in conductive and dielectric films, on the method of recrystallization blocking of gate oxides, on the mechanisms of compensations in ZnO layers grown in the ALD processes with ammonia water. We will investigate why gate oxides (mainly HfO_2) have excellent isolating properties, when deposited as amorphous ones, but loose these properties after recrystallization. Thus, the ways to block their recrystallizations are crucial and need detail investigations. The working hypothesis is that small deviations from oxides stoichiometry importantly affect electro-physical material parameters of selected oxides.

4.4. Projects Granted by the International Institutions

[Pro23] **Convergence of Electronics and Photonics Techologies for Enabling Terahertz Applications CELTA** (CELTA – Konwergencja elektroniki i technik fotonicznych na rzecz rozwoju zastosowań techniki terahercowej), EU Horizon 2020 project, (Projekt realizowany w ramach Horyzont 2020: MSCA-ITN-2015-ETN – Marie Skłodowska-Curie Innovative Training Networks (ITN-ETN)), project leader: Krzysztof Madziar, March 2016–February 2020

CELTA aims to produce the next generation of researchers who will enable Europe to take a leading role in the multidisciplinary area of utilising Terahertz technology for applications involving components and complete systems for sensing, instrumentation, imaging, spectroscopy, and communications. All these technologies are keys to tackling challenges and creating solutions in a large number of focus areas relevant for the societal challenges identified in the Horizon 2020 programme. To achieve this objective, CELTA is comprised of 11 leading research institutions and has assembled a comprehensive research training programme for all the 15 early-stage researchers (ESRs). CELTA integrates multidisciplinary scientific expertise, complementary skills, and experience working in academia and industry to empower ESRs to work in interdisciplinary teams, integrate their activities, share expertise, and promote a vision of a converged co-design and common engineering language between electronics and photonics for Terahertz technologies.

[Pro24] **Green Power Electronics** (Zielona energoelektronika), EU INTERREG BALTIC SEA REGION project, (Projekt realizowany w ramach umowy partnerskiej zawartej z University of Southern Denmark z siedzibą w Sonderborgu w Danii), project leader: Mariusz Sochacki, co-workers: Krystian Król, Norbert Kwietniewski, Katarzyna Kubicka, March 2016–March 2019

The project Green Power Electronics will enhance the capacity of Baltic Sea Region companies to take up advanced power electronics into their R&D strategies and investment planning. Advanced power electronics is based on new materials and is a disruptive technology enabling the energy supply chain to increase energy efficiency. The novel technology is expected to enter the markets within the next 3–7 years. Challenges regarding the reliability under harsh conditions, economic viability of the transition towards advanced power electronics as well as general agreement on the technology and quality standards need to be overcome.

During the project period we carry out three pilots between companies and research institutions within the sectors renewable energies, i.e. wind energy, e-mobility and smart houses. Through these pilots we demonstrate the technical maturity, reliability and economic feasibility of advanced power electronics.

We market the technical and economic opportunities of advanced power electronics to companies in the Baltic Sea Region. SMEs will develop their individual technology roadmaps to take up this novel technology.

[Pro25] **High-precision techniques of millimeter and sub-Thz band characterization of materials for microelectronics TEAM TECH** (Wysokoprecyzyjne techniki charakteryzacji materiałów w zakresie fal milimetrowych oraz subteraherco-wych do zastosowań mikroelektronicznych), EU Structural Funds project, (Fundusze strukturalne UE: Program Operacyjny Inteligentny Rozwój (PO IR)), project leader: Jerzy Krupka, November 2016–October 2019

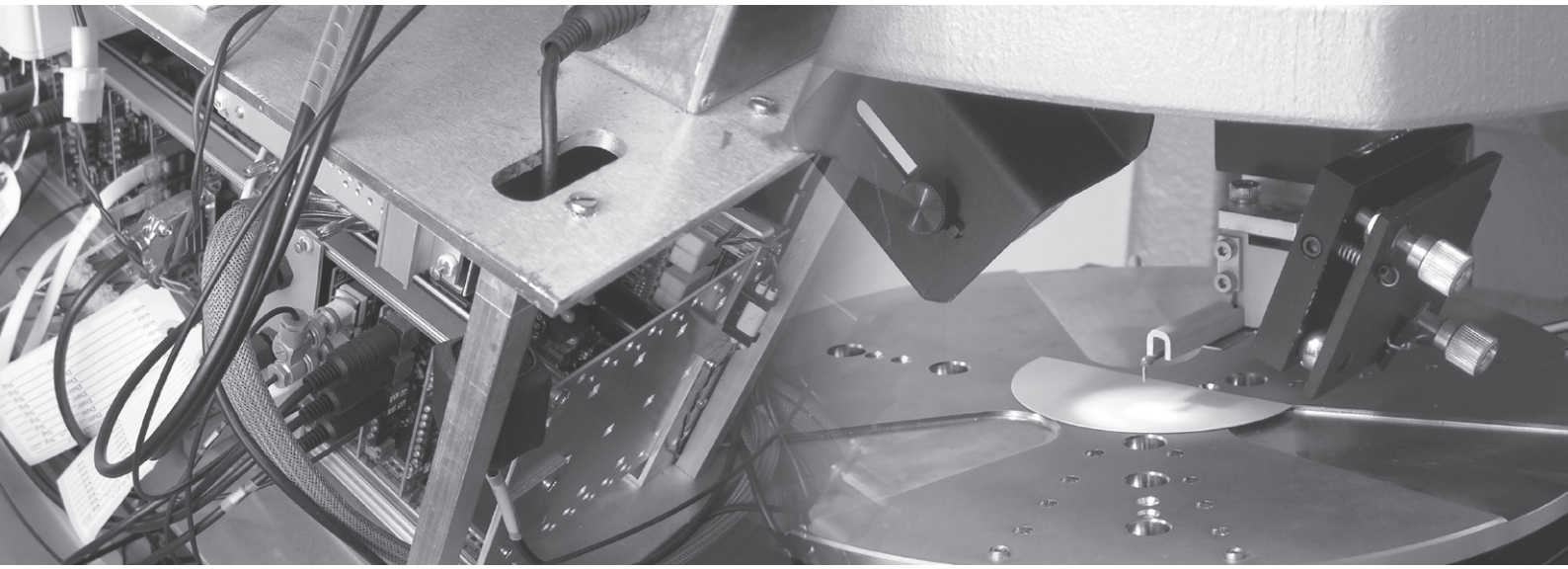
The main objective of this project will be to develop novel sensors and sensing methodologies useful to non-destructive contactless electric and magnetic characterization of materials at millimeter and sub-THz spectra. The implementation of this goal will be two-pronged. On one hand, the said resonant structures will be exploited to benefit from their inherent narrow-band properties, which are particularly useful at measuring low-loss materials. On the other hand, the research will also concern broadband measurement techniques based on multimode resonant structures. The auxiliary goal is adopting the technological approaches typical for the microelectronics industry and applies them for precise fabrication of novel resonant cavities operating in the millimeter and the sub-THz bands. Another such goal is development of a new low-loss yet high dielectric constant material for dielectric posts inserted into sensing cavities.

[Pro26] **Integrated Electronics and Photonics – development (with the participation of industry representatives) of an M.Sc. program in the area of Electronics including novel educational techniques and taught in English** within the framework of the project "NERW PW Science–Education–Development–Cooperation" financed from Axis III Higher Education for the Economy and Development of the Operational Programme Science Education Development 2014––2020

(„Zadanie 13 – Integrated Electronics and Photonics – opracowanie z udziałem przedstawicieli z otoczenia przemysłowego programu kształcenia wykorzystującego nowe formy dydaktyczne na studiach II stopnia na kierunku Elektronika prowadzonych w języku angielskim" w ramach projektu „NERW PW Nauka–Edukacja–Rozwój–Współpraca" finansowanego w marach Osi III Szkolnictwo wyższe dla gospodarki i rozwoju Operacyjnego Wiedza Edukacja Rozwój 2014–2020), project leader: Sławomir Szostak, March 2018–November 2021

[Pro27] **Photonic Integrated Circuits Accessible to Everyone PICs4All** (PICs4All – Program powszechnego dostępu do technologii układów fotoniki scalonej), EU Horizon 2020 project, (Projekt realizowany w ramach Horyzont 2020 (ERC, działanie Research & Innovation Action, Innovation Action)), project leader: Ryszard Piramidowicz, January 2016––December 2018

The aim of the PICs4All CSA was to establish a European network of Application Support Centres (ASCs) in the field of Photonic Integrated Circuits (PICs) technology. The main task of ASCs is to lower the barrier to Researchers and SMEs for applying advanced InP and TriPleX based Photonic IC technology as they are offered by the JePPIX platform, and thus to increase the awareness of the existence of this worldwide unique facility. This is realized by actively scouting new application opportunities throughout Europe, helping the candidates to determine the technical and/or economic viability when applying integrated optical solutions and supporting them in the design, manufacturing and evaluation phase of their Application Specific Photonic IC's (ASPICs).



Electronic Materials and Microsystem Technology Division

5. DISSEMINATION OF KNOWLEDGE

5.1. Students Scientific Associations

5.1.1. Students Scientific Association of Microelectronic and Nanoelectronics (KNMiN) (Koło Naukowe Mikroelektroniki i Nanoelektroniki KNMiN)

Association Tutor: Mateusz Śmietana, Ph.D., D.Sc.
Members of the Board: Mateusz Bagłaj, Michał Długoszewski, Mateusz Wąsowski
Total number of Members: 22

In the interests of the Students Scientific Group of Microelectronics and Nanoelectronics are issues mainly related to the technology, design instruments, characterization and application of new materials in the field of optoelectronics and microelectronics. Examples of topics dealt with by the members of the Student Scientific Associacion: preparation and characterization of semiconductor structures, the organization of trips to conferences, workshops and symposia (where group members can get acquainted with the latest achievements in the field of micro-, nano- and optoelectronics, meetings of eminent personalities from the world of modern science and to present the results of their own research).

5.1.2. Student Scientific Association of Optoelectronics (KNO) (Koło Naukowe Optoelektroniki KNO)

Association Tutor: Ryszard Piramidowicz, Ph.D, D.Sc.

Student Association of Optoelectronics formally started in May 2006, however, the custom of nonobligatory student seminar meetings – foundation of our Association – has been successfully continued since 2002. Presently, the Association consists of several students and Ph.D. students of Institute of Microelectronics and Optoelectronics, however graduate professionals complement our ranks, as well.

Main scientific interest covers:

- fiber lasers and amplifiers,
- photonic integrated circuits,
- special optical fibers and fiber components,
- new optically active materials for light sources (polymers, composites, glasses and nanocrystals doped with rare-earth ions).

The goals of Student Association of Optoelectronics:

- popularizing optoelectronics and photonics technology disciplines,
- conducting research and development works in the field of optoelectronics,
- supporting all forms of activity leading to the development of professional skills of KNO members.

Activities of KNO members in 2018:

The scientific efforts of the KNO members were primarily focused on R&D works on fiber lasers and amplifiers based on the first Polish active optical fibers developed by Optical Fiber Technology Laboratory of Marie Curie Sklodowska University. Other activities were aimed at deep reorganization of the KNO with respect of both management board and fields of research and training activity.

5.1.3. Students Scientific Association of Microsystems (ONYKS) (Koło Naukowe Mikrosystemów ONYKS)

Association Tutor: Jakub Jasiński, Ph. D.
Members of the Board: Jakub Latusek, Marharyta Kruk, Kacper Zezuliński
Total number of Members: 20

The members of the Students Scientifc Association are involved in the implementation of various projects (analog, microcontrollers, FPGAs) and have necessary tools to accomplish circuit boards. The scientifct interest also includes popularization of electronics among the youth and students.

In 2018 Students Scientifc Association took part in the following events:

- XXII Festival of Science organized by Polish Academy of Sciensces in Jabłonna, September 22th–23th, 2018. As in previous years, the memebers of ONYKS organized „Soldering school".
- Warsaw University of Technology Open Days 2018: Students Scientifc Association organized the workshop on techniques of soldering.

ONYKS has realized the following project:

- **Air Quality Measurement Device**
  The aim of the project was to create station measuring the amount of dust in the air, CO_2 level, temperature and humidity.

5.1.4. Student Scientific Association of Integrated Systems (Koło Naukowe Systemów Scalonych)

Association Tutor: Marek Niewiński, Ph. D.
Members of the Board: Krzysztof Belewicz, Adrian Oleksiak, Sebastian Cieślak
Total number of Members: 5

The main areas of interest are: developing mixed analog-digital system using SoC board, designing extension board for SoC, programming microcontrollers and Integrated Circuit design.

Project started in 2018 by association's members (and still under development):

"Customized development platform based on ESP32 chipset with MicroPython support."
The aim of the project was to develop a set a PCB boards: main micro-controller board and set of extensions board with selected sensors. The "heart" of the platform is W01 OEM Module with: Xtensa® dual–core 32–bit LX6 microprocessor, additional coprocessor for monitoring the ADC channels and GPIOs, memories: RAM and FLASH and with WiFi and Bluetooth communication. The developed extension boards enables to connect and integrate: temperature and pressure sensors, GSM and GPS module. Current stage of project realization is: developed PCB boards and preliminary testes selected sensors.

5.2. Cooperation with schools

In 2018 seven popular science lectures were delivered, as well as lectures advertising studies at FEIT for more than 350 high-school students.

5 groups of high-school students from all over Poland visited FEIT I. The participants attended a lecture on FEIT and visited selected laboratories.

The Faculty participated in the Science Festival 2018 organizing popular science lectures and classed in our laboratories.

Based on the experience and cooperation with the community of high-school teachers the first edition of Polish STEM PW (Science, Technology, Engineering) competition was organized and held in December 2018–January 2019 with more than 950 high-school students from all over Poland.

5.3. Fiber-Optic Photonics Platform (FOPP)
Polska Platforma Fotoniki Światłowodowej (PPFŚ)

Coordinator:
Ryszard Piramidowicz, Ph.D, D.Sc.
Warsaw University of Technology, Institute of Microelectronics and Optoelectronics

Consortium members:
Warsaw University of Technology (PW)
Bialystok University of Technology (PB)
Institute of Electronic Materials Technology (ITME)
Marie Curie-Sklodowska University (UMSC)
West Pomeranian University of Technology (ZUT)

Timeline: 2014–2018

The fundamental research objective of the Platform is to develop novel, innovative solutions for broadly understood optical fibers photonics, including such focus areas as sources and amplifiers of coherent and incoherent radiation, passive and active optical fibers of specially designed optical properties, micro-and nano-structured (including PCF) fibers for special applications, optical fiber sensors, micro and nano-optical elements and components.

The Platform is based on five pillars:

1) modeling and design,
2) fabrication technology,
3) characterization,
4) development and prototyping,
5) validation and testing constituting the complete food-chain of the manufacturing process.

Technological competences, indispensible for such a project, are offered by three main players on the Polish market of the fiber-optic technology: the Institute of Electronic Materials Technology (ITME), the Bialystok Technical University (PB) and the Marie Curie-Sklodowska University (UMCS). The design, characterization and prototyping capabilities are disposed by the three research groups of the Warsaw University of Technology (PW), while the validation and testing issues are covered mainly by West Pomeranian University of Technology (ZUT) and Warsaw University of Technology (PW). The combined potential of the platform's partners enables undertaking of practically all kinds of research and development work within the area of fiber-optic photonics and also significant involvement in the research within the field of planar/strip waveguide-based integrated structures. The main fields of interest are a result of up-to-now conducted projects (both fundamental research and R&D works), present expertise of partners and continuously monitored and anticipated demands of the market.

The core of the consortium consists of photonics fiber laboratories situated at the Warsaw University of Technology supported by technological laboratories of the main Polish manufacturers of specialty optical fibers (ITME, UMCS, PB). Infrastructure is complemented by testbeds of photonic systems offered by PW and ZUT. It is worth pointing out that the consortium members already have a unique infrastructure at their disposal and have technological ability and technical skills for manufacturing the sophisticated fiber-optic elements, successfully competing on the global market with the products of the most significant commercial manufacturers. Good examples are microstructed silica and polymer fibers developed at UMCS and systematically purchased by leading European research institutes and companies and nano-structured graded index lenses and microscope objectives

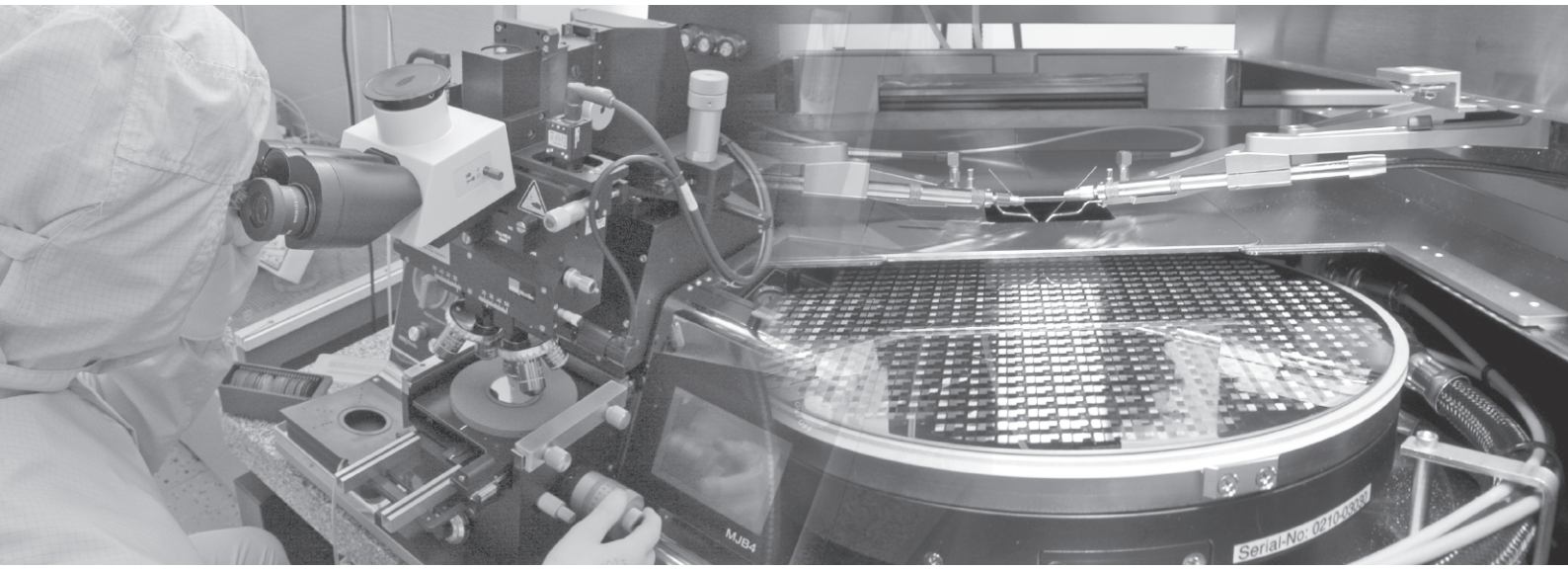
5.4. Photovoltaic Platform, Warsaw University of Technology (PVP) Platforma Fotowoltaiki Politechniki Warszawskiej (PF)

Coordinator:
Ryszard Piramidowicz, Ph.D, D.Sc.
Warsaw University of Technology, Institute of Microelectronics and Optoelectronics

The Photovoltaic Platform was established in 2014 at Warsaw University of Technology in order to increase utilization of the scientific potential and encouraging industry-oriented research services. The Photovoltaic Platform aims to bring together complementary competences of various research groups of WUT, thus creating strong multidisciplinary photovoltaic group capable of successful realization of both large research projects and development of complete solutions for the industry partners. The Photovoltaic Platform core consists of teams from the Faculty of Electronics and Information Technology and Faculty of Physics, as well as teams from other faculties involved in research on various aspects of photovoltaic technologies.

Range of competences of PVP covers all levels of photovoltaics – from physics of the solar cells, structure of modules, inverters and mounting large methods, design, development and performance evaluation of photovoltaic systems up to energy profiles prediction and assessment of grid integration issues. The Platform teams also help prospective investors to evaluate their models of engagement in the photovoltaic market, taking into consideration technical challenges, legal environment and economic feasibility.

Cooperation with industry partners is critical for long term development of photovoltaics at the Warsaw University of Technology. The Photovoltaic Platform cooperates closely with a number of companies interested in taking part in expected rapid development of photovoltaic market. Broad knowledge of Polish photovoltaic market provides the Photovoltaic Platform basis for further development of competences in connection with identified needs of the industry. In parallel with involvement in the cooperation with business partners the Photovoltaic Platform teams remain engaged in a number of research project.



Microelectronics and Nanoelectronics Devices Division

6. DEGREES AWARDED

6.1. Ph.D. Degrees

[PhD1] Marek Ciepłucha, **Digital integrated circuits verification methodology with regression testing** (Metodyka weryfikacji funkcjonalnej cyfrowych układów scalonych z wykorzystaniem testów regresyjnych), supervisor: Witold Pleskacz, 12 June 2018

[PhD2] Anna Jusza, **Investigation and analysis of luminescent properties of polymer composites with praseodymium activated nanocrystals** (Badanie i analiza właściwości luminescencyjnych kompozytów polimerowych z nanokryształami aktywowanymi jonami prazeodymu), supervisor: Ryszard Piramidowicz, 30 October 2018

[PhD3] Witold Rzodkiewicz, **Determination of local mechanical stresses in MOS structures by optical methods and study of the effect of these stresses on electrical parameters** (Określenie lokalnych naprężeń mechanicznych w strukturach MOS metodami optycznymi i badanie wpływu tych naprężeń na parametry elektryczne struktur), supervisor: Andrzej Jakubowski, 29 May 2018

[PhD4] Andrzej Taube, **Developement of selected construction elements of AlGaN/GaN HEMTs for application in high power, high frequency and high temperature electronics** (Opracowanie wybranych elementów konstrukcji tranzystorów HEMT AlGaN/GaN do zastosowań w elektronice wielkich częstotliwości, dużych mocy i wysokich temperatur), supervisor: Jan Szmidt, 27 March 2018

6.2. M.Sc. Degrees

[MSc1] Paweł Jan Bortnowski, **Thulium-doped fiber laser** (Laser światłowodowy domieszkowany jonami Tm3+), advisor: Ryszard Piramidowicz, 07 September 2018

[MSc2] Dariusz Michał Burnat, **Optical fibre structures with thin indium tin oxide films for simultaneous optical and electrochemical sensing** (Struktury światłowodowe z cienkimi warstwami tlenku cyny indu (ITO) do jednoczesnych analiz optycznych i elektrochemicznych), advisor: Mateusz Jakub Śmietana, 15 June 2018

[MSc3] Marta Maria Chmiel, **Design and implementation of DDR2 SDRAM Controller for System on Chip in Verilog HDL** (Projekt kontrolera pamięci DDR2 SDRAM dla System On Chip oraz jego implementacja w języku opisy sprzętu Verilog HDL), advisor: Arkadiusz Władysław Łuczyk, 18 October 2018

[MSc4] Dorota Herman-Kucharska, **Integration of printed copper into power semiconductor technologies** (Integration of printed copper into power semiconductor technologies), advisor: Ryszard Kisiel, 15 June 2018

[MSc5] Bartosz Krzemiński, **Functional verification of USB Device controller using UVM** (Weryfikacja funkcjonalna kontrolera USB z wykorzystaniem metodyki UVM), advisor: Andrzej Wielgus, 23 March 2018

[MSc6] Arkadiusz Jan Kulesza, **Microprocessor didactic module based on ARM Cortex M4 architecture** (Mikroprocesorowy moduł dydaktyczny oparty o architekturę ARM Cortex M4), advisor: Sławomir Szostak, 12 October 2018

[MSc7] Paulina Niedźwiedziuk, **Analysis of light generation in laser with PT symmetric mirror** (Analiza generacji promieniowania w laserze ze zwierciadłem PT wykazującym parzystą symetrię), advisor: Agnieszka Mossakowska–Wyszyńska, 22 March 2018

[MSc8] Piotr Kamil Paszke, **Glass microresonators doped with silver nanoparticles for biosensing applications** (Mikrorezonatory szklane domieszkowane nanocząstkami do systemów biosensorycznych), advisor: Ryszard Piramidowicz, 7 June 2018

[MSc9] Monika Maria Piestrzyńska, **Long-period fiber gratings coated with thin films of metal oxides for biosensor applications** (Długookresowe siatki światłowodowe pokryte cienkimi warstwami tlenków metali do zastosowań biosensorycznych), advisor: Mateusz Jakub Śmietana, 15 June 2018

[MSc10] Michał Karol Popławski, **Luminescence properties in UV-VIS spectral range of ZBLAN glasses doubly doped with thulium and ytterbium ions** (Badanie właściwości luminescencyjnych w zakresie UV-VIS szkieł ZBLAN domieszkowanych jonami tulu i iterbu), advisor: Ryszard Piramidowicz, 25 October 2018

[MSc11] Rafał Szymon Sierociński, **Remote optical powering of active elements in fibre-optic networks** (Zdalne zasilanie mocą optyczną elementów aktywnych w sieciach światłowodowych), advisors: Krzysztof Anders, Ryszard Piramidowicz, 6 June 2018

6.3. B.Sc. Degrees

[BSc1] Mateusz Bagłaj, **Magnetron sputtering deposited ultrathin films for a new generation of photonics devices** (Technologia ultracienkich warstw rozpylanych magnetronowo na potrzeby przyrządów fotonicznych nowej generacji), advisor: Robert Paweł Mroczyński, 9 February 2018

[BSc2] Sebastian Cieplak, **Construction of lighting measurment research system** (Budowa badawczego układu pomiaru oświetlenia), advisor: Marek Sutkowski, 26 September 2018

[BSc3] Michał Długoszewski, **Polymer composite optical fibers doped with rare earth ions** (Polimerowe światłowody kompozytowe domieszkowane jonami ziem rzadkich), advisor: Anna Maria Jusza, 9 February 2018

[BSc4] Michał Dudzik, **GUI design tool for Java AWT package** (Narzędzie do projektowania GUI w Javie przy użyciu pakietu AWT), advisor: Piotr Witoński, 21 September 2018

[BSc5] Jacek Gazda, **A hardware IP block with an AMBA APB interface and a local DMA port to support error correction of processor's operational memory** (Sprzętowy blok wspomagania korekcji błędów pamięci operacyjnej procesora z interfejsem AMBA APB i lokalnym portem DMA), advisor: Witold Pleskacz, 9 February 2018

[BSc6] Patryk Antoni Gromek, **Hardware AMBA AHB to MIG bus converter block for DDR3 memory controller** (Sprzętowy blok konwertera magistrali MIG do magistrali AHB dla kontrolera pamięci DDR3), advisor: Witold Pleskacz, 9 February 2018

[BSc7] Jan Stanisław Hetman, **Mechanical bending measurements with Long Period Fiber Gratings (LPFG)in various Refractive Index Unit (RIU)** (Badanie ugięć mechanicznych za pomocą długookresowych siatek światłowodowych LPFG w różnych współczynnikach załamania otoczenia), advisor: Mateusz Jakub Śmietana, 15 June 2018

[BSc8] Jan Jakub Jakubik, **Tool for building graphical user interface in Java programming language using JavaFX library** (Narzędzie do budowania graficznego interfejsu użytkownika w języku Java z wykorzystaniem biblioteki JavaFX), advisor: Piotr Witoński, 15 June 2018

[BSc9] Paweł Bolesław Kowalski, **Teleinformatic registration system with mobile access on the example of a medical devices database** (Teleinformatyczny system ewidencyjny z dostępem mobilnym na przykładzie bazy danych urządzeń medycznych), advisor: Elżbieta Piwowarska, 15 March 2018

[BSc10] Grzegorz Leszczyński, **Recognition of motion and motion capture using MEMS** (Rozpoznawanie i rejesrtacja ruchu z wykorzystaniem zintegrowanych układów MEMS), advisor: Sławomir Szostak, 12 October 2018

[BSc11] Xin Lu, **Object removal in videos** (Usuwanie obiektów w sekwencjach wideo), advisor: Piotr Garbat, 9 February 2018

[BSc12] Paweł Łucjan, **Autonomous sensor system of monitoring pitching and heeling of sailing yacht** (Autonomiczny czujnik kołysania i przechyłu jachtu żaglowego), advisor: Krzysztof Paweł Anders, 21 September 2018

[BSc13] Marcin Masiewicz, **Fabrication and characterization of multilayer optical fiber structures obtained using ALD technique** (Wytwarzanie i charakteryzacja światłowodowych struktur wielowarstwowych wykonanych w technice ALD), advisor: Mateusz Jakub Śmietana, 15 June 2018

[BSc14] Filip Mateusz Michalak, **VHDL design of asynchronous digital system with dual-rail communication protocol** (Projekt VHDL asynchronicznego systemu cyfrowego z dwuszynowym protokołem uzgadniania), advisor: Elżbieta Piwowarska, 29 June 2018

[BSc15] Jakub Michał Ochnio, **Automated system for measuring microwave parameters of a superconductor YBCOat low temperatures** (System do pomiaru parametrów mikrofalowych nadprzewodnika YBCO w niskich temperaturach), advisor: Sławomir Szostak, 9 February 2018

[BSc16] Maryla Ostrowska, **Scenic system for tracking soloist** (Sceniczny system śledzenia solistów), advisor: Marek Sutkowski, 15 February 2018

[BSc17] Piotr Paweł Pucko, **Erbium laser with loop reflectors** (Erbowy laser włóknowy ze zwierciadłami pętlowymi), advisor: Krzysztof Anders, 12 February 2018

[BSc18] Marcin Siennicki, **A multichannel WDM transmitter-receiver system in photonic integration technology** (Projektowanie wielokanałowego systemu nadawczo-odbiorczego WDM w technologii fotoniki scalonej), advisor: Stanisław Stopiński, 13 February 2018

[BSc19] Jakub Jan Szostak, **Synthesizable model of the Blowfish cryptographic algorithm in SystemVerilog** (Syntezowalny model algorytmu kryptograficznego Blowfish w SystemVerilog), advisor: Elżbieta Piwowarska, 15 February 2018

[BSc20] Bartłomiej Szymański, **The implementation of a battery charger circuit for integrated electromagnetic energy recovery module in 130 nm CMOS technology** (Implementacja układu ładowania baterii dla scalonego modułu odzyskiwania energii z pola elektromagnetycznego w technologii CMOS 130 nm), advisor: Krzysztof Siwiec, 15 February 2018

[BSc21] Grzegorz Świnarski, **A comparison of operating parameters of a DC motor driver based on silicon elements and silicon carbide elements** (Porównanie parametrów użytkowych sterownika silnika DC opartych o elementy krzemowe i elementy z węglika krzemu), advisor: Krystian Bogumił Król, 26 September 2018

[BSc22] Wojciech Maciej Świstak, **Model of the DMA driver on AMBA buses in SystemVerilog** (Model sterownika DMA na magistralach AMBA w SystemVerilog), advisor: Elżbieta Piwowarska, 29 June 2018

[BSc23] Mateusz Piotr Wąsowski, **Fiber laser based on prototype ytterbium (Yb^{3+}) doped fiber** (Laser światłowodowy z prototypowym włóknem domieszkowanym jonami Yb^{3+}), advisor: Krzysztof Paweł Anders, 21 September 2018

[BSc24] Kamil Paweł Wojciechowski, **The implementation of a physical layer driver for integrated circuit interface of external memory in 130 nm CMOS technology** (Implementacja nadajnika dla warstwy fizycznej do scalonego interfejsu pamięci zewnętrznej w technologii CMOS 130 nm), advisor: Tomasz Borejko, 20 December 2018

[BSc25] Bartosz Bartłomiej Zawada, **Tool for building graphical user interface in Java programming language using Swing package for program MATLAB** (Narzędzie do budowania graficznego interfejsu użytkownika w języku Java z wykorzystaniem pakietu), advisor: Piotr Witoński, 15 June 2018

VLSI Engineering
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7. PUBLICATIONS

7.1. Scientific and Technical Papers published in Journals Included in the ISI[1] Database

NUMBER	JOURNAL	AUTHORS	TITLE	DOI	VOLUME	PAGES
[Pub1]	Journal of Luminescence	Anders K., Jusza A., Komorowski P., Andrejuk P., Piramidowicz R.	Short wavelength up-converted emission studies in Er^{3+} and Yb^{3+} doped ZBLAN glasses	10.1016/j.jlumin.2018.04.056	vol. 201	427–433
[Pub2]	Sensors	Bogdanowicz R., Niedziałkowski P., Sobaszek M., Burnat D., Białobrzeska W., Cebula Z., Sezemsky P., Koba M., Straňak V., Ossowski T., Śmietana M.	Optical Detection of Ketoprofen by Its Electropolymerization on an Indium Tin Oxide-Coated Optical Fiber Probe	10.3390/s18051361	vol. 18 no. 5	1–15
[Pub3]	Nanomaterials	Dybowska-Sarapuk Ł., Kiełbasiński K., Araźna A., Futera K., Skalski A., Janczak D., Słoma M., Jakubowska M.	Efficient ink-jet printing of graphene based elements: influence of dispersing agent on inks viscosity	10.3390/nano8080602	vol. 8 no. 8	1–11
[Pub4]	Solar Energy	Fetliński B., Malinowski M.	Potential energy yield increase of a solar spectra down-converter equipped photovoltaic device in real operational conditions	10.1016/j.solener.2018.02.071	vol. 165 no. 01	148–158
[Pub5]	Circuit World	Firek P., Cichomski M., Waśkiewicz M., Piwoński I., Kisielewska A.	ISFET structures with chemically modified membrane for bovine serum albumin detection	10.1108/CW-10-2017-0061	vol. 44 no. 01	45–50
[Pub6]	Nano Energy	Haras M., Skotnicki T.	Thermoelectricity for IoT – A review	10.1016/j.nanoen.2018.10.013	vol.54 no. December 2018	461–476
[Pub7]	Journal of Physics-Condensed Matter	Hosain M., Le Floch J., Krupka J., Tobar M.	Rigorous ESR spectroscopy of Fe^{3+}impurity ion with oxygen vacancy in ferroelectric $SrTiO_3$ crystal at 20 mK	10.1088/1361-648X/aacc05	vol. 30 no. 29	1–6
[Pub8]	Journal of Applied Physics	Hosain M., Le Floch J., Krupka J., Bourhill J., Tobar M.	Whispering gallery mode dielectric spectroscopy of $SrLaAlO_4$at milliKelvin temperatures	10.1063/1.5029941	vol. 123 no. 23	1–6
[Pub9]	Applied Optics	Janaszek B., Kieliszczyk M., Tyszka-Zawadzka A., Szczepański P.	Multiresonance response in hyperbolic metamaterials	10.1364/AO.57.002135	vol. 57 no. 9	2135––2141
[Pub10]	Scientific Reports	Janik M., Koba M., Celebańska A., Bock W., Śmietana M.	Live E. coli bacteria label-free sensing using a microcavity in-line Mach-Zehnder interferometer	10.1038/s41598-018-35647-2	vol. 8 no. 1	1–7
[Pub11]	Optics and Laser Technology	Janik M., Koba M., Celebańska A., Bock W., Śmietana M.	Sensing properties of micro-cavity in-line Mach-Zehnder interferometer enhanced by reactive ion etching	10.1016/j.optlastec.2018.01.045	vol. 103 no. July 2018	260–266

[1] Institute for Scientific Information (Philadelphia, USA)

[Pub12]	Journal of Luminescence	Kaczkan M., Turczyński S., Malinowski M.	Spectroscopic properties and Judd–Ofelt analysis of Eu^{3+} in $Y_4Al_2O_9$ crystals	10.1016/j.jlumin.2017.12.027	vol. 196 no. April 2018	111–115
[Pub13]	IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems	Kasprowicz D.	Table-Based Model of a Dual-Gate Transistor for Statistical Circuit Simulation	10.1109/TCAD.2018.2852756	vol. in press 2018	1–8
[Pub14]	Applied Optics	Kieliszczyk M., Janaszek B., Tyszka-Zawadzka A., Szczepański P.	Tunable spectral and spatial filters for the mid-infrared based on hyperbolic metamaterials	10.1364/AO.57.001182	vol. 57 no. 5	1182––1187
[Pub15]	Bulletin of the Polish Academy of Sciences, Technical Sciences	Kiełbasiński K., Szałapak J., Młożniak A., Teodorczyk M., Pawłowski R., Krzemiński J., Jakubowska M.	Sintered nanosilver joints on rigid and flexible substrates	10.24425/123439	vol. 66 no. 3	325–331
[Pub16]	Nanotechnology	Kosiel K., Dominik M., Ściślewska I., Kalisz M., Guziewicz M., Gołaszewska K., Niedziółka-Jönsson J., Bock W., Śmietana M.	Alkali-resistant low-temperature atomic-layer-deposited oxides for optical fiber sensor overlays	10.1088/1361-6528/aaa9a3	vol. 29 no. 13	1–13
[Pub17]	Journal of Vacuum Science & Technology A	Kosiel K., Pągowska K., Kozubal M., Guziewicz M., Lawniczak-Jablonska K., Jakieła R., Syryanyy Y., Gabler T., Śmietana M.	Compositional, structural, and optical properties of atomic layer deposited tantalum oxide for optical fiber sensor overlays	10.1116/1.5017725	vol. 36 no. 3	1–11
[Pub18]	Optics and Laser Technology	Kosiel K., Koba M., Masiewicz M., Śmietana M.	Tailoring properties of lossy-mode resonance optical fiber sensors with atomic layer deposition technique	10.1016/j.optlastec.2018.01.002	vol. 102 no. June 2018	213–221
[Pub19]	Physica Status Solidi A-Applications and Materials Science	Król K., Sochacki M., Taube A., Kwietniewski N., Gierałtowska S., Wachnicki Ł., Godlewski M., Szmidt J.	Influence of Atomic Layer Deposition Temperature on the Electrical Properties of $Al/ZrO_2/SiO_2/4H$-SiC Metal-Oxide Semiconductor Structures	10.1002/pssa.201700882	vol. 215 no. 13	1–7
[Pub20]	Measurement Science & Technology	Krupka J., Aleshkevych P., Salski B., Kopyt P.	Ferromagnetic Linewidth Measurements Employing Electrodynamic Model of the Magnetic Plasmon Resonance	10.1088/1361-6501/aa990a	vol. 29 no. 2	1–10
[Pub21]	Materials Research Bulletin	Krupka J., Shakhil P., Arun N., Ratheesh R., Jantunen H., Kim H., Sebastian M.	Low loss polypropylene-silicon composites for millimetre wave applications	10.1016/j.materresbull.2018.03.047	vol. 104 no. August 2018	143–148
[Pub22]	Plasmonics	Krupka J., Pavlo A., Salski B., Kopyt P., Hartnett J.	Magnetic and Electric Solid-State Plasmon Spherical Resonators	10.1007/s11468-18-0878-0		1–6
[Pub23]	IEEE Transactions on Microwave Theory and Techniques	Krupka J., Pavlo A., Salski B., Kopyt P.	Magnetodynamic Study of Spin Resonances in Cylindrical and Spherical YIG Samples	10.1109/TMTT.2017.2758367	vol. 66 no. 2	803–812

[Pub24]	Measurement Science & Technology	Krupka J.	Measurement of the complex permittivity, initial permeability, permeability tensor and ferromagnetic linewidth of gyromagnetic materials	10.1088/1361 -6501/aacf5d	vol. 29 no. 9	1–22
[Pub25]	Archives of Civil and Mechanical Engineering	Małkiewicz K., Sztogryn M., Mikulewicz M., Wielgus A., Kamiński J., Wierzchoń T.	Comparative assessment of the corrosion process of orthodontic archwires made of stainless steel, titanium-molybdenum and nickel-titanium alloys	10.1016/j.acme. 2018.01.017	vol. 18 no. 3	941–947
[Pub26]	Journal of Lightwave Technology	Markowski K., Jędrzejewski K., Słowikowski M., Osuch T.	Self-apodization effect in tapered fiber Bragg gratings	10.1109/JLT. 2018.2829862	vol. 36 no. 14	2882– –2887
[Pub27]	Physica Status Solidi B - Basic Solid State Physics	Mazurak A., Jasiński J., Mroczyński R.	Stress-and-Sense Investigation of Memory Effect in Si-NCs MIS Structures	10.1002/pssb. 201700634	vol. 255 no. 10	1–6
[Pub28]	Physica Status Solidi-Rapid Research Letters	Mroczyński R., Jasiński J.	Electro-Physical Properties of Gate-Last Silicon MOSFETs with Low-Temperature SiO_xN_y/HfO_x Stack After Ultra-Shallow Fluorine Implantation from RF Plasma	10.1002/pssr. 201800152	vol. 12 no. 8	1–4
[Pub29]	Physica Status Solidi-Rapid Research Letters	Pacewicz A., Krupka J., Salski B., Kopyt P., Pavlo A.	Rigorous Electrodynamic Approach to Ferromagnetic Resonance in Cavity-Coupled Ferrimagnetic Films	10.1002/pssr. 201800144	vol. 12 no. 7	1800144-1– –1800144-4
[Pub30]	Materials Letters	Sebastian M., Krupka J., Arun S., Kim C., Kim H.	Polypropylene-high resistivity silicon composite for high frequency applications	10.1016/j.matlet. 2018.08.093	vol. 232 no. 1	92–94
[Pub31]	Polymer Composites	Shalu S., Kar P., Krupka J., Ghosh B.	Synthesis, characterization, thermal, dynamic mechanical, and dielectric studies of $Ba0.7Sr0.3TiO_3$/ /polystyrene composites	10.1002/pc.24711	vol. 39 no. S3	E1714– –E1724
[Pub32]	Optics Express	Stanczyk S., Kafar A., Grzanka S., Sarzyński M., Mroczyński R., Najda S., Suski T., Perlin P.	450 nm (Al,In)GaN optical amplifier with double 'j-shape' waveguide for master oscillator power amplifier systems	10.1364/OE.26. 007351	vol. 26 no. 6	7351– –7357
[Pub33]	IEEE Photonics Technology Letters	Stopiński S., Augustin L., Piramidowicz R.	Single-Frequency Integrated Ring Laser for Application in Optical Gyroscope Systems	10.1109/LPT. 2018.2814679	vol. 30 no. 9	781–784
[Pub34]	Surface and Coatings Technology	Stranak V., Bogdanowicz R., Sezemsky P., Wulff H., Kruth A., Śmietana M., Kratochvil J., Cada M., Hubicka Z.	Towards high quality ITO coatings: The impact of nitrogen admixture in HiPIMS discharges	10.1016/j.surfcoat. 2017.12.030	vol. 335 no. 15 February 2018	126–133
[Pub35]	Journal of Luminescence	Sujecki S., Sojka Ł., Pawlik E., Anders K., Piramidowicz R., Zhuoqi T., Furniss D., Barney E., Benson T., Seddon A.	Numerical analysis of spontaneous mid-infrared light emission from terbium ion doped multimode chalcogenide fibers	10.1016/j.jlumin. 2018.03.031	vol. 199 no. July 2018	112–115

[Pub36]	Sensors and Actuators A Physical	Śmietana M., Mikulic P., Bock W.	Nano-coated long-period gratings for detection of sub-nanometric changes in thin-film thickness	10.1016/j.sna.2017.12.052	vol. 270 no. 1 February 2018	79–83
[Pub37]	Journal of Lightwave Technology	Śmietana M., Sobaszek M., Michalak B., Niedziałkowski P., Białobrzeska W., Koba M., Sezemsky P., Stranak V., Karczewski J., Ossowski T., Bogdanowicz R.	Optical monitoring of electrochemical processes with ITO-based lossy-mode resonance optical fiber sensor applied as an electrode	10.1109/JLT.2018.2797083	vol. 36 no. 4	954–960
[Pub38]	Optics and Laser Technology	Śmietana M., Dominik M., Mikulic P., Bock W.	Temperature and refractive index sensing with Al_2O_3 – nanocoated long-period gratings working at dispersion turning point	10.1016/j.optlastec.2018.06.017	vol. 107 no. November	268–273
[Pub39]	Applied Surface Science	Wicher B., Chodun R., Nowakowska-Langier K., Okrasa S., Trzciński M., Król K., Minikayev R., Skowroński Ł., Kurpaska Ł., Zdunek K.	Relation between modulation frequency of electric power oscillation during pulse magnetron sputtering deposition of MoNx thin films	10.1016/j.apsusc.2018.06.179	vol. 456 no. 31 October 2018	789–796
[Pub40]	IEEE Transactions on Electron Devices	Wiśniewski P., Majkusiak B.	Modeling the Tunnel Field-Effect Transistor Based on Different Tunneling Path Approaches	10.1109/TED.2018.2821059	vol. 65 no. 6	2626––2631
[Pub41]	Nanoscale	Zdrojek M., Bomba J., Łapińska A., Dużyńska A., Żerańska-Chudek K., Suszek J., Stobiński L., Taube A., Sypek M., Judek J.	Graphene-based plastic absorber for total sub-terahertz radiation shielding	10.1039/C8NR02793E	vol. 10 no. 28	13426––13431

7.2. Scientific and Technical Papers Published in Journals not Included in the ISI Database

NUMBER	JOURNAL	AUTHORS	TITLE	DOI	VOLUME	PAGES
[Pub42]	International Journal On Advances in Systems and Measurements	Borecki M., Gęca M., Korwin-Pawlowski M., Prus P., Szmidt J.	Capillary Sensors with UV-Forced Degradation and Fluorescence Reading of Chemical Stability and Polycyclic Aromatic Hydrocarbons Presence in Diesel Fuels		vol. 11 no. 1 & 2	111–123
[Pub43]	Sensors & Transducers	Borecki M., Gęca M., Korwin-Pawlowski M., Prus P.	Capillary Sensor with UV-Forced Degradation and Examination of Fluorescence for Determination of Chemical Stability of Diesel and Biodiesel Fuels		vol. 220 no. 2	20–30
[Pub44]	arXiv	Hosain M., Le Floch J., Bourhill J., Krupka J., Tobar M.	Ferroelectric two level system and phase transition monitoring of $SrTiO_3$ dielectric crystal resonator as a phenomena of Landau theory			1–6

[Pub45]	Acta Physica Polonica A	Kruszewski P., Prystawko P., Grabowski M., Sochacki T., Sidor A., Bockowski M., Jasiński J., Łukasiak L., Kisiel R., Leszczynski M.	Vertical GaN Schottky Diodes Grown on Highly Conductive Ammono-GaN Substrate	10.12693/APhysPolA.134.969	vol. 134 no. 4	969–972
[Pub46]	Archives of Metallurgy and Materials	Wicher B., Chodun R., Nowakowska-Langier K., Okrasa S., Król K., Minikayev R., Strzelecki G., Zdunek K.	Structure and electrical resistivity dependence of molybdenum thin films deposited by dc modulated pulsed magnetron sputtering	10.24425/123809	vol. 63 no. 3	1339–1344

7.3. Scientific and Technical Papers Published in Conference Proceedings

NUMBER	PROCEEDINGS OF CONFERENCE / ISBN/DOI	AUTHORS	TITLE	PAGES
[Pub47]	SPIE Photonics Europe 2018 TECHNICAL PROGRAMME	Anders K., Komorowski P., Zdulska U., Jusza A., Piramidowicz R.	Optimization of upconversion excitation conditions in Er+Yb doped ZBLAN glasses for application in fiber lasers and amplifiers	1–1
[Pub48]	Book of Abstracts INTERPHOTONICS 2018 Kocaeli University	Anders K., Bortnowski P., Wąsowski M., Markowski K., Osuch T., Poturaj K., Makara M., Mergo P., Piramidowicz R.	Polish Active Optical Fibers for Applications in Laser Systems	141–141
[Pub49]	Książka Abstraktów XII Sympozjum Techniki Laserowej STL 2018 WAT	Anders K., Bortnowski P., Wąsowski M., Markowski K., Osuch T., Mergo P., Piramidowicz R.	Polskie światłowody aktywne do zastosowań w układach laserowych	40–40
[Pub50]	Programme and Abstracts of IOS 2018 Photonic Society of Poland	Anders K., Stopiński S., Jusza A., Kaźmierczak A., Paśnikowska A., Tomkiewicz M., Piramidowicz R.	WDM-PON access system based on integrated photonic devices	17–18
[Pub51]	Proceedings of SPIE: Photonics Applications in Astronomy, Communications, Industry, and High-Energy Physics Experiments 2018 ISBN 9781510622036 DOI:10.1117/12.2500289	Borecki M., Prus P., Korwin-Pawlowski M., Doroz P., Szmidt J.	Automatic detection of outlier data received in multi-parametric capillary sensors of diesel fuels fit for use	1–8
[Pub52]	The Ninth International Conference on Sensor Device Technologies and Applications, SENSORDEVICES 2018 ISBN 978-1-61208-660-6	Borecki M., Gęca M., Korwin-Pawlowski M., Doroz P., Prus P., Szmidt J.	Capillary Sensors with Two Coupled LEDs for UV-Forced Degradation and Fluorescence Reading of Chemical Stability of Diesel Fuels	126–131
[Pub53]	Proceedings of 25th International Conference Mixed Design of Integrated Circuits and Systems MIXDES 2018 Lodz University of Technology, Department of Microelectronics and Computer Science ISBN 978-83-63578-13-8 DOI:10.23919/MIXDES.2018.8436691	Butryn I., Wiechowski Ł., Pietroń D., Pleskacz W.	Ka Band Digitally Controlled Oscillator for FMCW Radar in 130 nm SiGe BiCMOS Technology	160–164

[Pub54]	Proceedings of 25th International Conference Mixed Design of Integrated Circuits and Systems MIXDES 2018 Lodz University of Technology ISBN 978-83-63578-13-8 DOI:10.23919/MIXDES.2018.8436679	Dec B., Pfitzner A.	Feasibility Studies of EEPROM Memory Implementations in VeSTIC Technology	275–279
[Pub55]	Proceedings of SPIE: Photonics Applications in Astronomy, Communications, Industry, and High-Energy Physics Experiments 2018 ISBN 9781510622036 DOI:10.1117/12.2501537	Firek P., Werbowy A., Śmietana M.	Technology of field effect transistor with DLC layer in gate area	1–9
[Pub56]	Proceedings of SPIE: Biophotonics: Photonic Solutions for Better Health Care VI ISBN 9781510618961 DOI:10.1117/12.2307417	Garbat P., Olszewska A., Waledzik K., Piramidowicz R.	Remote monitoring vital signs using active 3D imaging (Conference Presentation)	1–10
[Pub57]	Proceedings of SPIE: Photonics Applications in Astronomy, Communications, Industry, and High-Energy Physics Experiments 2018 ISBN 9781510622036 DOI:10.1117/12.2501616	Gęca M., Borecki M., Kociubiński A.	Multiparametric capillary sensor: stabilization of local heating	1–7
[Pub58]	Proceedings of the Baltic URSI Symposium supported by National Committees of the Baltic Countries ISBN 978-83-949421-3-7 DOI:10.23919/URSI.2018.8406709	Górecki P., Górecki K., Kisiel R., Myśliwiec M.	Influence of thermometric characteristics on accuracy of junction temperature measurements of laboratory made SiC Schottky diodes	660–663
[Pub59]	Książka Abstraktów XII Sympozjum Techniki Laserowej STL 2018 WAT	Janaszek B., Kieliszczyk M., Tyszka-Zawadzka A., Szczepański P.	Analiza właściwości generacyjnych laserów DBR opartych na hiperkryształach fotonicznych	52–52
[Pub60]	Proceedings of OSA Advanced Photonics Congress ISBN 978-1-943580-43-9 DOI:10.1364/BGPPM.2018.JTu5A.16	Janaszek B., Kieliszczyk M., Tyszka-Zawadzka A., Szczepański P.	Controllable Birefringence in Graphene-based Anisotropic Metamaterials	1–2
[Pub61]	Pacific Rim Conference on Lasers and Electro-Optics (CLEO-PR) 2018	Janaszek B., Kieliszczyk M., Tyszka-Zawadzka A., Szczepański P.	Control of mode propagation in tunable hyperbolic metamaterial waveguides	68–68
[Pub62]	Proc. SPIE: Metamaterials, Metadevices, and Metasystems 2018 ISBN 9781510620094 DOI:10.1117/12.2321017	Janaszek B., Kieliszczyk M., Tyszka-Zawadzka A., Szczepański P.	Coupled mode formulation by reciprocity in waveguides based on double and single negative metamaterial media	1–5
[Pub63]	Proceedings 26th International Conference on Optical Fiber Sensors ISBN 978-1-943580-50-7 DOI:10.1364/OFS.2018.ThE54	Janczuk-Richter M., Piestrzyńska M., Burnat D., Szot-Karpińska K., Sezemsky P., Stranak V., Bock W., Bogdanowicz R., Niedziółka-Jönsson J., Śmietana M.	Optical monitoring of electrochemical processes with ITO-coated long-period fiber grating	1–4
[Pub64]	Proceedings 26th International Conference on Optical Fiber Sensors ISBN 978-1-943580-50-7 DOI:10.1364/OFS.2018.ThE60	Janczuk-Richter M., Dominik M., Mikulic P., Bock W., Shao L., Maćkowski S., Niedziółka-Jönsson J., Śmietana M.	The effect of water penetration into glass monitored by long-period fiber gratings	1–4

[Pub65]	Proceedings on Advanced Fabrication Technologies for Micro/Nano Optics and Photonics XI ISBN 9781510615731 DOI:10.1117/12.2291120	Janik M., Eftimov T., Koba M., Śmietana M., Bock W.	Near infrared operation of femtosecond laser micro-machined in-fiber Mach Zehnder interferometers (uIMZI) for refractive index sensing	1–5
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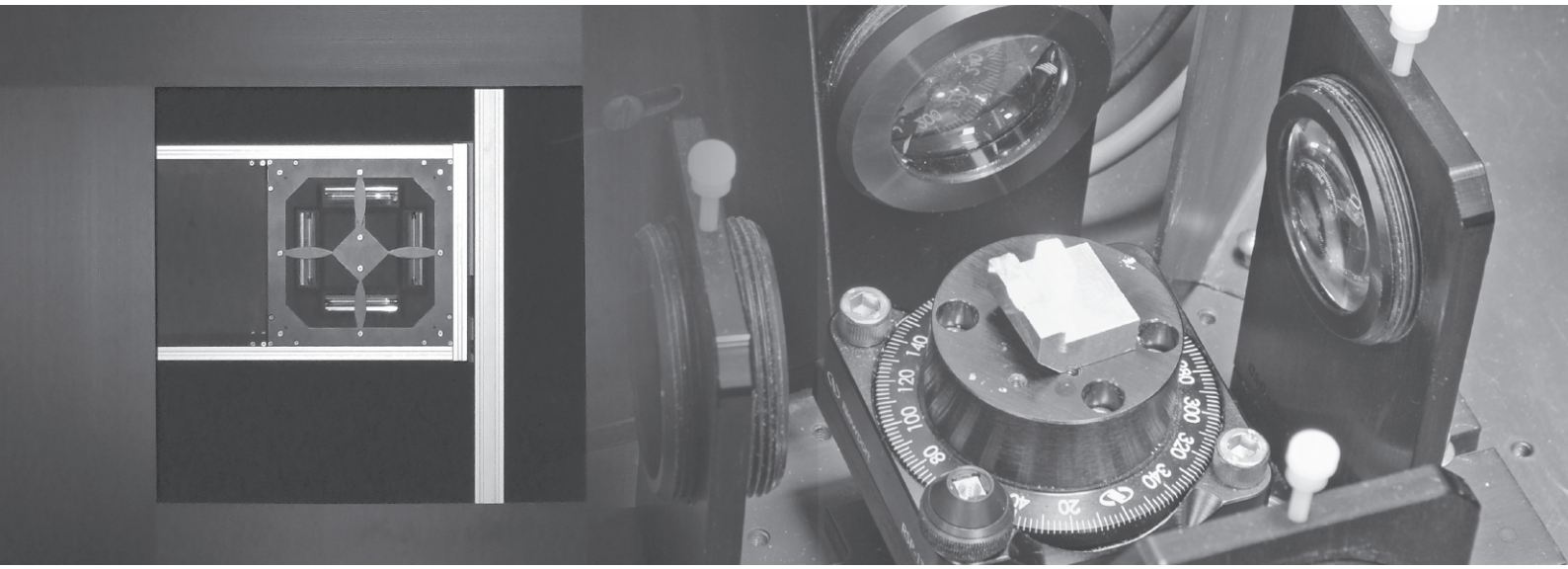
[Rep1]	Anders K., Bortnowski P., Osuch T., Piramidowicz R. [et al.]	Polskie światłowody aktywne do zastosowań w układach laserowych	**poster:** XII Sympozjum Techniki Laserowej 2018
[Rep2]	Anders K., Gusowski M., Koba M., Komorowski P., Bortnowski P., Osuch T., Markowski K., Szostak S., Zbik M., Wieczorek P., Piramidowicz R. [et al.]	Lasery światłowodowe średniej mocy domieszkowane jonami iterbu – osiągnięcia i wyzwania	**presentation:** XVIII Konferencja „Światłowody i ich zastosowania"
[Rep3]	Anders K., Stopiński S., Jusza A., Kaźmierczak A., Paśnikowska A., Piramidowicz R. [et al.]	WDM-PON access system based on integrated photonic devices	**paper presented:** 13th Conference Integrated Optics – Sensors, Sensing Structures and Methods 2018
[Rep4]	Anders K.	Hybrid light sources based on praseodymium doped low-phonon fibers	**scientific report** from the project granted by the University
[Rep5]	Beck R.M.	Nanophotonics with metal – group-IV-semiconductor nanocomposites: From single nanoobjects to functional ensembles (NaMSeN)	**scientific report** from the project granted by the National Centre for Research and Development
[Rep6]	Borecki J., Kalenik J., Steplewski W. [et al.]	Piezoresistive effect in embedded thick-film resistors	**presentation:** 42nd International Microelectronics and Packaging Conference 2018
[Rep7]	Janaszek B., Kieliszczyk M., Tyszka-Zawadzka A., Szczepański P.	Analiza właściwości generacyjnych laserów DBR opartych na hiperkryształach fotonicznych	**presentation:** XII Sympozjum Techniki Laserowej 2018
[Rep8]	Janaszek B., Kieliszczyk M., Tyszka-Zawadzka A., Szczepański P.	Controllable Birefringence in Graphene-based Anisotropic Metamaterials	**poster:** OSA Advanced Photonics Congress 2018
[Rep9]	Janaszek B., Kieliszczyk M., Tyszka-Zawadzka A., Szczepański P.	Control of mode propagation in tunable hyperbolic metamaterial waveguides	**paper presented:** Pacific Rim Conference on Lasers and Electro-Optics 2018
[Rep10]	Janaszek B., Kieliszczyk M., Tyszka-Zawadzka A., Szczepański P.	Coupled mode formulation by reciprocity in waveguides based on double and single negative metamaterial media	**paper presented:** SPIE Optics + Photonics, Conference Metamaterials, Metadevices, and Metasystems 2018
[Rep11]	Janaszek B.	Active Tunable Hyperbolic Metamaterials	**scientific report** from the project granted by the National Science Centre
[Rep12]	Jusza A., Lipińska L., Piramidowicz R. [et al.]	Kompozyty polimerowe aktywowane jonami prazeodymu do zastosowań w źródłach światła białego	**presentation:** XII Sympozjum Techniki Laserowej 2018
[Rep13]	Jusza A.	New photonic composite materials based on polymers doped with metal-organic complexes	**scientific report** from the project granted by the University

[Rep14]	Kaźmierczak A., Stopiński S., Jusza A., Anders K., Słowikowski M., Piramidowicz R. [et al.]	Interrogation of fiber optic sensor networks using integrated optics	**paper presented:** 13th Conference Integrated Optics – Sensors, Sensing Structures and Methods 2018
[Rep15]	Kieliszczyk M., Janaszek B., Mroczyński R.	Technology and properties of MIS structures with ALD dielectric layers for applications in non-volatile semiconductor memory NVSM devices	**poster:** Conference High-k oxides by ALD 2018
[Rep16]	Kieliszczyk M., Janaszek B., Tyszka-Zawadzka A., Mroczyński R., Szczepański P.	Tunable Hyperbolic Metamaterials for Novel Photonic Devices	**paper presented:** Pacific Rim Conference on Lasers and Electro-Optics 2018
[Rep17]	Kieliszczyk M., Janaszek B., Tyszka-Zawadzka A., Szczepański P.	Mode coupling in graphene-based hyperbolic metamaterial waveguides	**paper presented:** SPIE Optics + Photonics, Conference Metamaterials, Metadevices, and Metasystems 2018
[Rep18]	Kieliszczyk M., Janaszek B., Warda P., Tyszka-Zawadzka A., Szczepański P.	Analiza właściwości rezonatora optycznego z ośrodkiem o ujemnym współczynniku załamania	**poster:** XII Sympozjum Techniki Laserowej 2018
[Rep19]	Komorowski P., Anders K., Jusza A., Markowski K., Osuch T., Piramidowicz R. [et al.]	Lasery światłowodowe RE^{3+}: ZBLAN na zakres widzialny	**presentation:** XVIII Konferencja „Światłowody i ich zastosowania" 2018
[Rep20]	Komorowski P., Anders K., Jusza A., Osuch T., Piramidowicz R. [et al.]	Lasery światłowodowe na zakres widzialny z konwersją wzbudzenia	**presentation:** XII Sympozjum Techniki Laserowej 2018
[Rep21]	Krupka J.	High-precision techniques of millimeter and sub-Thz band characterization of materials for microelectronics TEAM TECH	**scientific report:** from the project granted by the EU Structural Funds project
[Rep22]	Kuźmicz W.	THIN but Great Silicon 2 Design Objects	**scientific report:** from the project granted by the EU project, ENIAC
[Rep23]	Madziar K.	Convergence of Electronics and Photonics Techologies for Enabling Terahertz Applications CELTA	**scientific report:** from the project granted by the EU Horizon 2020 project
[Rep24]	Malinowski M.	Tunable hyperbolic metamaterials for photonic devices of novel generation	**scientific report:** from the project granted by the National Centre for Research and Development
[Rep25]	Mazurak A., Jasiński J., Majkusiak B.	Determination of Border/Bulk Traps Parameters Based on (C-G-V) Admittance Measurements	**poster:** 20th Workshop on Dielectrics in Microelectronics 2018
[Rep26]	Mazurak A., Jasiński J., Mroczyński R.	Investigation of Memory Effect with Voltage or Current Charging Pulse Bias in MIS Structures based on codoped Si-NCs	**poster:** Joint International EUROSOI Workshop and International Conference on Ultimate Integration on Silicon 2018
[Rep27]	Mazurak A., Mroczyński R., Jasiński J., Majkusiak B., Beck R. [et al.]	Colloidal co-doped Si nanocrystals: fabrication of nanostructured composite MIS devices, their characterization, and modeling	**presentation:** Workshop on Silicon Nanoparticles 2018
[Rep28]	Mossakowska-Wyszyńska A., Witoński P., Szczepański P. [et al.]	Analysis of Light Generation in Laser with PT-Symmetric Mirror	**poster:** OSA Advanced Photonics Congress 2018

[Rep29]	Mroczyński R., Mazurak A.	Feasibility study of the application of co-doped all-inorganic silicon nanocrystals (Si-NCs) in Thin-Film Transistor (TFT) structures	**poster:** European Materials Research Society 2018 Fall Meeting 2018
[Rep30]	Mroczyński R.	RF Plasma enhanced metods for the applications in modern semiconductor structures snd devices	**paper presented:** 9th International Conference on Power Electronics for Plasma Engineering 2018
[Rep31]	Mroczyński R.	Technology and characterization of MOS/TFT structures with modern active materials	**scientific report** from the project granted by the University
[Rep32]	Myśliwiec M., Kisiel R.	Applying Sintering and SLID Bonding for Assembly of GaN Chips Working at High Temperatures	**paper presented**: 7th Electronics System-Integration Technology Conference 2018
[Rep33]	Niewiński M.	Adaptive digital filters for conditioning biomedical signals	**scientific report** from the project granted by the University
[Rep34]	Parka J.	The use of 3D images in the process of improving the quality of imaging and testing of frequency mixers with reduced transformation losses based on microwave photonics systems	**scientific report** from the project granted by the University
[Rep35]	Paśnikowska A., Kaźmierczak A., Stopiński S., Piramidowicz R. [et al.]	Design and characterization of integrated transceivers for fiber-optic access systems	**poster:** 13th Conference Integrated Optics – Sensors, Sensing Structures and Methods 2018
[Rep36]	Paśnikowska A., Stopiński S., Kaźmierczak A., Piramidowicz R. [et al.]	Wielokanałowe nadajniki telekomunikacyjne w technologii fotoniki scalonej	**presentation:** XII Sympozjum Techniki Laserowej 2018
[Rep37]	Pfitzner A.	Functional verification of the digital integrated circuits - probabilistic model of the regression testing procedure	**scientific report** from the project granted by the University
[Rep38]	Piramidowicz R., Stopiński S., Jusza A., Anders K., Kaźmierczak A., Paśnikowska A., Słowikowski M., Szczepański P.	Photonic integrated circuits – an emerging technology for optical sensing	**paper presented:** 13th Conference Integrated Optics – Sensors, Sensing Structures and Methods 2018
[Rep39]	Piramidowicz R., Stopiński S., Jusza A., Anders K., Kaźmierczak A., Paśnikowska A., Słowikowski M., Pleskacz W.	Układy fotoniki scalonej – nowe rozwiązania dla systemów telekomunikacyjnych i czujnikowych	**paper presented:** XII Sympozjum Techniki Laserowej 2018
[Rep40]	Piramidowicz R.	Directed-energy laser weapon systems, Non-lethal laser weapon systems	**scientific report** from the project granted by the National Centre for Research and Development
[Rep41]	Piramidowicz R.	New integrated photonic passive optical network	**scientific report** from the project granted by the National Centre for Research and Development
[Rep42]	Piramidowicz R.	Photonic Integrated Circuits Accessible to Everyone PICs4All	**scientific report** from the project granted by the EU Horizon 2020 project

[Rep43]	Pleskacz W.	Innovative, hardware-software component, based on a dedicated integrated circuit and software to perform various cryptographic application, with the particular attention paid to electronic identification systems with the high level of confidence	**scientific report** from the project granted by the National Centre for Research and Development
[Rep44]	Pleskacz W.	Miniature, dual-frequency, system-on-a-chip for precise satellite navigation GPS/Galileo integrated with application processor dedicated to IoT devices with low power consumption	**scientific report** from the project granted by the National Centre for Research and Development
[Rep45]	Puźniak M., Mroczyński R., Gajewski W.	Effect of deposition parameters on electrical properties and oxygen/nitrogen content of HfO_xN_y thin films	**poster:** 9th International Conference on Power Electronics for Plasma Engineering 2018
[Rep46]	Siwiec K.	Microelectronic integrated circuit for photonic integrated gyroscope	**scientific report** from the project granted by the University
[Rep47]	Słowikowski M., Kaźmierczak A., Stopiński S., Piramidowicz R.	Fotoniczne interrogatory scalone do zastosowań w układach czujnikowych	**presentation:** XII Sympozjum Techniki Laserowej 2018
[Rep48]	Słowikowski M., Mroczyński R., Kaźmierczak A., Stopiński S., Piramidowicz R.	Critical technical aspects of manufacturing photonics integrated circuits on a silicon platform	**poster:** 13th Conference Integrated Optics – Sensors, Sensing Structures and Methods 2018
[Rep49]	Śmietana M.	Conductive photonic structures for multiparametric bio-chemical diagnostics	**scientific report** from the project granted by the National Science Centre
[Rep50]	Śmietana M.	DIAMSEC – ultrasensitive sensing platform for rapid detection of epidemiological and pandemic threats	**scientific report**: from the project granted by the National Centre for Research and Development
[Rep51]	Śmietana M.	Investigation on interaction between bio-active media and electromagnetic field in photonic crystal fiber devices with suspended core	**scientific report** from the project granted by the National Science Centre
[Rep52]	Śmietana M.	Raman spectrometer with 3D printed mechanical elements	**scientific report** from the project granted by the University
[Rep53]	Sochacki M.	Green Power Electronics	**scientific report** from the project granted by the EU INTERREG BALTIC SEA REGION project
[Rep54]	Sochacki M.	Methods and means of protection and defense against high power microwave pulses	**scientific report** from the project granted by the National Centre for Research and Development
[Rep55]	Stopiński S., Jusza A., Piramidowicz R. [et al.]	Żyroskopy optyczne w generycznej technologii fotoniki scalonej	**presentation** XII Sympozjum Techniki Laserowej 2018
[Rep56]	Stopiński S., Jusza A., Piramidowicz R.	Optical gyroscope systems using integrated optics	**paper presented**: 13th Conference Integrated Optics – Sensors, Sensing Structures and Methods 2018
[Rep57]	Stopiński S.	Integrated optical gyroscope driven by an application specific integrated circuit	**scientific report** from the project granted by the University

[Rep58]	Sutkowski M., Paśko S., Zacharovas S. [et al.]	Generation of image sequences for digitally printed hologram from a cloud of points	**paper presented**: 11th International Symposium on Display Holography 2018
[Rep59]	Sutkowski M., Paśko S., Żuk B.	Układ optyczny do pomiarów wybranych parametrów ciała do fizjoterapii	**paper presented**: XXIV edycja Międzynarodowego Dnia Inwalidy 2018 – Konferencja Naukowa 2018
[Rep60]	Sutkowski M.	Raport dot. działalności holograficznej na Politechnice Warszawskiej	**research report:** 11th International Symposium on Display Holography 2018
[Rep61]	Szczepański P.	Analysis and investigation of photonic materials, structures and systems	**scientific report** from the project granted by the University
[Rep62]	Szmidt J.	Materials, technologies, structures and devices for sensorics, microsystems and power electronics	**scientific report** from the project granted by the University
[Rep63]	Szmidt J.	Oxide nanostructures for electronics, optoelectronics and photovoltaics	**scientific report** from the project granted by the National Science Centre
[Rep64]	Szmidt J.	Technologies of semiconductor materials for high power and high frequency electronics	**scientific report** from the project granted by the National Centre for Research and Development
[Rep65]	Witoński P., Mossakowska-Wyszyńska A., Szczepański P.	Modelowanie generacji promieniowania w laserze z aktywnym ośrodkiem posiadającym symetrię PT	**poster:** XII Sympozjum Techniki Laserowej 2018



Optoelectronics Division

10. CONFERENCES, SEMINARS AND MEETINGS

10.1. Conferences

NUMBER	CONFERENCE	PARTICIPANTS
[Con1]	7th Electronics System-Integration Technology Conference (ESTC 2018), September 18–21, Dresden, Germany	Kisiel R., Myśliwiec M.
[Con2]	9th International Conference on Power Electronics for Plasma Engineering (PE^2 2018), May 14–17, Freiburg, Germany	Mroczyński R., Puźniak M.
[Con3]	11th International Symposium on Display Holography (ISDH 2018), June 25–29, Aveiro, Portugal	Sutkowski M.
[Con4]	12th International Conference on Electromagnetic Wave Interaction with Water and Moist Substances (ISEMA 2018), June 04–07, Lublin, Poland	Krupka J.
[Con5]	13th Conference Integrated Optics – Sensors, Sensing Structures and Methods (IOS 2018), February 26 – March 02, Szczyrk, Poland	Anders K., Jusza A., Kaźmierczak A., Mroczyński R., Paśnikowska A., Piramidowicz R., Słowikowski M., Stopiński S.
[Con6]	2018 Baltic URSI Symposium, May 14–17, Poznań, Poland	Anders K., Jusza A., Kaźmierczak A., Kisiel R., Myśliwiec M., Paśnikowska A., Piramidowicz R., Pleskacz W., Słowikowski M., Stopiński S.
[Con7]	2018 IEEE MTT-S International Microwave Symposium, June 10–15, Philadelphia, USA	Krupka J.
[Con8]	22nd International Microwave and Radar Conference (MIKON 2018), May 15–17, Poznań, Poland	Krupka J.
[Con9]	25th International Conference Mixed Design of Integrated Circuits and Systems (MIXDES 2018), June 21–23, Gdynia, Poland	Butryn I., Dec B., Jaworski Z., Pałgan M., Pfitzner A., Pietroń D., Pleskacz W., Wiechowski Ł., Wielgus A.
[Con10]	26th International Conference on Optical Fiber Sensors (OFS 2018), September 24–28, Lausanne, Vaud, Switzerland	Koba M., Śmietana M., Tenderenda T.
[Con11]	42nd International Microelectronics and Packaging Conference (IMAPS Poland 2018), September 23–26, Gliwice, Poland	Borecki J., Kalenik J.
[Con12]	BIT's 4th World Congress of Smart Materials (WCSM 2018), March 06–08, Osaka, Japan	Mroczyński R.
[Con13]	Conference High-k oxides by ALD (High-k 2018), March 07–10, Wrocław, Poland	Janaszek B., Kieliszczyk M., Mroczyński R.
[Con14]	Conference on Advanced Fabrication Technologies for Micro/Nano Optics and Photonics XI (SPIE OPTO 2018), January 28–31, San Francisco, USA	Koba M., Śmietana M.
[Con15]	Conference SPIE Photonics Europe 2018 (SPIE PE 2018), April 22–26, Strasburg, France	Anders K., Garbat P., Jusza A., Kaźmierczak A., Komorowski P., Paśnikowska A., Piramidowicz R, Słowikowski M., Stopiński S.,
[Con16]	IEEE 21th International Symposium on Design and Diagnostics of Electonic Circuits and Systems (DDECS 2018), April 25–27, Budapest, Hungary	Pleskacz W., Reszewicz S., Siwiec K.
[Con17]	IEEE International Conference on Microwave Magnetics, June 24–27, Exeter, United Kingdom	Krupka J.
[Con18]	IEEE Winter Conference on Applications of Computer Vision WACV (WACV 2018), March 12–15, Lake Tahoe, USA	Garbat P.

[Con19]	International Conference on Photonics Research (INTERPHOTONICS 2018), October 09–12, Kemer/Antalya, Turkey	Anders K., Bortnowski P., Jusza A., Kaźmierczak A., Paśnikowska A., Pleskacz W., Piramidowicz R., Słowikowski M., Stopiński S.
[Con20]	Joint International EUROSOI Workshop and International Conference on Ultimate Integration on Silicon (EUROSOI-ULIS 2018), March 19–21, Granada, Spain	Jasiński J., Mazurak A., Mroczyński R.
[Con21]	OSA Advanced Photonics Congress (APC 2018), July 02–05, Zurich, Switzerland	Janaszek B., Kieliszczyk M., Szczepański P.
[Con22]	Pacific Rim Conference on Lasers and Electro-Optics (CLEO/Pacific Rim 2018), July 29 – August 03, Hong Kong, China	Janaszek B., Kieliszczyk M.
[Con23]	SENSORDEVICES 2018, The Ninth International Conference on Sensor Device Technologies and Applications, September 16–20, Venice, Italy	Borecki M., Szmidt J.
[Con24]	SPIE Optics + Photonics, Conference Metamaterials, Metadevices, and Metasystems (SPIE Optics+Photonics 2018), August 19–23, San Diego, USA	Janaszek B., Kieliszczyk M.,
[Con25]	The 10th International Conference on Microwave Materials and Their Applications (MMM 2018), October 01–04, Osaka, Japan	Krupka J.
[Con26]	The 5th International Conference on the Physics of Optical Materials and Devices (ICOM 2018), August 27–31, Igalo, Montenegro	Kaczkan M., Malinowski M.,
[Con27]	XII Sympozjum Techniki Laserowej (STL 2018), September 25–27, Jastarnia, Poland	Anders K., Bortnowski P., Janaszek B., Jusza A., Kaźmierczak A., Kieliszczyk M., Komorowski P., Mossakowska-Wyszyńska A., Paśnikowska A., Piramidowicz R., Słowikowski M., Stopiński S., Witoński P.
[Con28]	XLIInd IEEE-SPIE Joint Symposium on Photonics, Web Engineering, Electronics for Astronomy and High Energy Physics Experiments, June 03–10, Wilga, Poland	Borecki M., Firek P., Śmietana M., Szmidt J., Werbowy A.
[Con29]	XVIII Konferencja „Światłowody i ich zastosowania" (TAL 2018), November 20–23, Nałęczów, Lublin, Poland	Anders K., Bortnowski P.,Gusowski M., Jusza A., Koba M., Komorowski P., Piramidowicz R., Szostak S.
[Con30]	XXIV edycja Międzynarodowego Dnia Inwalidy 2018 – Konferencja Naukowa (MDI 2018), March 15–17, Zgorzelec, Poland	Sutkowski M.

10.2. Schools, Seminars and Meetings

NUMBER	EVENT	PARTICIPANTS
[Con31]	3rd Eastern European Workshop For Research Institutes, Smes And Large Companies, Generic Integration Technologies For Photonics, November 14, Warszawa, Poland	Piramidowicz R., Stopiński S.
[Con32]	20th Workshop on Dielectrics in Microelectronics (WODiM 2018), June 10–14, Berlin, Germany	Jasiński J., Majkusiak B., Mazurak A.
[Con33]	41st International Spring Seminar on Electronics Technology "Research and Development Tendencies in Advanced Electronics Technologies" (ISSE 2018), May 16–20, Zlatibor, Serbia	Kisiel R., Myśliwiec M.
[Con34]	European Materials Research Society 2018 Fall Meeting (E-MRS 2018 Fall Meeting), September 17–20, Warszawa, Poland	Majkusiak B., Mazurak A., Mroczyński R., Walczak J.
[Con35]	Workshop on Silicon Nanoparticles, October 01–03, Bertinoro, Italy	Beck R., Jasiński J., Majkusiak B., Mazurak A., Mroczyński R., Tanous D.

11. AWARDS

[Award1] Butryn Igor, Wiechowski Łukasz, Pietroń Daniel, Pleskacz Witold, **Outstanding Paper Award at 25th International Conference Mixed Design of Integrated Circuits and Systems MIXDES 2018** (Wyróżnienie za prezentację na konferencji MIXDES 2018), 2018

[Award2] Król Krystian Bogumił, Sochacki Mariusz, Kwietniewski Norbert, Werbowy Aleksander, Taube Andrzej, Gierałtowska Sylwia, Wachnicki Łukasz, Godlewski Marek, **WUT Rector's Collective Award for Scientific Achievements (3rd stage)** (Nagroda zespołowa III stopnia JM Rektora PW za osiągnięcia naukowe w latach 2016–2017), 2018

[Award3] Piramidowicz Ryszard, Stopiński Stanisław Tomasz, Garbat Piotr, Kaźmierczak Andrzej, Jusza Anna Maria, Anders Krzysztof Paweł, Paśnikowska Aleksandra, Słowikowski Mateusz, Osuch Tomasz, Markowski Konrad**, Second prize (first runner-up) at the Photonics Innovation Village 2018 exhibition at SPIE Photonics Europe 2018** (Druga nagroda (first runner-up) na wystawie Photonics Innovation Village 2018, podczas konferencji SPIE Photonics Europe 2018), 2018

[Award4] Pleskacz Witold, Borejko Tomasz, Radomski Tomasz, Narczyk Paweł, Marcinek Krzysztof, Berent Andrzej, Borkowski Adam, Butryn Igor, Mrozek Tomasz, Pietroń Daniel, Reszewicz Szymon, Wiechowski Łukasz, Siwiec Krzysztof, Harabień Rafał, Plasota Maciej, Wojciechowski Tomasz, Krej Mariusz, Klepacki Kamil, **Regional Prize Winner of the Galileo Masters 2018** (Nagroda Regional Prize Winner w Europejskim konkursie nawigacji satelitarnej Galileo Masters 2018), 2018

[Award5] Woźnicki Jerzy, **Doctor Honoris Causa of Taras Shevchenko National University of Kyiv** (Doktorat Honoris Causa Kijowskiego Narodowego Uniwersytetu im. T. Szewczenki), 2018