WARSAW UNIVERSITY OF TECHNOLOGY
Faculty of Electronics and Information Technology

Institute of Microelectronics and Optoelectronics

annual report 2023

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 2023, 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, the 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, "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 the end of his career, but also by its location – part of the Institute is located in the Electrical Engineering Building, where the Faculty of Communication (currently the Faculty of Electronics and Information Technology) began its operation in 1951. Nowadays, the Electrical Engineering Building is the location of the Institute's Technology Center, which consists of laboratories specialized in silicon processing (clean-room), hybrid technologies and assembly techniques, fiber optics, 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 investments conducted in recent years within the Innovative Economy Operational Program framework, have reached their full operational capability and are extensively used to conduct advanced research and provide research services.

The Institute conducts research in the field of technologies constituting the basis of modern electronics and information technology. The development of information technology may be viewed through the prism of four related technologies: data processing, transmission, storage, and presentation. In the field of data processing, the observed impressive progress is possible mainly due to rapid development of technologies for designing and manufacturing integrated circuits, i.e., microelectronics, and increasingly also nanoelectronics. Data transfer, which includes fiber optics and laser, and therefore optoelectronics and photonics. Storing an exponentially growing amount of data requires more and more capacious memories, both semiconductor-based as well as optical. This is where microelectronics and optoelectronics are used. Data presentation requires not only various optical systems (optoelectronics) but also appropriate image processing techniques. The development of electronics, which many years ago resulted in the emergence of integrated circuits, is now heading towards systems on a structure, as well as to microsystems integrating knowledge from the fields of materials technology, microelectronics, optoelectronics and photonics. The Institute of Microelectronics and Optoelectronics, to various extent, operates in each of these areas. These include in particular: VLSI circuits, design of ASICS's and electronic circuits, microsystems, microelectronic and nanoelectronic semiconductor devices (among others based on Si and wide-band semiconductors), ultra-thin films, hybrid circuits (e.g., microwave, optoelectronic), photonic systems (including design of ASPIC's circuits), sensors, lasers, active photonic materials, fiber optics and integrated photonics, nanophotonics, metamaterials, plasmonics, topological photonics, photovoltaics, and image processing.

In teaching, the Institute meets the challenges imposed by the development of modern technology and information society. The educational offer (at all levels – B.Sc., M.Sc., and Ph.D.) corresponds to the main fields of advanced electronics and photonics and, simultaneously, the primary research expertise of the Institute. The Institute's involvement in distance learning studies of Electronics and Telecommunications is also worth mentioning, mostly postgraduate studies in the domain of tools and techniques of virtual education that began in 2004. Several student laboratories in electronics, microelectronics, and photonics, located in the recently expanded wings of the Faculty building, have reached their full operational capability in 2017, considerably improving the quality of the education offered by IMiO.

In 2023, our staff authored and co-authored 163 publications, including 51 papers in scientific journals from the JCR list. Moreover, the Institute's expertise and infrastructure made it possible to get involved in numerous international and domestic projects.

A significant event in 2023 was the 14th Scientific Conference "Electron Technology – ELTE 2023", organized by the Institute. The conference was held on April 18th – 21st, 2023, in the Teutonic castle in Ryn, under the honorary patronage of the Minister of Education and Science, the Ministry of Economic Development and Technology and HM the Rector of the Warsaw University of Technology. The conference gathered almost 200 participants representing 35 entities, including scientists from leading centers in the country and numerous representatives of industry and public administration units. On the initiative of the representatives of the Ministry of Education and Science and the Ministry of Economic Development and Technology, a report from the conference was prepared, presenting the most important conclusions regarding the conditions for the development of Polish electronics in the broad sense.

I want to thank all my colleagues working at the Institute for their constant commitment and effort to make the Institute a unique place to be. Without our collective achievements, the Institute could not be what it is today.

Professor Jan Szmidt

ELTE is a cyclical conference of the Polish electronics community, the scope of which covers the principal branches of widely regarded electronics: microelectronics and nanoelectronics, photonics and nanophotonics, micro-systems, as well as electronic and optoelectronic materials. All editions of ELTE, gathering numerous specialists, became significant forums for the exchange of scientific ideas, and created opportunities for establishing relations between industry and academia sharing the same areas of interest.

During the conference, we hosted high-ranking state officials from those Ministries.

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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 primary competence covering the significant 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;
- plasmonics;
- microwaves, microwave photonics, and microwave measurement techniques;
- new materials for high-temperature, high-power, and high-frequency electronics;
- new materials and structures for modern photonics.

The research activity is supported by a number of projects financed by the 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.

In parallel to scientific activity also the didactic offer of the Institute has been recently expanded with completely new specializations: "Electronics and Photonics" (for first-degree education) and "Integrated Electronics and Photonics Systems" (for second-degree education), which have been developed 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. Microsystem and Electronic Material Technology Division

The research activity of the Division concentrates on optoelectronics (e.g., optical and electrochemical sensing and biosensing systems), 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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Mateusz Śmietana, Ph.D., D.Sc.	Research Tenured Professor
Michał Borecki, Ph.D., D.Sc.	Professor
Ryszard Kisiel, Ph.D., D.Sc.	Professor
Marcin Koba, Ph.D, D.Sc.	Assistant Professor
Piotr Firek, Ph.D.	Assistant Professor
Monika Janik, Ph.D.	Assistant Professor
Jerzy Kalenik, Ph.D.	Assistant Professor
Krystian Król, Ph.D.	Assistant Professor
Aleksander Werbowy, Ph.D.	Didactic Assistant Professor

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Piotr Ciszewski, M.Sc.	Ph.D. Student
Tomasz Gabler, M.Sc.	Ph.D. Student, Constructor
Maciej Kamiński, M.Sc.	Ph.D. Student, Assistant
Norbert Kwietniewski, M.Sc.	Research Assistant
Agnieszka Martychowiec, M.Sc.	Ph.D. Student, Constructor
Emil Pituła, M.Sc.	Ph.D. Student, Constructor
Mehdi Raji, M.Sc.	Ph.D. Student
Oskar Sadowski, M.Sc.	Ph.D. Student

Science, technical and administrative staff

Jakub Sikora, M.Sc.
Bartłomiej Stonio, M.Sc.
Jakub Warszewski, M.Sc.

The main research areas are as follows:

- design, modelling, fabrication and characterization visible-blind UV photodetectors and radiation detectors based on wide bandgap semiconductors and heterostructures;
- designing, modelling and fabrication of microelectronic and optoelectronic devices using transparent dielectric and conductive oxides;
- research and development of 2-D materials and their implementation in silicon technology;
- research and development of metal/carbon-based nanocomposites and their implementation in open gate field-effect transistors for biosensing, gas sensing or chemical sensing;
- the design, modelling, fabrication and characterization of power devices based on silicon carbide (SiC) technology including high voltage PiN diodes;
- fabrication and characterization of high-k dielectric layers;
- the development of electrical characterization methods for the determination of energy distribution of traps in MOS and junction devices;

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- fabrication and investigation of the following optoelectronic devices: integrated passive and active light wave guiding structures (modulators, bistable switches etc.) and optical fibre sensors;
- chemical and physical vapour deposited thin film technology and its application in optical fibre and waveguide sensing structures; sensor device designs and applications of Internet of Things (IoT);
- 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;
- 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;
- electronic packaging technology including power devices;
- 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.

1.4. Microelectronics and Nanoelectronics Devices Division

The research and teaching process carried out in the Microelectronic and Nanoelectronic Devices Division falls into four main areas: technology, diagnostics, and modelling of semiconductor structures and devices, as well as applications of microcontrollers or embedded systems.

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Thomas Skotnicki, Ph.D., D.Sc.	Tenured Professor
Lidia Łukasiak, Ph.D., D.Sc.	Didactic Professor
Jarosław Judek, Ph.D., D.Sc.	Research Assistant Professor
Jakub Jasiński, Ph.D.	Assistant Professor
Andrzej Mazurak, Ph.D.	Assistant Professor
Sławomir Szostak, Ph.D.	Assistant Professor
Jakub Walczak, Ph.D.	Didactic Assistant Professor
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Junior academic staff

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Yevgen Syryanyy, M.Sc.	Ph.D. Student

Technical and administrative staff

Witold Ciemiewski,
Krzysztof Krogulski

To name a few examples of its research topics:

- Fabrication of novel semiconductor, dielectric and conductive materials, including amorphous and transparent semiconductors and oxides, as well as high-k dielectric layers employing magnetron sputtering, ALD, or plasma techniques;
- Electrical (bulk properties, interface properties, contact properties, DC and high-frequency range, pulse measurements, charge-pumping) and structural characterization (surface properties, cross-section, chemical composition, and topography) of fabricated materials and periodic structures;
- Optimization of electrical and optical properties of fabricated materials using Design-of-Experiments (DoE) method to obtain tailored properties (transparency, reflection, etc.) of obtained layers that can be used in novel nanophotonic structures which possess tailorable and dynamically controllable spectral and angular optical properties;
- Integration and studies of two-dimensional (2D) and nanocrystalline materials in novel nanoelectronic and photonic devices;
- Design, modeling, and fabrication of nanophotonic periodic and metamaterial structures in thin- and ultra-thin regime (primarily planar hyperbolic metamaterials) based on novel semiconductor, dielectric, and conductive materials;
- Design and assembly of dedicated measurement tools, power supplies, and embedded systems with the integrated optoelectronic and photonic devices; SMD assembly and reliability tests;

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- Design autonomous nodes of wireless sensor networks such as smart mesh, smart dust, and IoT, using energy-harvesting technology;
- Hardware solutions of the problems with wireless short-range and long-range communication based on technologies and standards (NFC, HDX, FDX, EPC, Bluetooth, SubGHz, WiFi, GSM, ZigBee, and others in the 802.15.4 standard);
- Design, assembly, and programming customized, precise laboratory measurement devices;
- Wear-out and degradation processes in MOS/MIS structures and devices (breakdown of dielectrics layers, hot carriers effects, radiation damage effects);
- Advanced design and modeling of semiconductor and photonic structures using in-house software development capabilities based on well-established models of electromagnetic field interaction with matter;
- Transport mechanisms and quantum effects in MOS/MIS structures (transistors, memories, resonance, and tunnel diodes) with ultra-thin dielectric materials.

1.5. Optoelectronics Division

The main activity of the Optoelectronics Division is focused on research and education in all major areas of modern optoelectronics. These cover, in particular, laser physics and laser technique, laser spectroscopy, fiber-optic communication and sensing, microwave photonics, 2-D and 3-D image processing, photovoltaics, as well as integrated photonics (and specifically photonic integrated circuits, PICs). In all these fields the Optoelectronic Division offers top-level research expertise of the staff complemented with state-of-the-art research laboratories

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Junior academic staff

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Marcin Lelit, M.Sc.	Ph.D. Student, Science and Technical Specialist
Filip Łabaj, M.Sc.	Ph.D. Student
Aleksandra Paśnikowska, M.Sc.	Research Assistant
Andrzej Połatyński, M.Sc.	Ph.D. Student

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The academic staff of the Division provides lectures in photonics fundamentals, laser physics and laser technique, laser spectroscopy, integrated optoelectronics, digital image processing, fiber-optic and microwave photonics, and photovoltaics not only to the students of the Faculty of Electronics and Information Technology but also supporting Faculty of Physics and Faculty of Mechatronics. The lectures are in Polish and/or English and are accompanied by top-level laboratory classes.

The main research topics of the Optoelectronic Division covers:

- design and development of photonic integrated circuits (PICs) for telecom, datacom and sensing;
- design and development of solid-state lasers and amplifiers (especially fiber lasers and amplifiers);
- new materials for optoelectronics, which includes spectroscopic investigations of novel rare-earth doped crystals and glasses emitting in UV-VIS-NIR-MIR spectral range, nanocomposites, plasmonic structures, metamaterials, etc.;
- theoretical investigations of laser action in planar, fiber, and hollow waveguide lasers; analysis of light generation in DFB (distributed feedback) structures, metamaterials, plasmonic and photonic crystals structures; investigation of the statistical properties of the light generated in various laser structures;
- 2-D and 3-D multispectral image analysis and processing;
- terahertz imaging;
- microwave technique and microwave photonics - measurement techniques, modeling and computer-aided design (CAD) of microwave devices and circuits, optical-microwave frequency conversion processes, optoelectronic and microwave devices for data transmission networks;
- photovoltaic systems and applications.

1.6. 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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Dominik Kasprowicz, Ph.D.	Assistant Professor
Arkadiusz Łuczyk, Ph.D.	Assistant Professor
Marek Niewiński, Ph.D.	Didactic Assistant Professor
Krzysztof Siwiec, Ph.D.	Assistant Professor
Andrzej Wielgus, Ph.D.	Assistant Professor
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Bartosz Dec, M.Sc.	Assistant
Marika Grochowska, M.Sc.	Ph.D. Student
Paweł Pieńczuk, M.Sc.	Ph.D. Student
Andrzej Wojciechowski M.Sc.	Ph.D. Student

Science, technical and administrative staff

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Stanisław Jeszka, M.Sc.
Marcin Ludwiniak, M.Sc.
Kamil Stępniewski, 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 microprocessors, Global Navigation Satellite Systems, innovative AD converters, data processing in physical experiments and medical equipment, RF front ends for wireless data transmission etc.;
- modelling and control of leakage currents in nanometer digital circuits;
- investigations and development of new VESTIC microelectronic technology.

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1.7. Statistical Data

SPECIFICATION	2022	2023	DIFFERENCE
Academic staff	**92**	**86**	**-6**
Tenured professors	9	8	-1
Professors	8	8	0
Assistant professors	35	35	0
Assistants	8	8	0
Ph.D. Students	32	27	-5
Science, Technical and Administrative staff	**26**	**18**	**-8**
Teaching activities	**82**	**79**	**-3**
Basic courses	41	38	-3
Advanced courses	22	22	0
Special courses	19	19	0
Degrees awarded	**30**	**33**	**+3**
Ph.D. degrees	3	3	0
M.Sc. degrees	4	3	-1
B.Sc. degrees	23	27	+4
Research projects	**27**	**27**	**0**
Granted by the University	16	17	+1
Granted by State Institutions	10	10	0
Granted by International Institutions	1	0	-1
Publications	**139**	**163**	**+24**
Sci.-tech. papers in journals	0	64	-21
Sci.-tech. papers in conference proceedings	85	98	+44
Sci.-tech. books	54	1	+1
Patents	**0**	**9**	**+9**
Reports	**87**	**45**	**-42**
Conferences	**24**	**29**	**+5**
Awards	**16**	**12**	**-4**

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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, Tenured Professor, full time, Head of Microelectronics and Nanoelectronics Devices Division ('04–'21), 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 ('05–'13) and Vice-Chair of Technical Programme Committee ESSDERC'2019, Senior Member of IEEE ('97–'06), Head of CEZAMAT Project Office ('08–'12), Vice-President for Scientific Affairs of CEZAMAT PW Ltd ('12–), Vice-Director for Scientific Affairs of CEZAMAT ('16–), WUT Rector's Collective Award for Scientific Achievements ('06, '08, '12, '19), President's of the Republic of Poland Gold Medal for Long-Term Service ('23).

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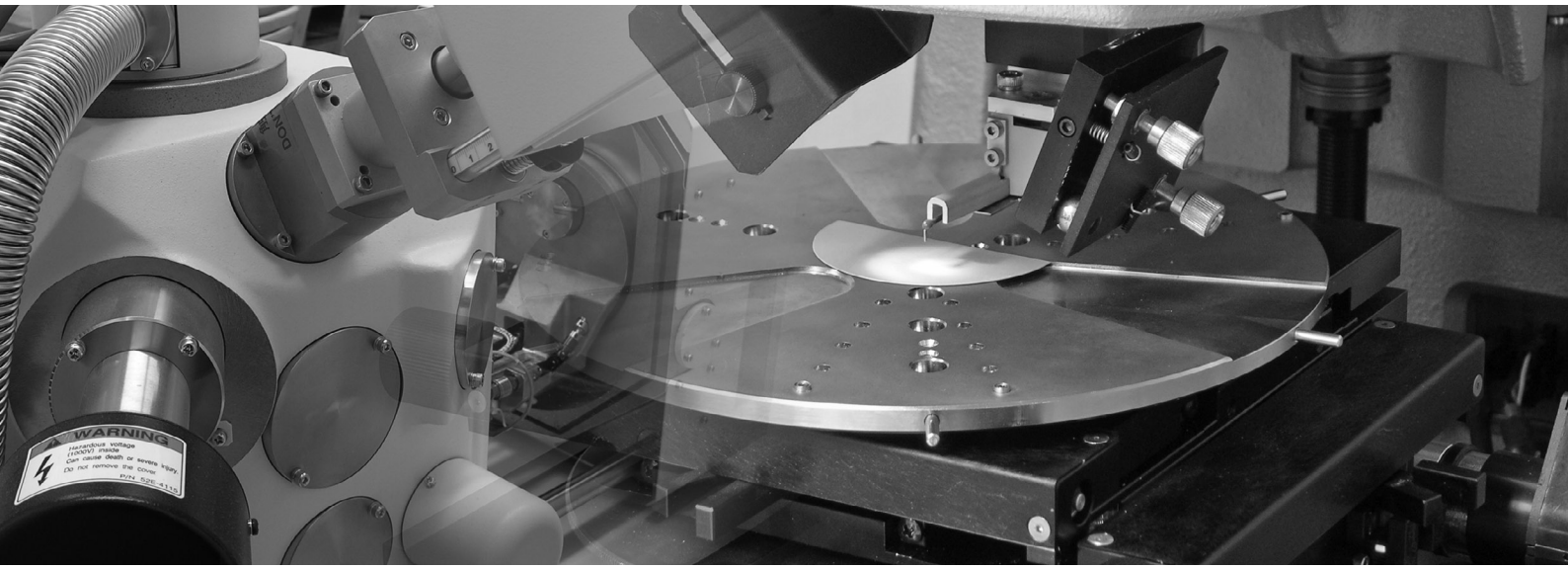

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VLSI Engineering
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3. TEACHING ACTIVITIES

3.1. Basic Courses

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

[Edu2] **APIOS, Programming for mobile Apple iOS and MacOS X** (Programowanie dla systemów: mobilnego iOS oraz MacOS X), Adam Wojtasik

[Edu3] **ELFO, Photonics elements** (Elementy Fotoniczne), Ryszard Piramidowicz

[Edu4] **ESO, Optoelectronic Devices and Systems** (Elementy i systemy optoelektroniczne), Marcin Kaczkan

[Edu5] **FOS, Fiber Optics** (Fotonika światłowodowa), Ryszard Piramidowicz

[Edu6] **FOT, Fundamentals of Photonics** (Podstawy fotoniki), Michał Malinowski

[Edu7] **FPEF, Semiconductor Physics in Electronics and Photonics** (Fizyka półprzewodników w elektronice i fotonice), Piotr Firek, Agnieszka Zaręba

[Edu8] **FPPI, Physical Fundamentals of Information Processing** (Fizyczne podstawy przetwarzania informacji), Jan Szmidt, Agnieszka Zaręba

[Edu9] **LFPEF, Semiconductors Physics in Electronics and Photonics – Laboratory** (Laboratorium fizyki półprzewodników w elektronice i fotonice), Agnieszka Zaręba

[Edu10] **LKP, Fundamentals of Lasers** (Lasery – kurs podstawowy), Paweł Szczepański

[Edu11] **LPPP, Introduction to Semiconductor Devices – Laboratory** (Laboratorium podstaw przyrządów półprzewodnikowych), Jakub Jasiński, Konrad Kiełbasiński, Agnieszka Zaręba

[Edu12] **MAKO, Materials and constructions** (Materiały i konstrukcje) Ryszard Kisiel, Marcin Myśliwiec, Aleksander Werbowy

[Edu13] **MZMO, Application of Matlab in Calculation Methods** (Matlab w zastosowanych metodach obliczeniowych), Krystian Król

[Edu14] **OZT, Integrated Optoelectronics** (Optoelektronika zintegrowana), Michał Malinowski, Agnieszka Mossakowska-Wyszyńska, Ryszard Piramidowicz

[Edu15] **PADS, Computer-Aided Design of Printed-Board Circuits** (Projektowanie obwodów drukowanych), Konraad Bruliński

[Edu16] **PAPRO, Programming Paradigms** (Paradygmaty programowania), Dominik Kasprowicz, Adam Wojtasik

[Edu17] **PELEL, Fundamentals of Electronic Devices and Circuits** (Podstawy elementów i układów elektronicznych), Sławomir Szostak, Lidia Łukasiak

[Edu18] **PMIK, Programming microcontrollers in C language** (Programowanie mikrokontrolerów w języku C), Sławomir Szostak

[Edu19] **PMK, Introduction to Microelectronics** (Podstawy mikroelektroniki), Andrzej Pfitzner

[Edu20] **POCY, Fundamentals of Digital Circuits** (Podstawy techniki cyfrowej), Andrzej Wielgus, Elżbieta Piwowarska

[Edu21] **POMAK, Fundamentals of materials and constructions** (Podstawy materiałów i konstrukcji), Piotr Firek, Jerzy Kalenik

[Edu22] **POMIK, Introduction to Microcontrollers** (Podstawy mikrokontrolerów), Jakub Jasiński

[Edu23] **PP, Semiconductor Devices** (Przyrządy półprzewodnikowe), Lidia Łukasiak, Agnieszka Zaręba

[Edu24] **PPP, Introduction to Semiconductor Devices** (Podstawy przyrządów półprzewodnikowych), Lidia Łukasiak, Agnieszka Zaręba, Sławomir Szostak

[Edu25] **PROO, Object-Oriented Programming** (Programowanie obiektowe), Dominik Kasprowicz

[Edu26] **PROS, Structured Programming** (Programowanie strukturalne), Michał Borecki

[Edu27] **PWJC, Fundamentals of modern C++** (Podstawy współczesnego języka C++), Marek Niewiński

[Edu28] **PZE, Team project** (Projekt zespołowy), Piotr Firek

[Edu29] **SOE, Operating Systems** (Systemy operacyjne), Andrzej Wielgus

[Edu30] **TELFO, Electronic and Photonic Technologies** (Technologie elektroniczne i fotoniczne), Romuald Beck, Piotr Firek

[Edu31] **TEOP, Ligthwave Telecommunication** (Telekomunikacja optofalowa), Agnieszka Szymańska

[Edu32] **TMIK, Fundamentals of Microprocessor Techniques** (Podstawy techniki mikroprocesorowej), Lidia Łukasiak

[Edu33] **USUX, Introduction to the UNIX System** (Użytkowanie systemu UNIX), Andrzej Wielgus

[Edu34] **WDOF, Introduction to Photonics** (Wstęp do fotoniki), Michał Malinowski, Ryszard Piramidowicz, Anna Jusza, Stanisław Stopiński, Krzysztof Anders

[Edu35] **WINF, Introduction to Computer Science** (Wstęp do Informatyki), Michał Borecki, Dominik Kasprowicz, Marek Niewiński, Andrzej Wielgus, Adam Wojtasik

[Edu36] **WMS, Introduction to Microsystems** (Wstęp do mikrosystemów), Andrzej Mazurak, Robert Mroczyński

[Edu37] **WNUM, Introduction to Numerical Methods** (Wstęp do metod numerycznych), Krystian Król

[Edu38] **WPROJ, Preliminary project** (Projekt wstępny), Andrzej Mazurak

3.2. Advanced Courses

[Edu39] **ASO, Semantic Image Analysis** (Analiza semantyczna obrazu), Piotr Garbat

[Edu40] **FUS, Photonic integrated circuits** (Fotoniczne układy scalone), Ryszard Piramidowicz, Anna Jusza, Krzsztof Anders, Stanisław Stopiński

[Edu41] **IPEF, Integration of Electronic and Photonic Devices** (Integracja przyrządów elektroniki i fotoniki), Robert Mroczyński

[Edu42] **KROMF, Development Trends in Microelectronics and Photonics** (Kierunki rozwoju mikroelektroniki i fotoniki), Jan Szmidt, Paweł Szczepański, Tomasz Skotnicki

[Edu43] **MEF, Mathematical Methods in Electronics and Photonics** (Metody matematyczne w elektronice i fotonice), Andrzej Pfitzner, Agnieszka Mossakowska, Dominik Kasprowicz

[Edu44] **MMC, Monte Carlo Methods** (Metody Monte Carlo), Dominik Kasprowicz, Marek Niewiński

[Edu45] **NAN, Nanotechnologies** (Nanotechnologie), Jan Szmidt, Aleksander Werbowy

[Edu46] **OBRO, Computational Imaging** (Obrazowanie obliczeniowe), Piotr Garbat

[Edu47] **PAUS, Integrated Analog Circuit Design** (Projektowanie analogowych układów scalonych), Krzysztof Siwiec, Tomasz Borejko

[Edu48] **PSSV, VLSI System Design** (Projektowanie systemów scalonych w technice VLSI), Zbigniew Jaworski

[Edu49] **SEN, Sensors** (Czujniki), Mateusz Śmietana, Marcin Koba, Monika Janik

[Edu50] **SSCV, Digital VLSI Systems** (Scalone systemy cyfrowe VLSI), Zbigniew Jaworski, Elżbieta Piwowarska

[Edu51] **SVR, VR and AR Systems** (Systemy wirtualnej i wzbogaconej rzeczywistości), Piotr Garbat

[Edu52] **SWIZ, 3D Vision Systems** (Systemy wizji 3D), Piotr Garbat

[Edu53] **SYWIZ, Vision Systems** (Systemy wizyjne), Piotr Garbat

[Edu54] **TSP, Spectroscopic Methods** (Techniki spektroskopowe), Michał Malinowski

[Edu55] **UIRB, Internet of Things Devices** (Urządzenia internetu rzeczy i ich bezpieczeństwo), Sławomir Szostak

[Edu56] **UMFO, Machine Learning in Image Photonics** (Uczenie maszynowe w fotonice obrazowej), Piotr Garbat

[Edu57] **ZOUL, Photonic Integrated Circuits for Optical Logic** (Zintegrowane optoelektroniczne układy logiczne), Michał Malinowski, Agnieszka Mossakowska-Wyszyńska

[Edu58] **ZPB, Joint Research Project** (Zespołowy projekt badawczy), Robert Mroczyński

[Edu59] **ZPDM, Advanced Multimedia Signal Processing** (Zaawansowane przetwarzanie danych multimedialnych), Piotr Garbat

[Edu60] **ZUKO, Radio Frequency Integrated Circuits** (Zintegrowane układy do komunikacji bezprzewodowej), Tomasz Borejko

3.3. Courses in English

[Edu61] **EELE1, Electronics 1**, Bogdan Majkusiak, Jakub Walczak, Andrzej Mazurak

3.4. Courses for other Faculties

[Edu62] **FPTUZ, Physical Basis of Information Transmission and Storage, WUT Distance Learning Center** (Fizyczne podstawy transmisji i przechowywania informacji, Ośrodek Kształcenia Na Odległość PW), Agnieszka Szymańska

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

[Edu64] **PFZ, Principles of Physics, WUT Distance Learning Cente**r (Podstawy Fizyki, Ośrodek Kształcenia na Odległość PW), Agnieszka Szymańska

[Edu65] **POBZ, Object-Oriented Programming, WUT Distance Learning Center** (Programowanie obiektowe, Ośrodek Kształcenia Na Odległość PW), Piotr Witoński

[Edu66] **TINZ, Internet Techniques, WUT Distance Learning Center** (Techniki internetu, Ośrodek Kształcenia Na Odległość PW), Piotr Witoński

[Edu67] **TL, Laser Technology, Faculty of Mechatronics** (Technika laserów, Wydział Mechatroniki), Ryszard Piramidowicz

[Edu68] **TL, Laser Technology, Faculty of Physics** (Technika laserów, Wydział Fizyki), Ryszard Piramidowicz

[Edu69] **TOZ, Lightwave Telecommunications, WUT Distance Learning Center** (Telekomunikacja optofalowa, Ośrodek Kształcenia Na Odległość PW), Krzysztof Madziar

[Edu70] **TTSZ, Signal Transmission Technology. WUT Distance Learning Center** (Technika transmisji sygnałów, Ośrodek Kształcenia Na Odległość PW), Krzysztof Madziar

[Edu71] **ZJ1Z, Laboratory 1 – Introduction to Information Technologies, WUT Distance Learning Center** (Zjazd 1 – Podstawy technologii informacyjnej, Ośrodek Kształcenia Na Odległość PW), Krzysztof Madziar

[Edu72] **ZJ4Z, Laboratory 4 – Advanced Specialization Laboratory, WUT Distance Learning Center** (Zjazd 4 – Zaawansowane laboratorium kierunkowe, Ośrodek Kształcenia Na Odległość PW), Agnieszka Szymańska

3.5. Courses in English for other Faculties

[Edu73] **FOC, Fiber Optic Communication Systems, Faculty of Physics**, Ryszard Piramidowicz

[Edu74] **LT, Laser Technique, Faculty of Mechatronics**, Ryszard Piramidowicz

[Edu75] **LT, Laser Technique, Faculty of Physics**, Ryszard Piramidowicz

[Edu76] **OFT, Optical Fiber Technology, Faculty of Mechatronics**, Ryszard Piramidowicz

[Edu77] **PIC, Photonic Integrated Circuits, Faculty of Physics**, Ryszard Piramidowicz

[Edu78] **PTIA, Photographic Techniques in Image Acqusition, Faculty of Mechatronics**, Marek Sutkowski

[Edu79] **SOP, Semiconductor Optoelectronics, Faculty of Physics**, Paweł Szczepański

4. RESEARCH PROJECTS

Project definitions and descriptions – prepared by Project Leaders.

4.1. Projects Granted by the University

[Pro1] **Carbon nitride thin films as a novel platform for combined optical and electrochemical biosensing** (Cienkie warstwy azotku węgla jako nowa platforma do jednoczesnych optycznych i elektrochemicznych badań biosensorycznych), project leader: Mateusz Śmietana, September 2023 – December 2024

The main objective of this project is to fabricate an optimized carbon nitride (CN) film on the surface of an optical fibre or planar waveguide. CN has to show two different complementary functionalities. First, because of its optical properties, when deposited on optical waveguides, it enables the generation of lossy-mode resonance (LMR) – the phenomenon enabling label-free optical biosensing. The second function is its simultaneous use as an electrode for electrochemical analysis. This unique combination of two different analytical methods in a single device provides high sensitivity and cross-verification of the readouts for improved reliability of the measurements.

[Pro2] **Development of an innovative technology for PVD deposition of a multilayer, nanocomposite transistor gate** (Układy fotoniki scalonej do zastosowań w systemach komunikacji w wolnej przestrzeni), project leader: Piotr Firek, May 2022 – December 2023

The goal of the project is to confirm the hypothesis that the prepared transistor with multuilayer gate will be selective to various gases and can also be used as a biosensor. It is planned to perform a number of technological processes leading to obtaining multilayer structures with a different number and thickness of palladium and carbon layers. In next step transistors will be tested in terms of their response to gas and the possibility of their biological activation.

[Pro3] **Development of optical interfaces for silicon-nitride-based photonic platform** (Rozwój interfejsów optycznych dla platformy fotonicznej na bazie azotku krzemu), project leader: Krzysztof Anders, co-workers: Mateusz Słowikowski, Marcin Lelit, Romuald Beck, Stanisław Stopiński, Ryszard Piramidowicz, January 2022 – December 2023

Photonic Integrated Circuits (PICs) are considered as one of the most promising photonic technologies for biological sensors, environmental sensors, data- and telecoms and quantum engineering applications. One of the key challenges in the development of any photonic platform (including SiN platform developed by IMiO and CEZAMAT), is to develop low loss input/output interfaces for PICs. In commercial photonic platforms, these interfaces are designed depending on the parameters of a given platform, such as signal wavelength, waveguide refractive indices, waveguide cross-sections, available fabrication technologies and design rules resulting from their limitations, and system application and configuration. Interfaces are not standardized, and, for each new platform, it is necessary to go through the whole development path.

The project is part of the platform development. The scope of R&D work in the project includes numerical simulations, design and fabrication and characterization of two types of interfaces:

1. Spot Size Converters (SSCs) operating over a wide spectral range and with low polarization loss.

2. advanced Grating Couplers (GCs), operating vertically, out of plane of the PICs, selective in the wavelength domain and sensitive to polarization, containing additional reflective structures improving their efficiency.

The project has been created as a result of intertnal research of IMiO and CEZAMAT, as well as preimplementation work carried out in the project under "Innovation Incubator 4.0". The work to date has included a full development cycle of waveguide elements, optical power loggers and AWG de-/multiplexers, and attempts have been made to integrate photonic circuits with microfluidic circuits. The first phase of work is summarized in reviewed a paper ("Passive photonic integrated circuits elements fabricated on a silicon nitride platform" (MDPI Materials – 140 pts, in preparation). The

results so far were presented at national and international conferences (European Conference on Integrated Optics, Integrated Optics – Sensors, Sensing Structures and Methods, Krajowa Electronic Conference). Extending the library of platform elements developed at IMiO and CEZAMAT will allow producing circuits prepared for direct integration with external semiconductor light sources, detectors and direct integration in sensors, as well for the use of optical fibers with modal profiles tailored to the designed interfaces.

The silicon nitride platform, developed by IMiO and CEZMAT, features transparency over a wide spectral range (from VIS to MIR) and is an attractive alternative to SOI and InP platforms, especially in the area of sensor and biomedical applications.

Teams from IMiO and CEZAMAT cooperate with industry, such as: VIGO Systems S.A., Centrum Badań I Rozwoju Technologii dla Przemysłu S.A. and Orange Polska S.A. An expression of the commitment of industry and business to the development of integrated photonics platforms is also the project Techmatstrateg MIRPIC, in which both units of the Warsaw University of Technology participate, and the leader is VIGO System S.A.

[Pro4] **Development, fabrication and characterization of HBT phototransistor test structures for the UV detection with limited sensitivity to the visible spectrum range** (Opracowanie, wytwarzanie i charakteryzacja struktur testowych fototranzystorów HBT do detekcji promieniowania UV o ograniczonej czułości na promieniowanie widzialne), project leader: Mariusz Sochacki, co-workers: Krystian Król, Norbert Kwietniewski, Aleksander Werbowy, January 2022 – – December 2023

Ultraviolet detectors have drawn many attention in the past decade due to the growing number of applications in the civil and military field. For the purpose of optical detection, photodiodes are commonly used due to their simply biasing and operation. However, all the types of usual photodiodes (PiN, Schottky or avalanche diodes), have some drawbacks, such as frequency performance limitations or, more importantly, the lack of internal amplification, which is significant in the detection process. The use of transistor structures instead will significantly simplify the design of electronic converters for the photoresponse conditioning.

The aim of the project is to fabricate a ZnO/4H-SiC heterojunction bipolar transistor (HBT) and to study its photosensitive properties within ultraviolet-visible spectrum range (UV-VIS). The selected material structure of the photodetector results from many years of experience in the implementation of semiconductor devices in silicon carbide technology and the investigation carried out successfully in recent years to analyse the ZnO/4H-SiC heterostructure in terms of photodetection properties in the UV range. Due to the significant area of high-tech and high-end applications, the resulting semiconductor structure is expected to be characterized by the highest possible sensitivity in the UV range and the lowest possible sensitivity in the visible range without the use of additional optical filtration. At the same time, the detector should have the shortest possible response time to fast-modulated radiation intensity and have dynamic characteristics allowing for operation in the impulse mode.

The research carried out within the project will be divided into four main parts: modelling of epitaxial structures of 4H-SiC, construction of the device, technology and characterization of the fabricated device. Modelling the parameters of the structure prior to ordering fully customized 4H-SiC wafers is becoming one of the basic elements contributing to the success of the project as it can completely eliminate all potential mistakes at the design stage. After developing the topography of the photo-HBTs and test structures, the whole technology will be divided into individual steps of photolithography along with a description of all processes required to make the photo-HBTs. The most important part of the research plan is comprehensive characterization of electrophysical properties of individual layers of the epitaxial structure, and the output parameters of the photodetector, and their comparison with the results presented by other groups describing such structures in terms of the analysis of fundamental phenomena affecting the final quality and performance of the photosensitive detector under development.

[Pro5] **Feasibility study of logic circuits using thermally stabilized complementary bipolar transistors** (Studium wykonalności układów logicznych z wykorzystaniem stabilizowanych termicznie komplementarnych tranzystorów bipolarnych), project leader: Piotr Mierzwiński, May 2023 – December 2024

The project titled "Feasibility Study of Logic Circuits Using Thermally Stabilized Complementary Bipolar Transistors" aims to explore the potential of complementary bipolar transistors for digital circuit implementation. While technologies like TTL, TTL-S, and ECL were once preferred for digital circuits, they have been largely replaced by CMOS technology. However, the concept of utilizing complementary bipolar transistors has been known since the 1970s.

Complementary bipolar transistors leverage small and symmetric lateral NPN and PNP bipolar transistors. These transistors are suitable for Very-Large-Scale Integration (VLSI) circuits, especially those requiring high speed or low current. Although digital circuits using complementary bipolar transistors won't replace the most advanced CMOS designs, they can serve as additional components in BiCMOS-type circuits alongside field-effect devices.

The project aims to conduct a feasibility study on logical circuits using complementary bipolar transistors. These transistors, including innovative geometries such as VESTIC, offer the potential for thermally stabilized logic blocks. Such blocks could be used to build fully functional digital circuits that operate effectively across a wide temperature range, striking a balance between power consumption and performance.

The feasibility study will guide future experimental work, including scenarios for verifying the proposed circuit designs across a broad temperature range. By addressing these challenges, researchers hope to pave the way for stable and efficient complementary bipolar transistor-based logic systems.

[Pro6] **Grant for publishing a review article titled: "Advances in Optical fiber sensors for in Vivo Applications – a Review of Sensors Tested on Living Organisms" in a prestigious international journal** (Grant na opublikowanie artukułu przeglądowego pt: "Advancements in Optical fiber sensors for in Vivo Applications – a Review of Sensors Tested on Living Organisms" w prestiżowym międzynarodowym czasopiśmie), project leader: Mateusz Śmietana, January 2023 – January 2024

The aim of the project is to prepare a review article on the topic "Advances in Optical fiber sensors for in Vivo Applications – a Review of Sensors Tested on Living Organisms" and publish it in a renowned scientific journal.

[Pro7] **Hyperbolic metamaterials for enhancing energy yield of photovoltaic modules** (Zastosowanie metamateriału hiperbolicznego na potrzeby zwiększenia uzysku energetycznego modułów fotowoltaicznych), project leader: Bartosz Fetliński, co-workers: Bartosz Janaszek, Marcin Kieliszczyk, Robert Mroczyński, January 2022 – December 2023

The aim of this project is to verify the feasibility of using hyperbolic metamaterials (HMM) as innovative coatings that allow the reduction of radiation heating of photovoltaic (PV) cells while ensuring antireflection properties in the spectral range useful for energy conversion. The main research assumption of the project is the statement that the structure with the above-mentioned properties will allow to increase the energy yield of the PV module by significantly reducing radiation heating, which is one of the dominant factors limiting the efficiency of energy conversion in PV cells.
The proposed method is characterized by conceptual and implementational simplicity as well as high technological scalability (it can be used for any commercially available PV modules), which constitutes its significant competitive advantage over the previously proposed solutions that require significant interference in the cell or module structure. According to the preliminary theoretical research, a properly designed hyperbolic metamaterial can act as an edge filter, providing a unique possibility of simultaneously obtaining high transmission and strong reflection in the appropriate spectral ranges. In connection with the fact that so far hyperbolic metamaterials have not been used in the proposed application, the proposed project is characterized by high scientific innovation. The planned work will include a comprehensive theoretical analysis and preliminary experimental verification of the proposed metamaterial structures, which will be carried out in cooperation with renowned national research centers: the Institute of Microelectronics and Photonics of the Łukasiewicz research network (IMiF) and the Institute of Physics of the Polish Academy of Sciences

(IFPAN). As part of the cooperation, prototype layers of component materials and HMM coatings will be fabricated and then structurally and optically characterized. It is also worth emphasizing that the use of hyperbolic metamaterial to increase energy yield from a PV module by limiting radiation heating is part of the current scientific research in the field of innovative optoelectronic elements and systems. In connection with the above, the results of the work carried out will be the subject of at least two publications in renowned scientific journals (Optics Express, Solar Energy) and conference announcements at international assemblies. The obtained results will also constitute the foundation for subsequent advanced research and the basis for applying for further funding under national programs. It should be emphasized that this research group has already published considerable achievements in highly scored magazines in the areas directly related to the subject of the proposed project.

[Pro8] **Influence of biological materials' charge on the functional parameters of opto-electrochemical biosensors** (Wpływ ładunku materiału biologicznego na parametry funkcjonalne światłowodowych biosensorów opto-elektrochemicznych), project leader: Monika Janik, May 2022 – December 2023

To develop high-quality biosensing solutions, the ability to identify changes occurring at the sensor-biofilm-buffer surfaces and assess their impact on the obtained results are crucial, especially in sensing solutions utilizing the electrochemical (ECh) domain. Therefore, the aim of the project is to investigate the influence of the tested biological materials' charge on the functional parameters of opto-electrochemical optical fiber-based platforms, i.e., dual-domain lossy mode resonance (LMR) sensors. Various model biological materials and redox systems will be utilized. The immobilization of biological materials on LMR's surface in different configurations will be verified independently in optical and ECh domains and simultaneously with the LMR-ECh system developed by the team. All the planned actions will allow for determining the range of the introduced disturbances and their influence on the sensor's performance, e.g., detection limit.

[Pro9] **Optical gyroscope in photonic integration technology** (Żyroskop optyczny w technologii fotoniki scalonej), project leader: Stanisław Stopiński, May 2023 – December 2023

The main scientific goal of this project is to develop a demonstrator of a miniature gyroscope system based on a photonic integrated circuit (ASPIC). The direct inspiration for undertaking such a defined research issue stems from two premises. The first is the existing market demand for efficient, miniature, and power-optimized gyroscope systems. The second premise is the extremely dynamic development of European and national potential in the field of experimental ASPIC technology, produced on monolithic substrates of indium phosphide, silicon nitride, and silicon. Integrated photonics technologies are currently transitioning from the research phase in laboratories to a phase of broad market implementation, primarily focused on the telecommunications and data communications markets so far. However, there is a growing involvement in sensor applications.

[Pro10] **Photonic integrated circuits for applications in free-space optical communication systems** (Ultracienkie warstwy ferroelektryczne wytwarzane metodami PVD dla zastosowań w nowoczesnych nieulotnych pamięciach półprzewodnikowych (NVSM)), project leader: Ryszard Piramidowicz, November 2023 – October 2025

The main goal of the project is to develop and investigate qualitatively new solutions for wireless optical communication, based on photonic integrated circuits (PICs), manufactured in various technologies and operating in different spectral ranges – the classical near-infrared range (NIR) typical for fiber optic telecommunications and in the significantly more attractive mid-infrared range (MIR) for free-space communication.

[Pro11] **Plasmons and polariton on structured Surfaces of group IVb metal notrides** (Plazmony i polarytony na nanostrukturyzowanych powierzchniach azotków metali z grupy IVb), project leader: Jarosław Judek, co-workers: Mateusz Słowikowski, January 2022 – December 2023

Group IVb metal nitrides, i.e., titanium nitride TiN, zirconium nitride ZrN and hafnium nitride HfN are well-known, extremely hard, thermally and chemically resistant conductive ceramics. However, they have been rediscovered recently due to previously rather ignored but very scientifically interesting plasmonic properties. The combination of plasmonic properties occurring in a wide spectral range, i.e., from below 400 nm to above 30 um, with such advantages as low production costs, resistance to high temperatures, and, importantly, compatibility with CMOS technology, makes metal nitrides from group IVb an interesting alternative to gold and silver – typical materials used in plasmonics today. The proposed project has two closely related goals. The first goal is to study the conditions of the deposition process and the plasmonic properties of titanium, zirconium, and hafnium nitrides resulting from the details of this process. The study of the interrelationship of the input parameters of the technological process with the obtained optical properties in the perspective of the application of nitride layers as plasmonic materials constitutes a significant scientific challenge. The correlation of the phenomena during the formation of layers with the obtained plasmonic properties of the studied materials will be an important interdisciplinary research problem. It is worth emphasizing that these materials are interesting primarily due to their optical properties in the context of the proposed project. The second goal of the proposed project is research in the field of production and characterization of groove plasmonics nanograting, produced on the surface of plasmonic material as a series of parallel slits with an appropriately selected period, depth, and pro le. The optical characterization of the produced structures is planned using the micro-reflectance technique, which is expected to allow both the determination of the plasmon propagation length and the observation of the photon-plasmon coupling. In order to demonstrate the maturity of the developed technology and the understanding of the physical phenomena occurring on the structured surface, it is proposed to use the produced plasmonic diffraction grating as a substrate for the Surface Enhanced Raman Spectroscopy (SERS) experiment. As a probe, it is planned to use a single graphene layer grown by Chemical Vapor Deposition (CVD) and transferred to a structured plasmonc surface.

[Pro12] **Real-time monitoring of impact of gamma radiation on properties of thin films** (Monitorowanie w czasie rzeczywistym wpływu promieniowania gamma na właściwości cienkich warstw), project leader: Mateusz Śmietana, May 2023 – December 2024

The aim of the project is to make a series of test structures of long-period fiber gratings and selected thin-film coatings on their surfaces, and to verify the possibility of using such systems to study in real time the impact of radiation exposure, including gamma radiation, on the properties of the thin films.

[Pro13] **System for the characterization of ferroelectric (FE) properties of thin films and FE nanoelectronic and photonic devices** (System do pomiarów i analizy właściwości ferroelektrycznych cienkich warstw oraz ferroelektrycznych przyrządów nanoelektronicznych i fotonicznych), project leader: Robert Mroczyński, October 2023 – – September 2025

The subject of the application is the purchase of a unique apparatus for measurements and analysis of thin films' ferroelectric (FE) properties. The equipment enables the implementation of subtle characterization of various materials, particularly dielectric and composite materials, with thicknesses even on a nanometer scale, which is unique for this equipment class.

[Pro14] **The study of the robustness of GNSS positioning against signal disturbances** (Badania odporności pozycjonowania GNSS na zakłócenia sygnału, BEYOND POB), project leader: Krzysztof Siwiec, March 2021 – February 2023

Global Satellite Navigation Systems (GNSS) are widely used positioning tools to monitor and navigate an object in space. The dynamic development of geoinformation technologies, in which the object location component is an essential element, also forces the continuous development and improvement of GNSS positioning algorithms and methods. As part of this development, one of the most critical elements is the broadly understood security of the use of GNSS positioning technology, in particular, to protect system users against malfunctions of the GNSS system caused by intentional (jamming, spoofing) and accidental (e.g. interference, navigation data errors) disturbances of measurement signals.

The proposed project's subject is related to the study of the robustness of the measurement data acquisition and processing algorithms to signal disturbances and the analysis of the impact of individual sources of disturbances on the positioning quality. As part of the project, it is planned to use a unique research infrastructure in the form of the GNSS Spirent GSSQOOO signal generator and the NaviSoC receiver by ChipCraft Sp. z o.o. (a spin-off company of the Warsaw University of Technology). The research tasks will include: analysis of the resistance of individual components of signal acquisition and positioning models to observation errors and disturbances in the operation of the GNSS systems; improvement and development of algorithms that increase the accuracy and reliability of GNSS positioning; development of methods of warning system users against its malfunctioning. The international research team, consisting of both specialists in the field of error analysis of GNSS observation and positioning models, as well as scientists in the field of electronics, telecommunications and the construction of GNSS receivers, will enable comprehensive research at the highest world level. The work will also result in developing a methodology for testing and metrological control of GNSS measurement systems. The planned effects can significantly increase the possibility of using GNSS technology in positioning applications requiring high accuracy and reliability.

[Pro15] **Thin-film photoluminescent structures using large-particle organic and non-organic matrices** (Cienkowarstwowe struktury fotoluminescencyjne wykorzystujące wielkocząsteczkowe matryce organiczne i nieorganiczne), project leader: Bartosz Fetliński, April 2023 – December 2024

The main goal of the "Thin-film photoluminescent structures using large-particle organic and non-organic matrices." is to investigate feasibility of modifying the photoluminescence properties of rare earth ions by their integration into three selected matrices, organic and nonorganic. The f-f transitions in the lanthanides are of forbidden character, which makes them particularly sensitive for surroundings of the ion in the matrix and symmetry of the integration site. In this project we aim to investigate this effect for a set of chosen rare earth ions incorporated into three types of organic and nonorganic matrices: silicate phosphates glasses, fluoropolymers such as Nafion® as well as polymer thin films. The production of these matrices also in the form of thin layers with a thickness of several tens of nanometers introduces an additional method of modifying the coordination environment of lanthanide ions, but also poses some engineering challenges. They mainly concern the optimization of methods for obtaining such layers in a controlled, repeatable manner, which also enables obtaining the desired structural properties of the layers, especially their continuity and homogeneity. Due to the significant importance of proper structural characterization within the project, which combines the competences of teams from Faculty of Electronics and Information Technology (FEIT) and the Faculty of Chemistry, we also anticipate cooperation with foreign partners (Paul Scherrer Institute – Switzerland, Vilnius University – Lithuania), who have advanced methods of structural characterization not available at WUT. Although the final selection of lanthanide+matrix systems will take place after more in-depth literature studies, we anticipate the use of europium ions, and probably also terbium and cerium. The photoluminescence properties of rare earth ions in the considered systems may also depend on external factors affecting the matrix, such as, for example, humidity, which makes it suitable for sensor applications or monitoring the condition of thin-film membranes, e.g. in fuel cells. Other possible areas of application of the developed structures are printed waveguides, fuel cells, thin-film sensors, amplifiers in integrated photonics. However, this project is of a basic research nature, and the developed structures samples obtained at the

Faculty of Chemistry will be characterized by optical spectroscopy methods by a team from the Institute of Microelectronics and Optoelectronics of FEIT. An attempt will be made to physically interpret the obtained results, including in particular the possible processes of energy transfer between the dopants and the matrix and the influence of the change of symmetry on the probabilities of the 4f-4f and 5d-4f transitions. As a result of the project, we anticipate the publication of 3 articles (including 2 from the upper decile) and the submission of a project proposal that will allow the continuation of research based on the knowledge obtained.

[Pro16] **Ultrasensitive genosensory optical fiber microsystem** (Ultraczuły genosensoryczny mikrosystem światłowodowy), project leader: Monika Janik, April 2023 – December 2025

The goal of this project is direct, fast, real-time, and label-free isothermal DNA amplification monitoring using microcavity fabricated in an optical fiber. The solution offers a significant advantage over many other sensing concepts – it makes possible optical analysis in just picolitre sample volumes with one of the highest reported sensitivities (over a few thousands of nm/RIU).

[Pro17] **Ultrathin ferroelectric PVD films for novel Non-Volatile Semiconductor Memory (NVSM) structures** (Ultracienkie warstwy ferroelektryczne wytwarzane metodami PVD dla zastosowań w nowoczesnych nieulotnych pamięciach półprzewodnikowych (NVSM)), project leader: Robert Mroczyński, September 2023 – September 2025

Modern advancements in integrated circuit technology have surpassed fundamental physical limits. The continuous progress in semiconductor device technology has led to the development of advanced processing and materials techniques. However, the increasing complexity and operating frequency of integrated circuits have resulted in an undesirable rise in power dissipation. In recent years, new concepts for logic and memory devices have emerged to mitigate power dissipation by leveraging different physical phenomena. Among these concepts, ferroelectric (FE)-based devices have gained attention due to their ease of integration into modern Field Effect Transistors (FET) and their potential for achieving high density, low power consumption, high-speed operation, and increased endurance. In this project, we propose comprehensive investigations into the ferroelectric effect in hafnium oxide (HfO_2)-based layers fabricated using magnetron sputtering.

4.2. Projects Granted by the National Centre for Research and Development

[Pro18] **Biopolymer materials with chemically and genetically programmed heavy metal selectivity for new generation ultra-sensitive biosensors** (Materiały biopolimerowe o programowanej chemicznie i genetycznie selektywności do metali ciężkich dla ultraczułych biosensorów nowej generacji), TECHMATSTRATEG III, Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Mateusz Śmietana, co-workers: Monika Janik, Marcin Koba, Norbert Kwietniewski, Katarzyna Lechowicz, Emil Pituła, Jakub Warszewski, Kinga Kondracka, January 2021 – – December 2023

The project concerns research and development and pre-implementation work which will result in the development of an ultra-sensitive and mobile device allowing for simultaneous and rapid water detection of at least 8 different heavy metals using electrochemical and optical measurements. The device will be able to detect the presence of contaminants at the source of water intended for human consumption in accordance with the standards of permissible concentrations of heavy metals recommended, among others, by the WHO and the Ministry of Health. Its implementation on the market will allow for quick and precise analysis of drinking water contamination and, after proper preparation of the sample, the analysis of environmental and waste water. To ensure the success of the project implementation, three independent strategies were proposed to obtain biological receptor layer interacting selectively with heavy metals in the form of DNA

aptamers, oligopeptides and modified GFPs. To create the final version of the device, allowing for rapid detection, these biomolecules will be selected from the above-mentioned three types of biological elements, which will provide the highest stability and the best qualitative and quantitative measurements of the presence of heavy metals in water. Thanks to the integration of research from renowned scientific centres, representing both chemical sciences and technical sciences, i.e. microelectronics and micro optics, with the cooperation with the business unit, a unique on the global market mobile instrument will be created, allowing to monitor environmental pollution in an extremely simple, mobile way and ensuring simultaneous detection of at least 8 heavy metals. So far, no one has developed and marketed a solution, which enables almost immediate detection of several pollutants at once, and no mobile device combining both electrochemical and optical detection has been constructed, which guarantees its considerable market potential.

[Pro19] **Development and implementation of an artificial intelligence system of virtual characters allowing simulation of their realistic behaviour and interactions with the player based on an autonomous analysis of the game participants' image in real time** (Opracowanie i implementacja systemu sztucznej inteligencji wirtualnych postaci pozwalającego na symulację ich realistycznych zachowań i interakcji z graczem na podstawie autonomicznej analizy obrazu uczestników gry w czasie rzeczywistym), GAMEINN, Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Piotr Garbat, August 2020 – June 2023

The aim of the project is to create a platform for the multiplayer- AR games (augmented reality multiplayer games) development based on cloud rendering and machine learning. The platform will be validated on an experimental test gameplay created for this purpose, making use of all functionalities of the system. The result of the project, i.e. a new product on the market – Pirxon platform, will be implemented directly in the company's activities of the consortium leader. The platform will be based on algorithms developed together with the consortium partner – Warsaw University of Technology (PW) and equipped with the first video system supporting augmented reality multiplayer games in real time.

[Pro20] **Development of a modular quantum computer infrastructure for special and military IT applications** (Opracowanie modularnej infrastruktury komputera kwantowego do specjalnych i wojskowych), TECHMATSTRATEG III, Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Jan Szmidt, December 2020 – December 2024

The aim of the project is a prototype of a modular quantum computer infrastructure (MIKOK) for IX RTL for special and military purposes as well as general IT applications. The modularity of the infrastructure ensures a high degree of its versatility, availability, and security for a variety of implicit and explicit applications implemented by many independent users. The infrastructure created as part of the project's implementation consists of four basic modules: Quantum Computer Unit, Secure Multi-Access Platform, Quantum Computer Compiler, and Quantum Computer Simulator. The use of infrastructure enables multi-access testing and running quantum algorithms in both implicit and explicit modes. The adopted modular solution provides the opportunity to expand the infrastructure (e.g., multiplying modules) and their development (e.g., increasing the number of qubits).

[Pro21] **New Versatile Platform for Illumination and Sensing – NewILUMIS** (Nowa uniwersalna platforma oświetleniowo-sensoryczna, M-ERA NET call 2019), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Marcin Kaczkan, September 2020 – August 2023

NewILUMIS project aims at developing a novel functional material based on a layered ceramic, associated to a surface plasmon resonance (SPR) structure and a mesoporous topcoat as an innovative photonic component for lighting/sensing. The target areas will be environmental protection and security, medical diagnostics, biosensing and chemical compound detection.

The core of the lightning structure will be a rare earth doped (RE^{3+}) ceramic (YAG). Its layered construction will allow tailoring the spectral and spatial characteristics of the light source under LED excitation. The ceramic composition (active dopants, scattering phase material, etc.) will be modified to obtain the desired colour rendering index and a high efficiency of the resulting source. This light source will be used for sensing when combined to SPR and functionalized mesoporous coatings. Packaging issues will also be considered to produce a demonstrator whose performance will be tested in relevant industrial applications.

[Pro22] **Photonics Integrated Circuits technologies for MIDIR** (Technologie układów fotoniki scalonej na zakres średniej podczerwieni – MIRPIC), TECHMATSTRATEG III, Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Ryszard Piramidowicz, co-workers: Krzysztof Anders, Anna Jusza, Aleksandra Paśnikowska, Stanislaw Stopiński, April 2020 – March 2024

The result of the project will be a "product innovation" in the form of Application Specific Photonic Integrated Circuits (ASPIC) designed to work in the midinfrared range, MIR (3–5.5 μm). In particular, different building blocks necessary to define ASPICs will be designed, manufactured and tested, which will allow to design, manufacture and test the parameters of the ASPIC demonstrator. The demonstrator will reflect the typical characteristics of integrated photonics, i.e. multi-channel, integration on a common substrate, electronic and optical interfaces, and packaging. The demonstrator will be a multi-channel receiver transmitter operating for least three wavelengths and designed for the detection of chemical compounds (e.g., CO_2, NO_x, SO_x) or for free-space optical communication. The result of the project will be "know-how" in the field of design and production of a basic set of functional blocks and their hybrid integration, which will allow to define the first in Poland technology platform of ASPIC circuits for the MIR range. Then as a result of the planned implementation will allow for the design and production of integrated photonics systems with different parameters corresponding to the changing needs of customers, in line with the concept of industry 4.0. Industry 4.0 assumes organization of production that allows reacting to changes in market demand for a product with specific parameters – "mass personalization". Strong competition and growing customer expectations mean that not only the systematic increase in production efficiency is needed but also the way to personalize it, i.e. produce short series of products designed according to the needs of a specific customer. Their price should not be higher than the price of mass-produced goods. Such flexibility is to be the result of the fourth industrial revolution and the product developed in the project is to meet these challenges.

[Pro23] **Development of an innovative photonic system for monitoring water resources** (Opracowanie innowacyjnego fotonicznego systemu monitoringu zasobów wodnych), HYDROSTRATEG, Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, VIGO Photonics S.A., project leader: Ryszard Piramidowicz, October 2023 – – September 2026

New photonic and non-invasive measurement methods will be developed and verified, followed by the construction of autonomous probes for remote monitoring of selected water quality parameters, such as monitoring nitrate, nitrite, and phosphorus compounds content. Optionally, research will also be conducted on the detection of ammonia and microplastics. Currently used methods employ extensive, expensive, and require highly qualified personnel to operate high-end laboratory equipment, often excessive compared to the requirements. Detection of signals from selected substances using matched systems will allow for miniaturization, automation, and cost reduction while increasing the level of security in monitored areas. Functional groups of various substances have a number of characteristic absorption lines (so-called fingerprints) in the mid-infrared range of 3–11 μm, enabling their identification. VIGO Photonics S.A. – a global leader in mid-infrared detector production, has the potential to develop appropriate detection systems. Research will be conducted on the possibility of using various measurement techniques (including Attenuated Total Reflectance, Raman spectroscopy) along with methods enabling their implementation in the form of miniature probes.

The measurement system will consist of a light source, a transducer structure, and a detection module. The light source will be QCL laser, ICL laser or incoherent source. The transducer structure (ultimately in the form of photonic structures) and the detection module (single or multi-element) as well as the development of infrastructure enabling measurements of selected parameters will be the subject of work carried out at VIGO Photonics. The completed probes will be supplemented with control, power, and telecommunication systems. Collaboration with scientific institutions will allow for the development of necessary measurement systems (IMO WUT), their verification, and practical use (ERCE PAN).

4.3. Projects Granted by the National Science Centre

[Pro24] **Heterogenous diamond biosensing nanoarchitectures: opto-electro-chemical interactions with antibody complexes** (Heterogeniczne diamentowe nanoarchitektury biosensoryczne: opto-elektrochemiczne interakcje z układami przeciwciał), OPUS, Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Mateusz Śmietana, October 2022 – October 2025

High demand for pathogen (viruses) detection has been giving a significant boost to recent research trends focusing on the development of fast, highly sensitive, label-free, miniature devices based on various principles. The efforts range from nanomaterials and heterostructures to novel device architectures. The aim of the efforts is to improve the sensor performance not only via enhanced analyte diffusion and surface area, but more importantly to deliver and explore physico-chemical phenomena in biosensing structures that would change our view on the present biosensing concepts. Prior examples here are for instance non-enzymatic glucose biosensors, aptamers as artificial antibodies, molecularly imprinted bioreceptors, or various use of surface plasmons.

The interdisciplinary team established for this project aims that simultaneous optical (OPT) and electrochemical (EC) interrogation of heterogenous diamond 3-dimensional nanoarchitectures (periodic nanowalls, nanocages or nanoneedles) could provide a fundamentally new sensing approach, when taking advantage of unique features of diamond.

EC materials are often not optically transparent and when they are, they suffer from a low potential EC range, low biocompatibility or unstable surface modification. However, electrically conductive and transparent boron-doped diamond nanoarchitectures will allow us to benefit from unique optical and EC performance to meet such challenging demands. Moreover, advanced nanofabrication of diamond will enable to form 3-dimensional structures with a heterogenous distribution of both OPT and EC properties, allowing to enhance specific interactions with locally grafted antibodies. For instance, we assume that the EC polarization sweep will introduce the increase of the bioanalyte concentration close to the surface via migration transports and that sensing will also be locally optically amplified. Next, electromagnetic field distribution and electron transfer will be tailored by periodic nanoarchitectures enhancing and specifying interactions taking place at the diamond-molecule interface.

According to the literature, diamond-based nanostructured biosensors were never simultaneously interrogated in OPT and EC domains. The main scientific objective is thus to reveal fundamental mutual OPT-EC interactions at the diamond-based nanoarchitectures biofunctionalized with antibody complexes that can be beneficial for applications in label-free biosensing systems.

We will explore two complementary architectures: (A) application of nanopatterned silicon wafers such as photonic crystals (1D or 2D) coated with diamond film, and (B) synthesis of self-assembled 3D-diamond structures with periodic nanoarchitectures such nanowalls, nanocages or nanoneedles, where intrinsic and boron-doped structures will be combined with superior EC/OPT and biofunctional diamond properties. To achieve that we will use advanced deposition and surface processing techniques, such as electron beam lithography, reactive ion etching, and modified chemical vapour deposition (CVD) processes to obtain diamond films and their nanostructures. The nanoarchitecture device design and experimental data will be supported by multi-scale ab-initio and molecular dynamics simulations.
To make the sensing system specific to certain biological targets, the nanoarchitectures will be biofunctionalized with

antibodies towards virus proteins as non-infectious proxies (i.e., specifically influenza, SARS, HSV antigen proxies), directly or via gold nanoparticles. The heterogeneous approach with nano-engineered diamond will induce targeted grafting of antibodies complexes, allowing for high specificity of biosensing system along with enhanced sensitivity delivered by simultaneous electronic (EC charge transfer) and OPT (photonic and plasmonic) interactions.

To successfully address the above aims, challenges, and required expertise in the interdisciplinary D4CZaPLa project, the new international and complementary team is formed where groups at Gdańsk University of Technology (GUT), Warsaw University of Technology (WUT), and Institute of Physics, Czech Academy of Sciences (FZU) join forces, expertise and facilities. FZU specializes in multi-scale computational simulations, synthesis and nanodiagnostics of diamond nanoarchitectures, while GUT are experts in doping, biofunctionalization and electrochemical analyses and WUT designs and studies thin film optical biosensors.

[Pro25] **Optical fiber biosensing systems for fast and early identification of inflammatory factors** (Światłowodowe systemy biosensoryczne do szybkiego i wczesnego wykrywania czynników zapalnych), OPUS 18, Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Mateusz Śmietana, July 2020 – July 2023

Accurate and fast medical diagnostics are crucial for fighting with majority of health issues, which include fast-spreading bacterial or viral infection, as well as progressing cancer disease. In medical practice an advanced experience is essential for correct diagnosis, which almost always needs to be supported by a series of examinations and laboratory analysis. These are often very time-consuming, which leads to more rapid spread of the disease, its fast progress or makes the treatment less successful and more expensive. Thus, a great investments are made all over the world on development of novel, more effective, faster, and more functional biosensing architectures and procedures.

Out of available biosensors, these based on optical interactions between sensor and a target biological material are very often considered. The devices are designed for detection of changes in properties of liquids (typically refractive index – RI, absorption, or fluorescence) or changes at the interface of the liquid and the sensor active area (thickness, RI and absorption of the surface layer). When no florescent label is involved and only RI variation in proximity of the sensor surface is monitored, the sensing concept is often called as "label-free". These changes may result from formation of the bio-layer on the surface of the bio-sensor. Optical label-free biosensors offer greatly shortened vs florescent-based sensors sampling to result time and possibility of target biomaterial binding kinetics measurements. Moreover, when they are based on optical fibers, they offer probe-like character of the sensor, allowing for direct in-vivo analysis, as well as when fiber end-face is used, a small active surface of the sensor that makes possible precise in-spot analysis. However, obtaining highly sensitive and selective optical fiber label-free biosensor is highly challenging, especially when mass production of the sensors is considered.

The main aim of this project is to study the optical response to changes in optical properties at the surface of optical fiber sensors with stack of nano-films at the end-faces. Due to biofunctionalized surface of the stack changes in the optical properties will correspond to concentration of selected inflammatory markers. We claim that optimized in properties stacks can be targeted towards certain size or character of the bound biomolecules, what makes possible their identification in complex biological liquids. In this project we will consider such biological targets as myeloperoxidase and neutrophil elastase that are well-known inflammatory markers belonging to the group of enzymes produced locally by the activated immune cell and play an important role in the inflammation process underlying many pathological conditions. These markers are different in size and character and that is why require different architecture of the stack, but can be tuned using the same "generic" and mass-applicable technology. Moreover, we claim that the sensors can be applicable for in-vivo measurements, even in locations inside human body distant to other sensors, what may be impossible or dangerous for the patient when other types of interrogation are considered.

The work will be performed by a consortium of the group at Institute of Microelectronics and Optoelectronics, Warsaw University of Technology led by Prof. Mateusz Śmietana, group at Division of Immunology, Medical University of Warsaw led by Dr. Tomasz Rygiel, and the group of Surface Nanoengineering at the Institute of Physical Chemistry Polish

Academy of Sciences led by Prof. Joanna Niedziółka-Jönsson. The project will include numerical analysis of the nano-film stacks based on measured properties of the films, developing fabrication process, functionalization of the sensor surface, determination of sensing parameters, as well as comparison of the results with other label-based and label-free sensing techniques, and finally determination of the sensor performance in conditions as at in-vivo examinations. For fabrication of the sensors we plan to use advanced physical and chemical vapor deposition techniques tuned towards their application for deposition on optical fibers. As thin film materials will be examined various metal and semiconductor oxides, nitrides and oxy-nitrides, as well as carbon-based materials. Material selection will be determined by the film robustness when stay in contact with pH expected in environments typical for in-vivo experiments.

[Pro26] **Translucent titanium dioxide nanostructures deposited on substrates with complex geometry for photoconversion and sensorics** (Nanostruktury półprzezroczystego ditlenku tytanu osadzane na podłożach o złożonej geometrii do fotokonwersji i sensoryki), CEUS-UNISONO, Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Mateusz Śmietana, co-workers: Monika Janik, Emil Pituła, Mariusz Sochacki, April 2021 – March 2024

The project aims on fundamental material research on semi-transparent nanostructured surfaces with complex 3D geometry for enhancement of light harvesting and label-free sensing. Titania nanotube arrays with tunable absorption light spectra due to tailoring of the band-gap and nanotube dimension will be in particular studied. Well-defined nanotube arrays will be formed on surfaces with complex geometry to achieve unique light-matter interacting systems. In particular, a double-faced nanotube-array-based system with sequential light absorption and an optical-fibre-based sensor coated with nanotube arrays for label-free sensing of various gases and liquid analytes will be fabricated and investigated.

4.4. Projects Granted by the Ministry of Education and Science

[Pro27] **Optical multi sensor fusion for ionizing radiation diagnostics (WP1)** (Fuzja wielu czujników optycznych na potrzeby diagnostyki promieniowania jonizującego (pakiet WP 1)), Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, project leader: Mateusz Śmietana, October 2023 – January 2024

The aim of the "OPTIcal Multi-SEnsor fusion for ionizing radiation Diagnostics" project was to design, develop, calibrate and test in real conditions an innovative, integrated solution based on optical sensors connecting several technological platforms. The project responds to research needs in the field of real-time radiation monitoring and uses state-of-the-art, non-standard optical sensing elements to create a universal platform allowing for applications in HEP facilities and the space industry, as well as the transfer of the developed technology to partners around the world.

Microelectronics and Nanoelectronics Devices 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.

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.

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

Association Tutor: Jakub Jasiński, Ph. D.

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

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

Association Tutor: Marek Niewiński, Ph. D.

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.

5.2. 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.

6. DEGREES AWARDED

6.1. Ph.D. Degrees

[DSc1] Butryn Igor, **Low power hybrid oscillator and its design method in nanometer CMOS technologies** (Układ zintegrowanego generatora o architekturze hybrydowej i niskim poborze mocy oraz metoda jego projektowania w nanometrowych technologiach CMOS), scientific supervisor: Pleskacz Witold and Siwiec Krzysztof, June 21

[DSc2] Kowalczyk Marcin, **Optically active nonlinear solid-state materials containing Bi^{3+} doped with Eu^{3+} and their investigation via spectroscopic methods** (Optycznie czynne nieliniowe materiały ciała stałego zawierające jony Bi^{3+} domieszkowane jonami Eu^{3+} i ich badanie metodami spektroskopowymi), scientific supervisor: Kaczkan Marcin, September 15

[DSc3] Mierzwiński Piotr, **Bipolar transistor in VESTIC technology** (Tranzystor bipolarny w technologii VESTIC), scientific supervisor: Kuźmicz Wiesław, June 20

6.2. M.Sc. Degrees

[MSc1] Mikołajczyk Piotr, **Modeling of multi-mode interference couplers in photonic integration technology for mid-infrared spectral range** (Modelowanie sprzęgaczy interferencyjnych MMI w technologii fotoniki scalonej na zakres średniej podczerwieni), supervisor: Stopiński Stanisław, October 13

[MSc2] Stępniewski Kamil, **An integrated temperature sensor with polynomial calibration** (Zintegrowany czujnik temperatury z kalibracją wielomianową), supervisor: Siwiec Krzysztof, October 13

[MSc3] Waszczak Daniel, **Implementation of HDL fractional sample rate converter model generator in Python** (Implementacja generatora modelu HDL konwertera częstotliwości próbkowania w języku Python), supervisor: Pleskacz Witold, October 13

6.3. B.Sc. Degrees

[BSc1] Bożek Wojciech, **Development of a fuzzy systems simulator using co-simulation of VHDL models and MATLAB/Simulink** (Opracowanie symulatora systemów rozmytych z wykorzystaniem symulacji mieszanej modeli VHDL oraz MATLAB/Simulink), supervisor: Wielgus Andrzej, February 10

[BSc2] Domian Konrad, **Optimizing Language Constructs in Models of Digital Function Blocks in Verilog HDL for Logical Synthesis** (Optymalizacja konstrukcji językowych w modelach cyfrowych bloków funkcjonalnych w języku Verilog HDL pod kątem syntezy logicznej), supervisor: Pleskacz Witold, February 10

[BSc3] Fokt Damian, **The use of sensors to implement hybrid random number generators** (Zastosowanie czujników do realizacji hybrydowych generatorów liczb losowych), supervisor: Borecki Michał, September 21

[BSc4] Głąbicki Adam, **Stand for research of emission characteristic – project and realization** (Stanowisko do badań charakterystyk emisyjnych – projekt i realizacja), supervisor: Kaczkan Marcin, February 14

[BSc5] Gołębiowska Aneta, **Study and analysis of parameters that influence GNSS signal acquisition** (Badanie i analiza czynników wpływających na akwizycję sygnału GNSS), supervisor: Borejko Tomasz, February 24

DEGREES AWARDED

[BSc6] Goraj Dawid, **Analysis of the properties of photonic crystals based on TiO_2** (Analiza własności kryształów fotonicznych na bazie TiO_2), supervisor: Mossakowska-Wyszyńska Agnieszka, July 3

[BSc7] Górski Damian, **Implementation of selected algorithms for coding internal states of a finite state machine** (Implementacja wybranych algorytmów kodowania stanów wewnętrznych automatu skończonego), supervisor: Wielgus Andrzej, February 10

[BSc8] Grajeta Mikołaj, **Technology of aluminum doped zinc oxide (AZO) layers for flexible and transparent photovoltaics** (Technologia warstw tlenku cynku domieszkowanego glinem (AZO) dla elastycznej i transparentnej fotowoltaiki), supervisor: Mroczyński Robert, February 14

[BSc9] Jaczyński Jarosław, **Project of implementation of a Schmitt trigger in VESTIC technology** (Projekt realizacji przerzutnika Schmitta w technologii VESTIC), supervisor: Pfitzner Andrzej, September 27

[BSc10] Kobus Dominik, **Vacuum station control system for magnetron sputtering** (Układ sterowania stanowiska próżniowego do rozpylania magnetronowego), supervisor: Szostak Sławomir, September 21

[BSc11] Kokoszka Jakub, **Testing the parameters of the quality of Internet services using open-source tools and the Raspberry PI platform** (Badanie parametrów jakości usług internetowych z wykorzystaniem narzędzi open-source i platformy Raspberry PI), supervisor: Niewiński Marek, February 14

[BSc12] Kosowski Paweł, **Integration of chosen Bluetooth LEmodule with Cypress PSoC v 5 microcontroller platform** (Integracja wybranego modułu Bluetooth LE z platformą mikrokontrolerów Cypress PSoC v 5), supervisor: Niewiński Marek, July 3

[BSc13] Mierzejewski Daniel, **Implementation of SMMU (System Memory Management Unit)Model in SystemVerilog Language** (Implementacja modelu jednostki zarządzania pamięcią systemową SMMU (System Memory Management Unit) w jeżyku SystemVerilog), supervisor: Pleskacz Witold, September 27

[BSc14] Misztal Jakub, **Implementation in Verilog HDL of the bridge circuit to convert Atomic Transactions from AMBA AXI5 standard to AMBA AXI4 standard** (Implementacja w języku Verilog układu mostka do konwersji transakcji atomowych (Atomic Transactions) ze standardu AMBA AXI5 do standardu AMBA AXI4), supervisor: Pleskacz Witold, February 10

[BSc15] Moniewski Michał, **Implementation of a Voltage Reference in 22 nm FD-SOI Technology** (Implementacja źródła napięcia odniesienia w technologii 22 nm FD-SOI), supervisor: Borejko Tomasz, September 21

[BSc16] Pałka Michał, **Platform for supplying low-power electronic devices with energy harvested from the environment** (Platforma do zasilania niskomocowych urządzeń elektronicznych energią pozyskaną z otoczenia), supervisor: Szostak Sławomir, February 14

[BSc17] Piaskowski Ludwik, **Data acquisition system for production processses using the OPC communication standard** (System akwizycji danych procesów produkcyjnych wykorzystujący standard komunikacji OPC), supervisor: Niewiński Marek, February 24

[BSc18] Pieniążek Andrzej, **Dedicated system for diagnostics of devices using CAN and LIN buses** (Dedykowany system do diagnostyki urządzeń wykorzystujących magistrale CAN i LIN), supervisor: Niewiński Marek, September 27

[BSc19] Prusinowski Patryk, **Cross-platform application for data acquisition via USB port** (Wieloplatformowa aplikacja do akwizycji danych za pomocą portu USB), supervisor: Niewiński Marek, February 24

[BSc20] Przybyłkowski Witold, **A tool for semiconductor device parameter extraction based on its electrical characteristics** (Narzędzie do identyfikacji parametrów konstrukcyjnych przyrządu półprzewodnikowego na podstawie jego charakterystyk elektrycznych), supervisor: Kasprowicz Dominik, February 14

[BSc21] Rutkowski Hubert, **Analysis of the durability of optical fiber sensors coated with thin layers of indium tin oxide** (Analiza trwałości czujników światłowodowych pokrytych cienkimi warstwami tlenku indu cyny), supervisor: Janik Monika, September 21

[BSc22] Salwa Agnieszka, **Smart alarm system** (Inteligentny system alarmowy), supervisor: Jaworski Zbigniew, February 10

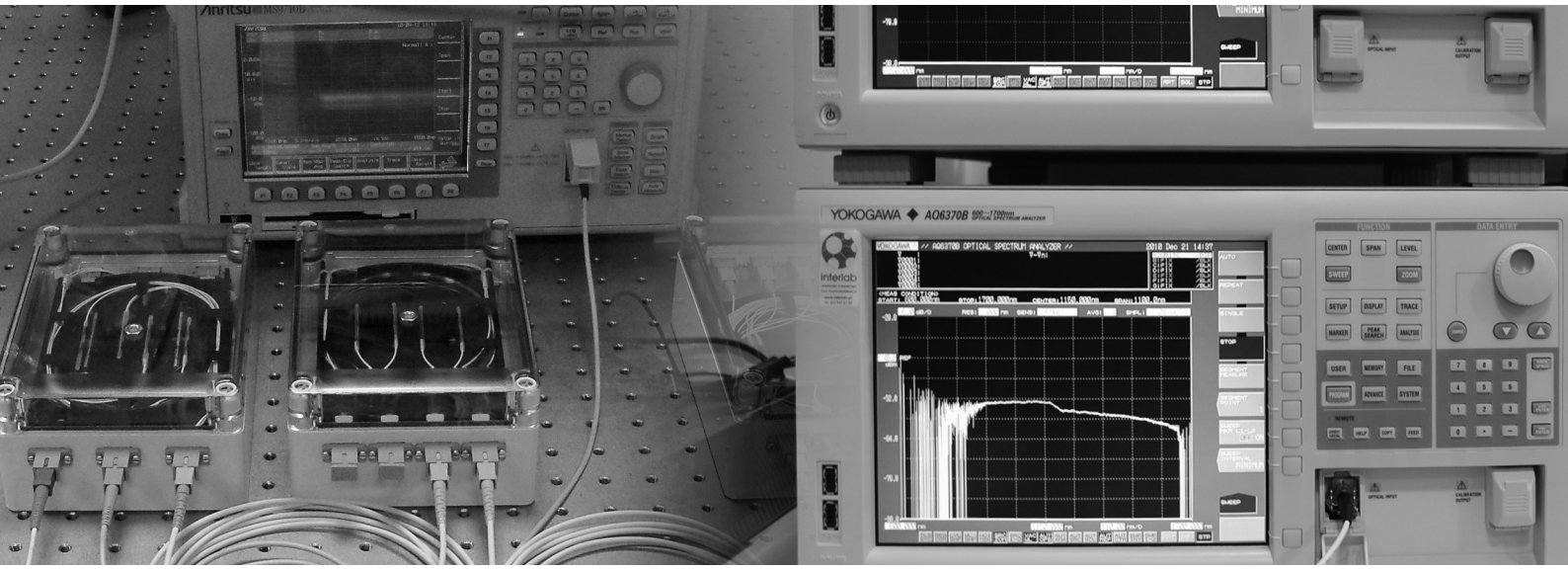
[BSc23] Steć Wojciech, **Adaptation of wireless personal alarm module to waterproof version** (Adaptacja bezprzewodowego osobistego modułu alarmowego do wersji wodoszczelnej), supervisor: Sochacki Mariusz, February 10

[BSc24] Wiśniewski Daniel, **Module for testing the operating characteristics of car fans** (Moduł do badania charakterystyki pracy wentylatorów samochodowych), supervisor: Szostak Sławomir, February 14

[BSc25] Władziński Marcin, **Implementation of voltage regulator for System on a Chip using FD-SOI 22 nm technology** (Implementacja regulatora napięcia zasilania dla scalonych systemów elektronicznych w technologii FD-SOI 22 nm), supervisor: Borejko Tomasz, February 10

[BSc26] Zbiciak Albert, **Design and implementation of bootloader subblocks** (Projekt i implementacja podbloków bootloadera dla procesora CCNV1), supervisor: Pleskacz Witold, February 10

[BSc27] Zieliński Michał, **Dedicated programming module for generating VeSFET transistor geometry description** (Dedykowany moduł programistyczny do generowania opisu geometrii tranzystora VeSFET), supervisor: Dec Bartosz, February 10



Optoelectronics Division

7. PUBLICATIONS

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

NUMBER	JOURNAL	AUTHORS	TITLE	DOI	VOLUME, NUMBER	PAGES, ARTICLE NUMBER
[Pub1]	ACS Omega	Shokri A., Melikhov Y., Syryanyy Y., Demchenko I.	Point Defects in Silicon-Doped Ga_2O_3: Hybrid-DFT Calculations	10.1021/acsomega.3c05557	vol. 8, no. 46	pp. 43732–43738
[Pub2]	Applied Optics	Butt M., Kozłowski Ł., Piramidowicz R.	Numerical scrutiny of silica-titania-based reverse rib waveguide with vertical and rounded side walls	10.1364/ao.480856	vol. 62, no. 5	pp. 1296–1302
[Pub3]	Applied Physics Letters	Janusz S., Drozdowska K., Rehman A., Welearegay T., Österlund L., Rumyantsev S., Cywiński G., Stonio B., Krajewska A., Sai P.	Low-frequency noise in Au-decorated graphene–Si Schottky barrier diode at selected ambient gases	10.1063/5.0152456	vol. 122, no. 21	pp.1–6, no. 211901
[Pub4]	Applied Surface Science	Wicher B., Chodun R., Greczynski G., Lachowski A., Trzciński M., Pshyk A., Król K., Kulikowski K., Skowroński Ł., Zdunek K.	Carbon ion self–sputtering attained by sublimation of hot graphite target and controlled by pulse injection of a neon–helium gas mixture	10.1016/j.apsusc.2023.156708	vol. 620	pp.1–15, no. 156708
[Pub5]	Carbon	Grzegorz S., Hänzi P., Filipkowski A., Janik M., Mrózek M., Stepanenko Y., Bogdanowicz R., Romano V., Heidt A., Buczyński R., Klimczak M.	Nonlinearity shaping in nanostructured glass-diamond hybrid materials for optical fiber preforms	10.1016/j.carbon.2023.118465	vol. 215, no. November	no. 118465
[Pub6]	Crystals	Witoński P., Mossakowska-Wyszyńska A., Szczepański P.	Gain Properties of the Single Cell of a One-Dimensional Photonic Crystal with PT Symmetry	10.3390/cryst13020258	vol. 13, no. 2	pp.1–12, no. 258
[Pub7]	Electronics (Switzerland)	Janaszek B., Butt M., Piramidowicz R.	Semi-Analytical Approach versus Finite Element Method for Analysis of Propagation Properties in Rectangular Waveguides: Silica-Titania Technological Platform	10.3390/electronics13010073	vol. 13, no. 1	pp.1–12, no. 73
[Pub8]	Electronics (Switzerland)	Marcinek K., Pleskacz W.	Variable Delayed Dual-Core Lockstep (VDCLS) Processor for Safety and Security Applications	10.3390/electronics12020464	vol. 12, no. 2	pp.1–18, no. 464
[Pub9]	Electronics (Switzerland)	Mierzwiński P., Kuźmicz W.	VES-BJT: A Lateral Bipolar Transistor on SOI with Polysilicon Emitter and Collector	10.3390/electronics12081871	vol. 12, no. 8	pp.1–18, no. 1871
[Pub10]	Electronics (Switzerland)	Wojciechowski A., Marcinek K., Pleskacz W.	Relative Jitter Measurement Methodology and Comparison of Clocking Resources Jitter in Artix 7 FPGA	10.3390/electronics12204297	vol. 12, no. 20	pp.1–31, no. 4297
[Pub11]	IEEE Journal of Selected Topics in Quantum Electronics	Janaszek B., Tyszka-Zawadzka A., Szczepański P.	Graphene-Based Hyperbolic Metamaterial Acting as Tunable THz Power Limiter	10.1109/jstqe.2023.3271766	vol. 29, no. 5: Terahertz Photonics	pp.1–9, no. 4700209

[1] Journal Citation Reports; https://jcr.clarivate.com

[Pub12]	Journal of Applied Physics	Haras M., Robillard J., Skotnicki T., Dubois E.	Design and fabrication of nanometer measurement platform for better understanding of silicon mechanical properties	10.1063/5.0152192	vol. 134, no. 2	pp. 1–15, no. 024305
[Pub13]	Journal of Lightwave Technology	Burnat D., Kwietniewski N., Bartnik K., Koba M., Kochanowska O., Kondracka K., Śmietana M.	Tailoring Refractive Index and Surface Sensitivity of an Optical Fiber Fabry-Perot Interferometer by a Thin Layer Deposition	10.1109/jlt.2022.3227030	vol. 41, no. 6	pp. 1865––1873
[Pub14]	Journal of Lightwave Technology	Esposito F., Stancalie A., Srivastava A., Śmietana M., Mihalcea R., Negut C., Campopiano S., Iadicicco A.	The impact of gamma irradiation on optical fibers identified using Long Period Gratings	10.1109/JLT.2022.3191163	vol. 41, no. 13	pp. 4389––4396
[Pub15]	Journal of Lightwave Technology	Paśnikowska A., Stopiński S., Kaźmierczak A., Piramidowicz R.	Multi-channel integrated transmitters with cyclic AWG	10.1109/jlt.2023.3339594	vol. early access	pp. 1–15
[Pub16]	Journal of Lightwave Technology	Widomski A., Stopiński S., Anders K., Piramidowicz R., Karpiński M.	Precise on-chip spectral and temporal control of single--photon-level optical pulses	10.1109/jlt.2023.3278987	vol. 41, no. 19	pp. 6255––6262
[Pub17]	Journal of Magnetism and Magnetic Materialsl	Pacewicz A., Krupka J., Mikkelsen J., Lynnyk A., Salski B.	Accurate measurements of the ferromagnetic resonance linewidth of single crystal BaM hexaferrite spheres employing magnetic plasmon resonance theory	10.1016/j.jmmm.2023.170902	vol. 580	pp. 1–8, no. 170902
[Pub18]	Materials	Brzozowski E., Kamiński M., Taube A., Sadowski O., Król K., Guziewicz M.	Carrier Trap Density Reduction at SiO_2/4H-Silicon Carbide Interface with Annealing Processes in Phosphoryl Chloride and Nitride Oxide Atmospheres	10.3390/ma16124381	vol. 16, no. 12	pp. 1–12, no. 4381
[Pub19]	Materials	Demchenko I., Nikiforow K., Chernyshova M., Melikhov Y., Syryanyy Y., Korsunska N., Khomenkova L., Brodnikovskyi Y., Brodnikovskyi D.	X-ray Photoelectron Spectroscopy Analysis of Scandia-Ceria-Stabilized Zirconia Composites with Different Transport Properties	110.3390/ma16165504	vol. 16, no. 16	pp. 1–12, no. 5504
[Pub20]	Materials	Irfan M., Khan Y., Rehman A., Ullah N., Khonina S., Kazanskiy N., Butt M.	Plasmonic Perfect Absorber Utilizing Polyhexamethylene Biguanide Polymer for Carbon Dioxide Gas Sensing Application	10.3390/ma16072629	vol. 16, no. 7	pp.1–13, no. 2629
[Pub21]	Materials	Kowalczyk M., Kaczkan M., Majchrowski A., Malinowski M.	A Comparative Study of Eu^{3+}-Doped Sillenites: $Bi_{12}SiO_20$ (BSO) and $Bi_{12}GeO_20$ (BGO)	10.3390/ma16041621	vol. 16, no. 4	pp.1–14, no. 1621
[Pub22]	Materials	Puźniak M., Seweryn A., Gajewski W., Klepka M., Witkowski B., Godlewski M., Mroczyński R.	Studies of Electrical Parameters and Thermal Stability of HiPIMS Hafnium Oxynitride (HfO_xN_y) Thin Films	10.3390/ma16062539	vol. 16, no. 6	pp. 1–16, no. 2539
[Pub23]	Materials Science in Semiconductor Processing	Jóźwik I., Jagielski J., Ciepielewski P., Dumiszewska E., Piętak-Jurczak K., Kamiński M., Kentsch U.	Depth-distribution of resistivity within ion-irradiated semiconductor layers revealed by low-kV scanning electron microscopy	10.1016/j.mssp.2023.107640	vol. 165	pp. 1–6, no. 107640

[Pub24]	Measurement	Butt M., Kazanskiy N., Khonina S.	Tapered waveguide mode converters for metal-insulator-metal waveguide plasmonic sensors	10.1016/j.measurement.2023.112601	vol. 211	pp.1–7, no. 112601
[Pub25]	Measurement	Grzegorz S., Filipkowski A., Pysz D., Warszewski J., Buczyński R., Śmietana M., Kasztelanic R.	From D-shaped to D-shape optical fiber – a universal solution for sensing and biosensing applications (Drawn D-shape fiber and its sensing applications)	10.1016/j.measurement.2023.113642	vol. 222, no. 30 November	pp.1–8, no. 113642
[Pub26]	Measurement	Pituła E., Janik M., Sezemsky P., Szymańska K., Olszewski M., Stranak V., Koba M., Śmietana M.	Smartphone-based dynamic measurements of electro--optically modulated lossy-mode resonance and its biosensing applications	10.1016/j.measurement.2022.112349	vol. 206, no. January	pp.1–9, no. 112349
[Pub27]	Measurement	Sezemsky P., Koba M., Curda P., Bogdanowicz R., Stranak V., Śmietana M.	Electro-optical transducer based on indium-tin-oxide-coated optical fiber for analysis of ionized media	10.1016/j.measurement.2023.112695	vol. 212	pp.1–8, no. 112695
[Pub28]	Microchimica Acta	Ficek M., Cieślik M., Janik M., Brodowski M., Sawczak M., Bogdanowicz R., Ryl J.	Boron-doped diamond nanosheet volume-enriched screen-printed carbon electrodes: a platform for electroanalytical and impedimetric biosensor applications	10.1007/s00604-023-05991-w	vol. 190, no. 10	pp.1–14, no. 410
[Pub29]	Micromachines	Butt M.	Numerical Assessment of a Metal-Insulator-Metal Waveguide-Based Plasmonic Sensor System for the Recognition of Tuberculosis in Blood Plasma	10.3390/mi14040729	vol. 14, no. 4	pp.1–11, no. 729
[Pub30]	Micromachines	Shahbaz M., Butt M., Piramidowicz R.	Breakthrough in Silicon Photonics Technology in Telecommunications, Biosensing, and Gas Sensing	10.3390/mi14081637	vol. 14, no. 8	pp.1–32, no. 1637
[Pub31]	Nanomaterials	Kazanskiy N., Khonina S., Butt M.	Recent Development in Metasurfaces: A Focus on Sensing Applications	10.3390/nano13010118	vol. 13, no. 1	pp.1–24, no. 118
[Pub32]	Nanomaterials	Voronkov G., Aleksakina Y., Ivanov V., Zakoyan A., Stepanov I., Grakhova E., Butt M., Kutluyarov R.	Enhancing the Performance of the Photonic Integrated Sensing System by Applying Frequency Interrogation	10.3390/nano13010193	vol. 13, no. 1	pp.1–15, no. 193
[Pub33]	Nanoscale	Dróżdż P., Haras M., Przewłoka A., Krajewska A., Filipiak M., Słowikowski M., Stonio B., Czerniak-Łosiewicz K., Mierczyk Z., Skotnicki T., Dmitry L.	A graphene/h-BN MEMS varactor for sub-THz and THz applications	10.1039/D2NR06863J	vol. 15, no. 30	pp. 12530––12539
[Pub34]	Optical Materials Express	Sarnecki J., Malinowski M., Podniesiński D.	Electron spin resonance study of an annealed Cr,Mg:YAG epitaxial saturable absorber	10.1364/ome.497450	vol. 13, no. 11	pp. 3098––3112
[Pub35]	Optics and Lasers in Engineering	Suszek J., Makowski M., Kołodziejczyk A., Włodarczyk F., Sobczyk A., Nurczyk P., Duda P., Starobrat J., Beck R., Kowalczyk A., Sypek M.	Extended depth of focus for high-end machine vision lenses by annular achromatic add-on diffractive elements	10.1016/j.optlaseng.2022.107445	vol. 162	pp.1–10, no. 107445

[Pub36]	Optics Express	Janaszek B., Tyszka-Zawadzka A., Szczepański P.	Dispersion-enabled control of photonic density of states in photonic hypercrystals	10.1364/oe.496980	vol. 31, no. 17	pp. 27948––27961
[Pub37]	Optics Express	Łabaj F., Kalwas J., Piramidowicz R.	Design and development of a miniature mid-infrared linear variable filter based spectrometer for environmental sensing	10.1364/oe.497564	vol. 31, no. 23	pp.1–14, no. 37583
[Pub38]	Optics Express	Mossakowska-Wyszyńska A., Witoński P., Szczepański P.	Nonlinear operation of an FP laser with PT symmetry active medium	10.1364/oe.479222	vol. 31, no. 5	pp.8518––8534, no. 479222
[Pub39]	Optics Express	Armas D., Kwietniewski N., Matias I., Burnat D., Śmietana M., Del Villar I.	Enhancement of lossy mode resonance sensing properties by the introduction of an intermediate low-refractive-index layer	10.1364/OL.487135	vol. 48, no. 12	pp.3123––3126
[Pub40]	Opto-Electronics Review	Fokt M., Jasik A., Sankowska I., Mączko H., Paradowska K., Czuba K.	The growth and characterisation of type I GaSb/AlSb superlattice with a thin GaSb layer	10.24425/opelre.2023.147912	vol. 31, no. 4	pp.1–7
[Pub41]	Opto-Electronics Review	Shahbaz M., Kozłowski Ł., Butt M., Piramidowicz R.	Mitigating the bending losses of the silica-titania-based rib waveguide structure	10.24425/opelre.2023.145551	vol. 31, no. 1	pp.1–7, no. e145551
[Pub42]	Physica Status Solidi A-Applications and Materials Science	Taube A., Borysiewicz M., Sadowski O., Wójcicka A., Tarenko J., Wzorek M	All-Oxide Transparent Vertical Indium Tin Oxide and Aluminum-Doped Zinc Oxide/ -Ga_2O_3 Schottky Diodes	10.1002/pssa.202300251	vol. 220, no. 19	pp.1–7, no. 2300251
[Pub43]	Plasmonics	Butt M., Kazanskiy N., Khonina S.	Miniaturized Design of a 1×2 Plasmonic Demultiplexer Based on Metal–Insulator-Metal Waveguide for Telecommunication Wavelengths	10.1007/s11468-023-01795-z	vol. 18	pp. 635–641
[Pub44]	Przegląd Elektrotechniczny	Bolek K., Urbański M.	Effect of the Preamplifier Stage on the Acquisition of Low-Amplitude Nonlinear Dynamics Signals	10.15199/48.2023.10.39	vol. 99, no. 10	pp. 200–203
[Pub45]	Scientific Reports	Janik M., Gabler T., Koba M., Panasiuk M., Dashkevich Y., Łęga T., Dąbrowska A., Naskalska A., Żołędowska S., Nidzworski D., Pyrć K., Gromadzka B., Śmietana M.	Low-volume label-free SARS-CoV-2 detection with the microcavity-based optical fiber sensor	10.1038/s41598-023-28790-y	vol. 13, no. 1	pp.1–10, no. 1512
[Pub46]	Scientific Reports	Janik M., Lechowicz K., Pituła E., Warszewski J., Koba M., Śmietana M.	Enhanced spectroelectrochemistry with lossy-mode resonance optical fiber sensor	10.1038/s41598-023-42853-0	vol. 13, no. 1	pp.1–10, no. 15523
[Pub47]	Scientific Reports	Nabiałek A., Chumak O., Aleshkevych P., Domagala J., Pacewicz A., Salski B., Krupka J., Seki T., Takanashi K., Baczewski L., Szymczak H.	Influence of the strain effect on magnetocrystalline anisotropy in Co_2Fe0.4Mn0.6Si Heusler alloys	10.1038/s41598-023-43979-x	vol. 13, no. 1	pp.1–9, no. 17016
[Pub48]	Sensors and Actuators B – Chemical	Dominguez I., Corres J., Del Villar I., Mozo J., Simerova R., Sezemsky P., Stranak V., Śmietana M., Matias I.	Electrochemical lossy mode resonance for detection of manganese ions	10.1016/j.snb.2023.134446	vol. 394, no. 1	pp.1–10, no. 134446

[Pub49]	Sensors and Actuators B – Chemical	Drozdowska K., Rehman A., Smulko J., Rumyantsev S., Stonio B., Krajewska A., Słowikowski M., Filipiak M., Sai P., Cywiński G.	Enhanced gas sensing by graphene-silicon Schottky diodes under UV irradiation	10.1016/j.snb.2023.134586	vol. 396	pp.1–9, no. 134586
[Pub50]	Solid-State Electronics	Wiśniewski P., Mazurak A., Jasiński J., Beck R.	Study of silicon-oxide RRAM devices based on complex impedance spectroscopy	10.1016/j.sse.2023.108732	vol. 208	pp.1–5, no. 108732
[Pub51]	The Journal of Physical Chemistry Part C: Nanomaterials, Interfaces and Hard Matter	Lipińska W., Olejnik A., Janik M., Brodowski M., Sapiega K., Pierpaoli M., Siuzdak K., Bogdanowicz R., Ryl J.	Texture or Linker? Competitive Patterning of Receptor Assembly toward Ultra-Sensitive Impedimetric Detection of Viral Species at Gold-Nanotextured Titanium Surfaces	10.1021/acs.jpcc.3c00697	vol. 127, no. 20	pp. 9584––9593

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

NUMBER	JOURNAL	AUTHORS	TITLE	DOI	VOLUME NUMBER	PAGES, ARTICLE NUMBER
[Pub52]	Elektronika – Konstrukcje, Technologie, Zastosowania	Kasprowicz G., Siwiec K., Kasprowicz D., Wojciechowski A., Borkowski A., Pleskacz W., Sowiński M., Przywózki T., Kulik P., Poźniak K., Wawrzyniak Z.	Design of a cryogenic integrated circuit for next-generation quantum computers	10.15199/13.2023.8.13	vol. 64, no. 8	pp.69–70
[Pub53]	Elektronika – Konstrukcje, Technologie, Zastosowania	Kasprowicz G., Sowiński M., Poźniak K., Szmidt J., Przywózki T., Kulik P., Kuś M., Wawrzyniak Z., Szczepański P., Słowik O., Życzkowski M., Marć P., Pakuła A., Nawrat A., Daniec K., Wereszczyński K., Kuczerski T., Kawałek R., Sadowski M., Suleja W., Witkowski P.	Electronic control system for the quantum computer infrastructure in the MIKOK project	10.15199/13.2023.8.14	vol. 64, no. 8	pp.72–75
[Pub54]	Elektronika – Konstrukcje, Technologie, Zastosowania	Kasprowicz G., Wawrzyniak Z., Poźniak K., Szmidt J., Sowiński M., Kulik P., Przywózki T., Kisiel A., Kornakov G., Beck R., Wiśniewski P., Knap W., Trzeciak L., Sypek M., Nurczyk P.	CEZAMAT technical potential usage in organising the quantum computer technology laboratory	10.15199/13.2023.8.15	vol. 64, no. 8	pp.76–80
[Pub55]	Elektronika – Konstrukcje, Technologie, Zastosowania	Malinowski M., Kisiel A., Szmidt J., Poźniak K., Kasprowicz G., Wawrzyniak Z., Wiśniewski P.	Quantum technologies – strategic development priority for the Warsaw University of Technology	10.15199/13.2023.8.1	vol. 64, no. 8	pp.2–4
[Pub56]	Encyclopedia	Butt M.	Integrated Optics: Platforms and Fabrication Methods	10.3390/encyclopedia3030059	vol. 3, no. 3	pp. 824––838
[Pub57]	Heliyon	Rehman A., Khan Y., Ahmed R., Ullah N., Butt M.	Human tracking robotic camera based on image processing for live streaming of conferences and seminars	10.1016/j.heliyon.2023.e18547	vol. 9, no. 8	pp.1–14, no. e18547
[Pub58]	Heliyon	Trihan R., Bogucki O., Kozlowska A., Ihle M., Ziesche S., Fetliński B., Janaszek B., Kieliszczyk M., Kaczkan M., Rossignol F., Aimable A.	Hybrid gold-silica nanoparticles for plasmonic applications: A comparison study of synthesis methods for increasing gold coverage	10.1016/j.heliyon.2023.e15977	vol. 9, no. 5	pp.1–14, no. e15977

[Pub59]	International Journal of Electronics and Telecommunications	Lelit M., Białecki A., Gabler T., Łabaj F., Pituła E., Romaniuk R.	Selected Advances of Quantum Biophotonics – a Short Review	10.24425/ijet.2023.144376	vol. 69, no. 2	pp. 399–405
[Pub60]	Photonics	Butt M., Shahbaz M., Kozłowski Ł., Kaźmierczak A., Piramidowicz R.	Silica-Titania Integrated Photonics Platform-Based 1 × 2 Demultiplexer Utilizing Two Serially Cascaded Racetrack Microrings for 1310 nm and 1550 nm Telecommunication Wavelengths	10.3390/photonics10020208	vol. 10, no. 2	pp.1–12, no. 208
[Pub61]	Photonics	Butt M., Shahbaz M., Piramidowicz R.	Racetrack Ring Resonator Integrated with Multimode Interferometer Structure Based on Low-Cost Silica–Titania Platform for Refractive Index Sensing Application	10.3390/photonics10090978	vol. 10, no. 9	pp.1–10, no. 978
[Pub62]	Photonics	Rehman A., Khan Y., Irfan M., Butt M.	Investigation of Optical-Switching Mechanism Using Guided Mode Resonances	10.3390/photonics10010013	vol. 10, no. 1	pp.1–17, no. 13
[Pub63]	Photonics	Shahbaz M., Butt M., Piramidowicz R.	A Concise Review of the Progress in Photonic Sensing Devices	10.3390/photonics10060698	vol. 10, no. 6	pp.1–27, no. 698
[Pub64]	Photonics Letters of Poland	Kilicaslan E., Butt M., Kaźmierczak A., Piramidowicz R.	Technological challenges in the development of silica-titania platform for integrated optics	10.4302/plp.v15i3.1221	vol. 15, no. 3	pp.42–44

7.3. Scientific and Technical Papers Published in Conference Proceedings

NUMBER	PROCEEDINGS OF CONFERENCE / ISBN	AUTHORS	TITLE	DOI	PAGES, ARTICLE NUMBER
[Pub65]	46th International Spring Seminar on Electronics Technology (ISSE) ISBN 979-8-3503-3485-2	Myśliwiec M., Kisiel R.	Die attachment Process Overview for High Power Semiconductors	10.1109/ISSE57496.2023.10168484	pp.1–5
[Pub66]	Extended Abstracts of: 46th International Spring Seminar On Electronics Technology ISBN 978-606-35-0528-7	Myśliwiec M., Kisiel R.	Die attachment processes overview for high power semiconductors		pp. 64–65, no. C086
[Pub67]	IEEE/MTT-S International Microwave Symposium: IMS ISBN 979-8-3503-4764-7	Krupka J., Pacewicz A., Salski B., Prusak D., Magalski A.	Multi-Frequency Resonant Measurements of the Complex Permittivity and Initial Permeability of Barium Ferrite Ceramic	10.1109/ims37964.2023.10187947	pp. 490––492
[Pub68]	Materiały XLV seminarium „System oceny zgodności wyrobów elektronicznych i elektrotechnicznych"	Sochacki M.	Nowe technologie na rzecz miniaturyzacji i poprawy sprawności energetycznej urządzeń elektrycznych		pp. 27–29
[Pub69]	Proceedings of 2023 IEEE International Meeting for Future of Electron Devices ISBN 979-8-3503-9378-1	Wiśniewski P., Stonio B., Jasiński J., Mazurak A.	Characterization of resistive switching phenomena in thermal silicon oxide RRAM devices by means of small-signal measurements	10.1109/imfedk60983.2023.10366347	pp.1–2

[Pub70]	Proceedings of 30th International Conference on Mixed Design of Integrated Circuits and System (MIXDES 2023) ISBN 979-8-3503-1352-9	Wojciechowski A., Marcinek K., Pleskacz W.	Dual TDL Based Phase Difference Detector Architecture	10.23919/mixdes58562.2023.10203267	pp. 122–126
[Pub71]	Proceedings of SPIE: European Workshop on Optical Fibre Sensors (EWOFS 2023) vol. 12643 ISBN 9781510665002	Burnat D., Szot-Karpińska K., Sezemsky P., Janik M., Koba M., Niedziółka-Jönsson J., Stranak V., Śmietana M.	Opto-electrochemical sensing of C-reactive protein using optical fiber lossy-mode resonance sensor	10.1117/12.2678113	pp.1–4, no. 126430X
[Pub72]		Esposito F., Stancalie A., Srivastava A., Śmietana M., Mrazek J., Mihalcea R., Negut D., Campopiano S., Iadicicco A.	Response of long period gratings written in B/Ge and P-doped optical fibers to gamma radiation	10.1117/12.2678163	pp.1–4, no. 126430A
[Pub73]		Gabler T., Valapil K., Jarosińska E., Krześniak A., Janik M., Koba M., Witkowska-Nery E., Jonsson-Niedziolka M., Śmietana M.	Microcavity in-line Mach-Zehnder interferometer and electrochemical assays combined for cell monitoring system	10.1117/12.2679199	pp.1–4, no. 1264312
[Pub74]		Janik M., Niedziałkowski P., Lechowicz K., Koba M., Sezemsky P., Stranak V., Śmietana M.	Does the refractive index sensitivity matter the most? Charge of biological material and performance of label-free biosensors	10.1117/12.2678085	pp.1–4, no. 1264315
[Pub75]	Proceedings of SPIE: Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues XXI vol. 12383 ISBN 9781510658714	Stojek R., Łabaj F.	Modular, multispectral infrared imaging system for reflection and transmission measurements	10.1117/12.2649254	pp.1–7
[Pub76]	Proceedings of SPIE: Infrared Imaging Systems: Design, Analysis, Modeling, and Testing XXXIV vol. 12533 ISBN 978-1-5106-6181-3	Leshchenko Y., Kaczmarek K., Łabaj F., Małecki S., Miedziński D., Sochacki M.	Imaging infrared seeker design and tests for FOK guided missile	10.1117/12.2665111	pp.1–14
[Pub77]	Proceedings of the 2023 Conference on Lasers and Electro-Optics Europe & European Quantum Electronics Conference (CLEO/Europe-EQEC) ISBN 979-8-3503-4600-8	Lelit M., Anders K., Słowikowski M., Juchniewicz M., Stonio B., Stopiński S., Piramidowicz R.	Advanced Optical Interfaces for Silicon-Nitride-Based Bio-Photonic Platform Operating in Visible Spectral Range	10.1109/cleo/europe-eqec57999.2023.10232749	pp.1–1
[Pub78]		Piramidowicz R., Stopiński S., Anders K., Jusza A., Lelit M., Połatyński A., Wiśniewski P., Słowikowski M., Juchniewicz M., Pavłov K., Żbik M., Jureńczyk J., Pierściński K., Pierścińska D.	MIRPIC - A Rising Photonic Integration Platform for Mid-Infrared	10.1109/cleo/europe-eqec57999.2023.10231876	pp.1–1
[Pub79]	Proceedings of Twelfth International Conference on Image Processing Theory, Tools and Applications (IPTA 2023) ISBN 979-8-3503-2541-6	Dzieniszewska A., Garbat P., Piramidowicz R.	Skin Lesion Classification Based on Segmented Image	10.1109/ipta59101.2023.10320004	pp.1–6
[Pub80]	Proceedings of: 14th Electron Technology Conference ELTE 2023 ISBN 978-83-64102-05-9	Anders K., Stopiński S., Jusza A., Paśnikowska A., Słowikowski M., Piramidowicz R.	Układy fotoniki scalonej w generycznej technologii fosforku indu		pp. 238–239, no. SP|56

[Pub81]	Proceedings of: 14th Electron Technology Conference ELTE 2023 ISBN 978-83-64102-05-9	Bieniek A., Stopiński S., Piramidowicz R.	Zintegrowane lasery jednoczęstotliwościowe do zastosowań w układach żyroskopowych	pp. 242–243, no. SP|58
[Pub82]		Bolek K., Kliś B., Woliński T., Rutkowska K., Sobotka P.	Wykorzystanie niechłodzonych fotodiod lawinowych do detekcji sygnału z materiałów scyntylacyjnych	pp. 202–203, no. SP|38
[Pub83]		Borecki M., Zan L., Szmidt J.	Zastosowanie technologii Internetu Rzeczy w urządzeniach czujnikowych przeznaczonych do pomiarów parametrów atmosfery	pp. 132–133, no. SP|03
[Pub84]		Borkowski A., Siwiec K., Pleskacz W.	Przetwornik C/A do sterowania elektrodami DC kriogenicznych pułapek jonowych w komputerach kwantowych następnej generacji	pp. 278–279, no. SP|76
[Pub85]		Bortnowski P., Lelit M., Połatyński A., Bieniek A., Butt M., Stopiński S., Piramidowicz R.	Multipleksery AWG dla platformy technologicznej HYPHa – projekty i zastosowania	pp. 234–325, no. SP|54
[Pub86]		Butryn I., Siwiec K., Pleskacz W.	Metoda projektowania scalonego generatora drgań elektrycznych o architekturze hybrydowej	pp. 276–277, no. SP|75
[Pub87]		Dąbrowski P., Jasiński J.	Koncepcja systemu do pomiaru prędkości i przemieszczenia łodzi względem brzegu	pp. 136–137, no. SP|05
[Pub88]		Dec B., Pfitzner A.	Koncepcja pamięci FLASH NAND dla integracji w technologii VeSTIC	pp. 156–157, no. SP|15
[Pub89]		Filipiak M., Juchniewicz M., Myśliwiec M., Pavłov K., Słowikowski M., Stonio B., Wiśniewski P.	Optymalizacja procesu fotolitografii na transparentnych podłożach	pp. 198–199, no. SP|36
[Pub90]		Firek P., Czerwosz E., Wronka H., Szmidt J., Kozłowski M., Furmańczyk P.	Technologia wytwarzania i właściwości gradientowych warstw węglowo-palladowych	pp. 90–91, no. R|40
[Pub91]		Firek P., Stonio B., Kondracka K., Caban P.	Technology of transistor with a two-dimensional MoS_2 layer in the gate area	pp. 158–159, no. SP|16
[Pub92]		Gabler T., Janik M., Sosnowska M., Koba M., Myśliwiec A., Kutwin M., Sawosz-Chwalibóg E., Śmietana M.	Życie w światłowodzie: Monitorowanie komórek interferometrem mikrownękowym	pp. 210–211, no. SP|42
[Pub93]		Golas M., Stonio B., Słowikowski M., Pavłov K., Lelit M., Wiśniewski P.	Modelowanie dyspersji anomalnej w falowodach z azotku krzemu	pp. 250–251, no. SP|62
[Pub94]		Grajeta M., Fetliński B., Warda P., Ożga M., Witkowski B., Mroczyński R.	Technologia i optymalizacja warstw tlenku cynku domieszkowanego glinem (AZO) dla zastosowań w ogniwach fotowoltaicznych	pp. 264–265, no. SP|69
[Pub95]		Haras M., Ahmed N., Wiśniewski P., Skotnicki T.	Energy harvesting in application to powering detectors of THz radiation	pp. 28–29, no. R|09
[Pub96]		Janaszek B., Fetliński B., Kaczkan M., Kieliszczyk M., Szczepański P., Trihan R., Aimable A., Rossignol F., Kozlowska A., Bogucki O., Kowalko J., Ihle M., Ziesche S., Giemza P., Szczypa M.	Plasmonic sensor based on nanoshells for detection of water contaminants	pp. 206–207, no. SP|40

[Pub97]	Proceedings of: 14th Electron Technology Conference ELTE 2023 ISBN 978-83-64102-05-9	Janaszek B., Tyszka-Zawadzka A., Kieliszczyk M., Mroczyński R., Szczepański P.	Kształtowanie właściwości optycznych metamateriałów anizotropowych	pp.98–99, no. R|44
[Pub98]		Janaszek B., Tyszka-Zawadzka A., Szczepański P.	Analiza gęstości stanów w hiperkryształe fotonicznym	pp. 256–257, no. SP|65
[Pub99]		Juchniewicz M., Słowikowski M., Stonio B., Michalak B., Pavlov K., Filipiak M., Myśliwiec M., Lelit M., Wiśniewski P., Stopiński S., Beck R., Piramidowicz R.	Technologia wytwarzania pasywnych fotonicznych układów scalonych na zakres średniej poczerwieni	pp. 228–229, no. SP|51
[Pub100]		Judek J., Mroczyński R., Jastrzębski C., Ożga M., Seweryn A., Witkowski B., Godlewski M., Belosludtsev A., Bitinaitis I.	Metody pasywacji materiałów 2D na przykładzie grafenu CVD	pp. 188–189, no. SP|31
[Pub101]		Jusza A., Anders K., Bortnowski P., Kaźmierczak A., Butt M., Zięba M., Tyszkiewicz C., Karasiński P., Piramidowicz R.	Elementy optycznie aktywne dla platformy HYPHa	pp. 236–236, no. SP|55
[Pub102]		Kalenik J., Steplewski W., Borecki J., Chołaj A., Kozłowski M., Serzysko T.	Fałszywy efekt piezorezystywny w polimerowo-węglowych rezystorach grubowarstwowych	pp. 170–171, no. SP|22
[Pub103]		Kaźmierczak A., Butt M., Kozłowski Ł., Shahbaz M., Połatyński A., Jusza A., Anders K., Stopiński S., Olszewski J., Martynkien T., Duda Ł., Czyż K., Pawłów J., Prokop K., Zdończyk M., Rola K., Guzik M., Cybińska J., Zięba M., Tyszkiewicz C., Karasiński P., Piramidowicz R.	Demonstrator układu czujnikowego na platformie HYPHa-koncepcja i projekt	pp. 204–205, no. SP|39
[Pub104]		Kieliszczyk M., Janaszek B., Fetliński B.	The role of genetic programming in photonic design	pp. 230–231, no. SP|52
[Pub105]		Kozłowska A., Bogucki O., Węglarz H., Szysiak A., Kaczkan M., Fetliński B., Janaszek B., Kieliszczyk M., Trihan R., Rossignol F., Aimable A., Ihle M., Ziesche S., Giemza P.	Luminoforowe źródła światła do zastosowań oświetleniowo-czujnikowych	pp.76–77, no. R|33
[Pub106]		Kozłowski Ł., Shahbaz M., Połatyński A., Dudek M., Butt M., Kaźmierczak A., Piramidowicz R.	Podstawowe bloki funkcjonalne platformy technologicznej HYPHa	pp. 232–232, no. SP|53
[Pub107]		Kwietniewski N., Martychowiec A., Koba M., Śmietana M.	Masowe wytwarzanie cienkowarstwowych interferometrów światłowodowych	pp. 220–221, no. SP|47
[Pub108]		Lelit M., Słowikowski M., Juchniewicz M., Stonio B., Michalak B., Pavlov K., Filipiak M., Myśliwiec M., Duszczyk A., Karoń S., Wiśniewski P., Anders K., Stopiński S., Beck R., Piramidowicz R.	Scalone sensory biofotoniczne na platformie SiN	pp.46–47, no. R|18
[Pub109]		Majkusiak B.	Modelowanie układu sprzężonych nano-obszarów w ultracienkiej warstwie izolatora	pp.84–85, no. R|37
[Pub110]		Małkowski A., Stonio B., Pavlov K., Filipiak M., Wiśniewski P., Firek P.	Wytwarzanie tlenku chromu metodą PVD do zastosowań w maskach fotolitograficznych	pp. 186–187, no. SP|30
[Pub111]		Michalak B., Słowikowski M., Pavlov K., Filipiak M., Juchniewicz M., Stonio B., Myśliwiec M., Golas M., Haras M., Wiśniewski P., Beck R.	Wytwarzanie krzemowych struktur podwieszanych na potrzeby fotonicznych układów scalonych	pp. 226–227, no. SP|50

[Pub112]	Proceedings of: 14th Electron Technology Conference ELTE 2023 ISBN 978-83-64102-05-9	Mierzwiński P.	Komplementarne tranzystory bipolarne w technologii VESTIC i podsumowanie badań	pp. 154–155, no. SP|14
[Pub113]		Mroczyński R.	Ultracienkie warstwy PVD w przyrządach mikro/nanoelektroniki oraz fotoniki	pp.18–18, no. R|04
[Pub114]		Musolf P., Burnat D., Kwietniewski N., Martychowiec A., Bartnik K., Roźniecka E., Janik M., Koba M., Rygiel T., Śmietana M., Niedziolka-Jonsson J.	Optymalizacja modyfikacji powierzchni czujnika światłowodowego do wykrywania markerów stanu zapalnego	pp.212-213, no. SP|43
[Pub115]		Myśliwiec M., Kisiel R.	Wpływ technologii montażu diod SiC w obudowie TO-257 na szybkość chłodzenia	pp. 272–273, no. SP|73
[Pub116]		Nieborek M., Jastrzębski C., Płociński T., Wróbel P., Seweryn A., Judek J.	Właściwości azotku tytanu jako materiału plazmonicznego kompatybilnego z technologią CMOS	pp. 178–179, no. SP|26
[Pub117]		Niemirski W., Jasiński J.	Koncepcja urządzania do pomiaru efektywnej powierzchni czołowej (CdA) kolarza	pp. 130–131, no. SP|02
[Pub118]		Ożga M., Godlewski M., Sybilski P., Mroczyński R., Witkowski B.	Nanostruktury tlenkowe wzrastane prostą i szybką odmianą metody hydrotermalnej	pp.92–93, no. R|41
[Pub119]		Pavłov K., Filipiak M., Słowikowski M., Wiśniewski P.	Analiza defektów powierzchni mikrosoczewek wytworzonych metodą elektronolitografii	pp. 260–261, no. SP|67
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[Pub121]		Piramidowicz R., Stopiński S., Anders K., Jusza A., Paśnikowska A., Lelit M., Połatyński A., Kaźmierczak A., Butt M., Wiśniewski P., Słowikowski M., Juchniewicz M., Pavłov K., Żbik M., Jureńczyk J., Pierściński K., Pierścińska D.	Fotoniczne Układy Scalone – technologie , wyzwania i perspektywy	pp. 66–67, no. R|28
[Pub122]		Pituła E., Kouao D., Grochowska K., Sezemsky P., Simerova R., Siuzdak K., Stranak V., Śmietana M.	Nanorurki ditlenku tytanu wytwarzane metodą anodyzacji na potrzeby czujnikowe	pp. 192–193, no. SP|33
[Pub123]		Poźniak K., Kasprowicz G., Szmidt J., Kuś M., Wawrzyniak Z., Kulik P., Sowiński M., Szczepański P., Życzkowski M., Marć P., Pakuła A., Nawrat A., Daniec K., Wereszczyński K., Kuczerski T., Kawałek R., Sadowski M., Suleja W., Witkowski P.	Budowa infrastruktury jednostki komputera kwantowego do cywilnych i specjalnych zastosowań informatycznych	pp.56–56, no. R|23
[Pub124]		Puźniak M., Mroczyński R., Gajewski W., Seweryn A.	Badania parametrów elektrycznych i stabilności termicznej cienkich warstw tlenku-azotku hafnu (HfOxNy) wytworzonych technologią HIPIMS	pp. 168–169, no. SP|21
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[Pub126]		Różański P., Mroczyński R., Gajewski W.	Wpływ wyładowania HIPIMS na wytwarzanie ultracienkich warstw tlenków metali do zastosowań w pamięciach typu RRAM	pp. 180–181, no. SP|27

[Pub127]	Proceedings of: 14th Electron Technology Conference ELTE 2023 ISBN 978-83-64102-05-9	Sikora J., Warszewski J., Martychowiec A., Kwietniewski N., Koba M., Śmietana M.	Światłowodowa mikroelektroda do zastosowań analitycznych	pp. 208–209, no. SP|41
[Pub128]		Słowikowski M., Lelit M., Juchniewicz M., Stonio B., Michalak B., Pavłov K., Filipiak M., Myśliwiec M., Golas M., Wiśniewski P., Anders K., Stopiński S., Beck R., Piramidowicz R.	Rozwój platformy fotoniki scalonej bazującej na azotku krzemu	pp. 110–111, no. R|50
[Pub129]		Śmietana M.	Bioczujniki światłowodowe – nowe możliwości badania małych objętości z podwyższoną wiarygodnością	pp. 38–39, no. R|14
[Pub130]		Sochacki M.	Nowe technologie półprzewodnikowe na rzecz poszanowania energii	pp.22–23, no. R|06
[Pub131]		Stonio B., Golas M., Słowikowski M., Filipiak M., Wiśniewski P., Krajewska A., Firek P.	Technologia wytwarzania struktur fotonicznych oraz integracji z detektorami opartymi na materiałach 2D	pp. 244–245, no. SP|59
[Pub132]		Stopiński S., Anders K., Jusza A., Lelit M., Połatyński A., Słowikowski M., Wiśniewski P., Jureńczyk J., Liebert M., Pierściński K., Pierścińska ., Piramidowicz R.	MIRPIC – nowa platforma fotoniki scalonej na zakres mid-IR	pp. 240–241, no. SP|57
[Pub133]		Taube A., Kamiński M.	Projektowanie zakończenia złącza wertykalnych diod p-i-n z azotku galu o napięciu pracy do 1200V	pp. 146–147, no. SP|10
[Pub134]		Taube A., Kamiński M., Ekielski M., Tarenko J., Sadowski O., Pągowska K., Kosiel K., Kruszka R., Zadura M., Brzozowski E., Kisiel R., Prystawko P., Bockowski M., Grzegory I., Szerling A.	Lateralne i wertykalne przyrządy półprzewodnikowe na bazie azotku galu do zastosowań w elektronice dużej mocy	pp.26–27, no. R|08
[Pub135]		Taube A., Kamiński M., Ekielski M., Tarenko J., Sadowski O., Pągowska K., Kosiel K., Kruszka R., Zadura M., Brzozowski E., Kisiel R., Prystawko P., Bockowski M., Grzegory I., Szerling A.	Wertykalne diody Schottky'ego i heterozłączowe na bazie tlenku galu	pp. 144–145, no. SP|09
[Pub136]		Wiśniewski P., Mazurak A., Jasiński J., Stonio B., Filipiak M., Beck R.	Przyrządy RRAM na bazie struktur MIS z tlenkiem krzemu	pp.44–45, no. R|17
[Pub137]		Zabrzewski J., Jasiński J., Wiśniewski P., Szostak S.	Koncepcja jednostki wymuszająco-pomiarowej do charakteryzacji struktur typu RRAM	pp. 274–275, no. SP|74
[Pub138]		Zdanowicz M., Koba M., Osuch T.	Mikroobróbka laserowa do wytwarzania pasywnych elementów fotonicznych	pp. 222–223, no. SP|48
[Pub139]	Program of the 9th International Symposium on Optical Materials, IS-OM'9	Butt M., Rola K., Guzik M., Bachmatiuk A., Tyszkiewicz C., Karasiński P., Martynkien T., Olszewski J., Kaźmierczak A., Piramidowicz R.	HYPHa project -A voyage of developing a low-cost integrated photonic platform	pp.16–16
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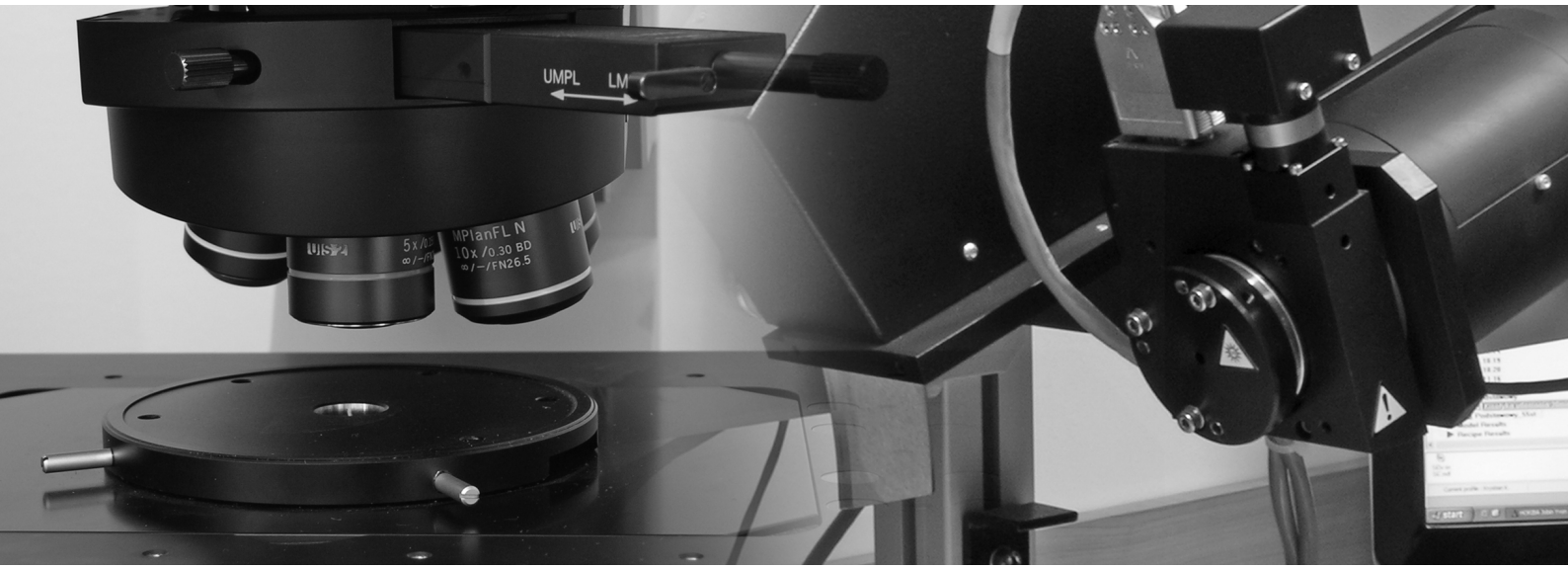
[Pub141]	Anders K., Stopiński S., Jusza A., Paśnikowska A., Słowikowski M., Piramidowicz R.	InP-based photonic integrated circuits of EEDH WUT	pp.75–76
[Pub142]	Bieniek A., Stopiński S., Szleter T., Szostak S., Piramidowicz R.	Development of miniaturized optical gyroscopes using photonic integration technologies	pp.80–81
[Pub143]	Bortnowski P., Lelit M., Połatyński A., Butt M., Stopiński S., Piramidowicz R.	AWG components for HYPHA integrated photonic platform – design and applications	pp.82–83
[Pub144]	Juchniewicz M., Słowikowski M., Stonio B., Michalak B., Pavłov K., Filipiak M., Myśliwiec M., Lelit M., Wiśniewski P., Anders K., Stopiński S., Beck R., Piramidowicz R.	Waveguiding components for MIRPIC platform – progress in technology	pp.38–40
[Pub145]	Jureńczyk J., Kubiszyn Ł., Seredyński B., Krawczyk A., Ropelewski P., Anders K., Stopiński S., Piramidowicz R.	Mid-IR detectors for MIRPIC platform – current status and perspectives	pp.44–45
[Pub146]	Jusza A., Stopiński S., Anders K., Kustosz Ł., Pierściński K., Pierścińska D., Piramidowicz R.	Integrated photonics for free-space optical communication	pp.91–93
[Pub147]	Kaźmierczak A., Butt M., Kozłowski Ł., Shahbaz M., Jusza A., Anders K., Stopiński S., Olszewski J., Martynkien T., Duda Ł., Czyż K., Pawłów J., Prokop K., Zdończyk M., Rola K., Guzik M., Cybińska J., Zięba M., Tyszkiewicz C., Karasiński P., Piramidowicz R.	HYPHa – innovative photonic integration platform for sensing applications	pp.28–30
[Pub148]	Kozłowski Ł., Shahbaz M., Dudek M., Butt M., Kaźmierczak A., Piramidowicz R.	SiO_2:TiO_2 Integrated Photonic 1x2 DEMUX based on Y-splitter for telecom and sensing applications	pp. 102–103
[Pub149]	Lelit M., Anders K., Słowikowski M., Juchniewicz M., Stonio B., Pavłov K., Stopiński S., Beck R., Piramidowicz R.	Development of integrated optical interfaces for silicon-nitride-based photonic platform	pp. 104–106
[Pub150]	Lelit M., Słowikowski M., Juchniewicz M., Stonio B., Michalak B., Pavłov K., Filipiak M., Myśliwiec M., Wiśniewski P., Anders K., Stopiński S., Duszczyk A., Karoń S., Beck R., Piramidowicz R.	Functionalized photonic silicon-nitride-based integrated circuits operating in visible wavelengths for biosensing applications	pp.49–51
[Pub151]	Piramidowicz R., Stopiński S., Anders K., Jusza A., Paśnikowska A., Lelit M., Połatyński A., Kaźmierczak A., Butt M., Wiśniewski P., Słowikowski M., Juchniewicz M., Pavłov K., Zbik M., Jureńczyk J., Liebert M., Pierściński K., Pierścińska D.	Photonic Integrated Circuits – technologies, platforms, and applications	pp.21–22
[Pub152]	Połatyński A., Lelit M., Anders K., Stopiński S., Piramidowicz R.	Waveguiding components for MIRPIC platform – design and modelling	pp.36–37
[Pub153]	Shahbaz M., Kozłowski Ł., Butt M., Kaźmierczak A., Piramidowicz R.	Numerical evaluation of silica-titania-based reverse rib waveguide and standard rib waveguide structures	pp. 122–124
[Pub154]	Słowikowski M., Lelit M., Juchniewicz M., Stonio B., Michalak B., Pavłov K., Filipiak M., Myśliwiec M., Golas M., Wiśniewski P., Anders K., Stopiński S., Beck R., Piramidowicz R.	Silicon-nitride based generic platform – current status and perspectives	pp.34–35

Programme and Abstracts of the IOS'2023 Conference – Integrated Optics – Sensors, Sensing Structures and Methods IOS'2023

[Pub155]	Programme and Abstracts of the IOS'2023 Conference – Integrated Optics – Sensors, Sensing Structures and Methods IOS'2023	Stopiński S., Anders K., Jusza A., Słowikowski M., Bieniek A., Piramidowicz R.	InP-based integrated photonic interrogators		pp. 23–24
[Pub156]		Wiśniewski P., Stonio B., Słowikowski M., Filipiak M., Pavłov K., Haras M., Skotnicki T.	Technology of MIM diode rectifiers for THz rectennas		pp. 129–130
[Pub157]	Progress on Pattern Classification, Image Processing and Communication Proceedings of the CORES and IP&C Conferences 2023 ISBN 978-3-031-41629-3	Garbat P., Galiński G., Żakowski M., Bieniek M., Lasocki M.	Image Analysis System for Augmented Reality Games	10.1007/978-3-031-41630-9_10	pp. 93–100
[Pub158]		Garbat P., Smyl M.	Deep Learning for Pit Detection in Cherries	10.1007/978-3-031-41630-9_9	pp. 85–92
[Pub159]	Streszczenia: XII Konferencja Techniki Próżni PTP 2023	Czerwosz E., Wronka H., Firek P., Gawdzik J., Kowalik R., Sidło W., Furmańczyk P., Suchańska M., Kęczkowska J., Kozłowski M.	Wykorzystanie heterowarstw gradientowego układu węgiel-pallad do zmiany właściwości elektrod stosowanych w procesie utleniania elektrochemicznego		pp. 45–46
[Pub160]		Czerwosz E., Wronka H., Firek P., Krawczyk S., Kozłowski M., Sochacki M., Szmidt J.	Otrzymywanie i właściwości tranzystorów polowych z bramką z nanostrukturalnej warstwy C-Pd		pp. 47–48
[Pub161]		Suchańska M., Kęczkowska J., Belka R., Czerwosz E., Wronka H., Firek P., Szmidt J.	Zastosowanie spektroskopii ramanowskiej do określania stopnia grafityzacji warstw węglowo-palladowych otrzymywanych metodą PVD		pp.8–10
[Pub162]	XXXVth General Assembly and Scientific Symposium of the International Union of Radio Science (URSI GASS) ISBN 9789463968096	Pieńczuk P., Pleskacz W., Janczyk G.	Readout Integrated Circuit for MIR Detector within ASPIC	10.46620/ursigass.2023.3087.cfcc7818	pp.1–4

7.4. Scientific and Technical Books

NUMBER	AUTHORS	PUBLISHER/ISBN	TITLE	DOI	PAGES
[Pub163]	Butt M.	Katti Aavishkar, Sharma Yogesh *(eds.)*, Bentham Science Publishers ISBN 9789815049756	In: Photonic Materials: Recent Advances and Emerging Applications, chapter: Photonic Crystal Instruments	10.2174/9789815049756123010004	pp.1–20



Microsystem and Electronic Material Technology Division

8. PATENTS

[Pat1] Borkowski Adam, Siwiec Krzysztof, Pleskacz Witold: **Radio receiving and transmitting track for short-range communication** (Radiowy tor odbiorczo-nadawczy do komunikacji bliskiego zasięgu), Topography of integrated circuits, Protected, Application number: S.0095, Patent/rights number: T.0091, Application date: 20-12-2022, Patent (decision) date: 23-01-2023, Publication of patent: [WUP 08-05-2023]

[Pat2] Jęczmień Adam, Stępniewski Kamil, Siwiec Krzysztof, Pleskacz Witold: **Source of reference current and voltage** (Źródło referencyjnego prądu i napięcia), Topography of integrated circuits, Protected, Application number: S.0096, Patent/rights number: T.0092, Application date: 20-12-2022, Patent (decision) date: 23-01-2023, Publication of patent: [WUP 08-05-2023]

[Pat3] Stępniewski Kamil, Siwiec Krzysztof, Pleskacz Witold: **Light sensor for cryptographic applications** (Czujnik światła do zastosowań kryptograficznych), Topography of integrated circuits, Protected, Application number: S.0101, Patent/rights number: T.0097, Application date: 20-12-2022, Patent (decision) date: 23-01-2023, Publication of patent: [WUP 08-05-2023]

[Pat4] Stępniewski Kamil, Siwiec Krzysztof, Pleskacz Witold: **RC generator with a nominal frequency of 13.56 MHz for cryptographic applications** (Generator RC o częstotliwości nominalnej 13,56 MHz do zastosowań kryptograficznych), Topography of integrated circuits, Protected, Application number: S.0099, Patent/rights number: T.0095, Application date: 20-12-2022, Patent (decision) date: 23-01-2023, Publication of patent: [WUP 08-05-2023]

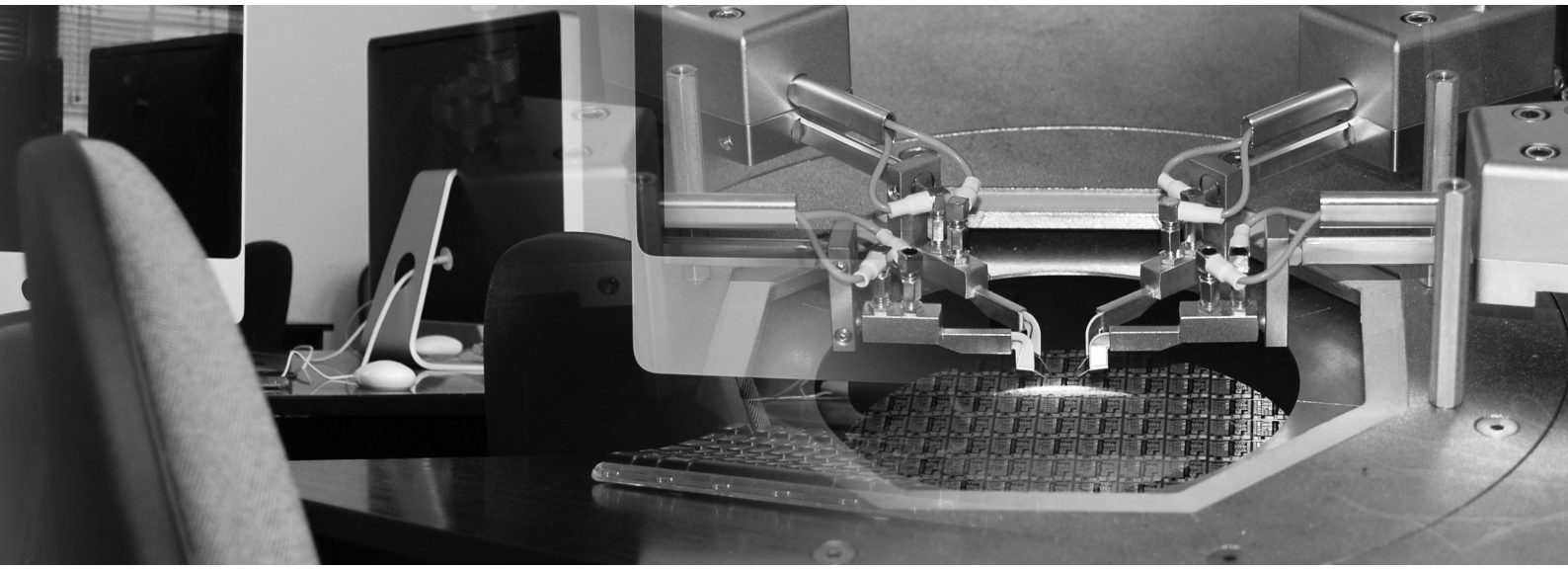
[Pat5] Stępniewski Kamil, Siwiec Krzysztof, Pleskacz Witold: **Ring oscillator controlling a microprocessor** (Oscylator pierścieniowy sterujący mikroprocesorem), Topography of integrated circuits, Protected, Application number: S.0098, Patent/rights number: T.0094, Application date: 20-12-2022, Patent (decision) date: 23-01-2023, Publication of patent: [WUP 08-05-2023]

[Pat6] Stępniewski Kamil, Siwiec Krzysztof, Pleskacz Witold: **Temperature sensor for cryptographic applications** (Czujnik temperatury do zastosowań kryptograficznych), Topography of integrated circuits, Protected, Application number: S.0100, Patent/rights number: T.0096, Application date: 20-12-2022, Patent (decision) date: 23-01-2023, Publication of patent: [WUP 08-05-2023]

[Pat7] Stępniewski Kamil, Siwiec Krzysztof, Pleskacz Witold: **Voltage comparator for cryptographic applications** (Komparator napięcia do zastosowań kryptograficznych), Topography of integrated circuits, Protected, Application number: S.0097, Patent/rights number: T.0093, Application date: 20-12-2022, Patent (decision) date: 23-01-2023, Publication of patent: [WUP 08-05-2023]

[Pat8] Zdrojek Mariusz, Judek Jarosław: **Application of a polymer-carbon material for shielding from electromagnetic radiation with wavelengths in sub-terahertz and terahertz ranges** (Zastosowanie materiału polimerowo-węglowego do ekranowania przed promieniowaniem elektromagnetycznym o długości fal z zakresu subterahercowego i terahercowego), Invention, Protected, Application number: US 201716769541, Patent/rights number: US 11773224, Application date: 04-12-2017, Patent (decision) date: 03-10-2023, Publication of patent: [USPTO 03-10-2023]

[Pat9] Zdrojek Mariusz, Krzyszfof Jakubczak, Judek Jarosław, Dużyńska Anna, Łapińska Anna, Wróblewska Anna, Żerańska-Chudek Klaudia: **Composite material for shielding electromagnetic radiation, raw material for additive manufacturing methods and a product comprising the composite material as well as a method of manufacturing the product** (Materiał kompozytowy do ekranowania promieniowania elektromagnetycznego, surowiec do metod wytwarzania przyrostowego oraz wyrób składający się z materiału kompozytowego oraz sposób wytwarzania tego wyrobu) , Invention, Protected, Application number: US 2020276797, Patent/rights number: US 11766854, Application date: 27-02-2020, Patent (decision) date: 26-09-2023, Publication of patent: [USPTO 26-09-2023]



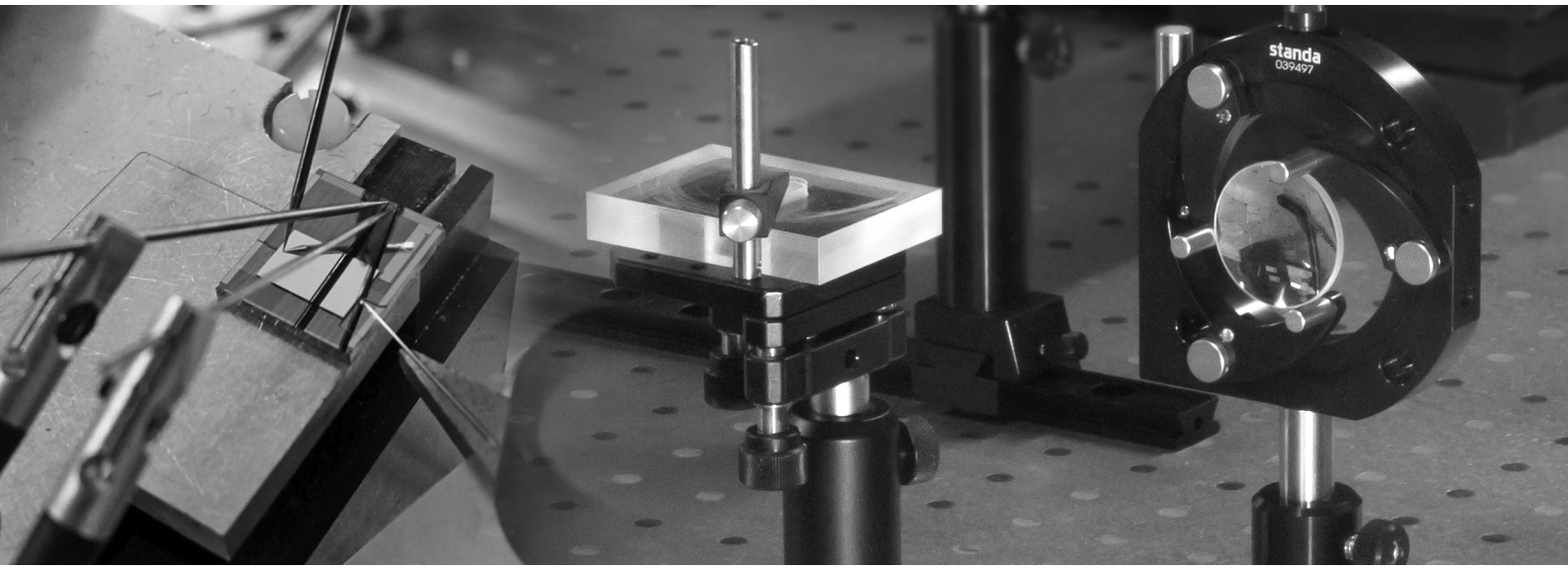
VLSI Engineering
and Design Automation Division

9. REPORTS

NUMBER	Authors	Title	Type
[Rep1]	Anders K.	Development of optical interfaces for silicon-nitride-based photonic platform	**Scientific report** from the project granted by Warsaw University of Technology
[Rep2]	Bolek K.	Wpływ stopnia przedwzmacniacza pomiarowego na rekonstrukcje dynamiki chaotycznej słabych sygnałów	**Paper Presented**: XV Konferencja Naukowo-Techniczna Podstawowe Problemy Metrologii
[Rep3]	Bortnowski P., Osiński S., Słowikowski M., Juchniewicz M., Wiśniewski P., Piramidowicz R.	Bloki funkcjonalne AWG dla platformy technologicznej HYPHa – modelowanie, projekt i technologia	**Poster**: XX Konferencja Światłowody i ich zastosowania
[Rep4]	Butt M., Kozłowski Ł., Dudek M., Shahbaz M., Kilicaslan E., Dziekan Z., Kaźmierczak A., Piramidowicz R.	A Novel Demultiplexer Solution for Silica-titania Platform-based Photonic Integrated Circuits	**Poster**: PhotonIcs and Electromagnetics Research Symposium
[Rep5]	Fetliński. B.	Hyperbolic metamaterials for enhancing energy yield of photovoltaic modules	**Scientific report** from the project granted by Warsaw University of Technology
[Rep6]	Fetliński. B..	Novel glassy and nanocrystalline phosphors for white LED lighting safe for human vision	**Scientific report** from the project granted by Warsaw University of Technology
[Rep7]	Firek P.	Development of an innovative technology for PVD deposition of a multilayer, nanocomposite transistor gate	**Scientific report** from the project granted by Warsaw University of Technology
[Rep8]	Firek P., Kondracka K., Kiepura A., Waśkiewicz M., Lewicki S., Zdanowski R., Sochacki M.	Influence of gate dielectric in FET structure on the possibilities of cell viability identification	**Poster**:45th International Microelectronics and Packaging Conference
[Rep9]	Garbat P.	Development and implementation of an artificial intelligence system of virtual characters allowing simulation of their realistic behaviour and interactions with the player based on an autonomous analysis of the game participants' image in real time	**Scientific report** from the project granted by the National Centre for Research and Development
[Rep10]	Janik M.	Influence of biological materials' charge on the functional parameters of opto-electrochemical biosensors	**Scientific report** from the project granted by Warsaw University of Technology
[Rep11]	Judek J.	Plasmons and polariton on structured Surfaces of group IVb metal notrides	**Scientific report** from the project granted by Warsaw University of Technology
[Rep12]	Kaczkan M.	New Versatile Platform for Illumination and Sensing - NewILUMIS	**Scientific report** from the project granted by the National Centre for Research and Development
[Rep13]	Kalenik J., Stęplewski W., Borecki J., Chołaj A., Kozłowski M., Serzysko T.	False Piezoresistive Effect Indicator	**Poster**:45th International Microelectronics and Packaging Conference
[Rep14]	Kamiński M., Sadowski O., Taube A., Ekielski M., Tarenko J., Zadura M., Wzorek M., Szerling A.	Optimization of low resistivity Ti/Al/TiN/Au ohmic contacts to buffer-free AlGaN/GaN high electron mobility transistor structures	**Presentation**: SPIE Photonics West

[Rep15]	Kamiński M., Tarenko J., Sadowski O., Taube A., Ekielski M., Zadura M., Kosiel K., Jóźwik I., Brzozowski E., Szerling A., Prystawko P., Bockowski M., Grzegory I.	Vertical GaN Trench-MOSFETs Fabricated on Ammonothermally Grown Bulk GaN Substrates	**Paper Presented**: 14th International Conference on Nitride Semiconductors
[Rep16]	Kaźmierczak A.	Arrays of diffractive optical elements for applications in optical interface systems of photonic integrated circuits	**Scientific report** from the project granted by Warsaw University of Technology
[Rep17]	Kisiel R.	New generation of high thermal efficiency components packages for space	**Scientific report** from the project granted by the International Institutions – EU
[Rep18]	Kisiel R., Myśliwiec M.	Milestones in Electronic Packaging	**Paper Presented**: 45th International Microelectronics and Packaging Conference
[Rep19]	Koba M.	Fiber optic electro-optical modulator for studying electromagnetic interactions caused by high-energy laser radiation	**Scientific report** from the project granted by Warsaw University of Technology
[Rep20]	Krupka J., Chen X., Xu X., Guo B., Hong W., Wang H., Salski B., Pacewicz A., Kopyt P.	Characterization of LTCC MgO ceramic pills with a TE_01delta resonator up to 50 GHz and beyond	**Presentation**: 12th International Conference on Microwave Materials and their Applications
[Rep21]	Linowski D., Wojciechowski A., Rybak T.	SpaceFibre and image compression on RTG4 FPGA (Syderal Polska)	**Presentation**: SpacE FPGA Users Workshop, 5th Edition
[Rep22]	Mazurak A.	Study on the charge transport mechanism and filament formation in Metal-Insulator-Metal (MIM) structures	**Scientific report** from the project granted by Warsaw University of Technology
[Rep23]	Mazurak A., Jasiński J., Płociński T., Stonio B., Wiśniewski P.	Resistive switching effect in MOS devices with highly doped silicon	**Poster**: 23rd Conference of Insulting Films on Semiconductors
[Rep24]	Myśliwiec M., Kisiel R.	Thermal interface materials – influence of the type of interface metallization on the thermal resistance of the joint	**Poster**: 45th International Microelectronics and Packaging Conference
[Rep25]	Pacewicz A., Krupka J., Kopyt P., Salski B.	Measurements of the complex permittivity of ferrites at millimeter wave frequencies	**Presentation**: 12th International Conference on Microwave Materials and their Applications
[Rep26]	Pacewicz A., Krupka J., Salski B.	Electrodynamic theory of resonances in gyromagnetic materials: insights and applications	**Presentation**: The European Conference Physics of Magnetism
[Rep27]	Piramidowicz R.	Photonics Integrated Circuits technologies for MIDIR	**Scientific report** from the project granted by the National Centre for Research and Development
[Rep28]	Pleskacz W.	Projektowanie i realizacja specjalizowanych układów scalonych ASIC w polskich realiach	**Paper Presented**: 14th Electron Technology Conference
[Rep29]	Prystawko P., Grzanka E., Taube A., Kamiński M.	Development of NPN structures for Vertical GaN Trench-MOSFETs	**Poster**: 14th International Conference on Nitride Semiconductors
[Rep30]	Sadowski O., Kamiński M., Taube A., Tarenko J., Guziewicz M., Wzorek M., Szerling A., Prystawko P., Bockowski M., Grzegory I.	Low resistivity Ti/Al/TiN/Au ohmic contacts to Ga- and N-face n-GaN for vertical power devices	**Poster**: 14th International Conference on Nitride Semiconductors
[Rep31]	Siwiec K.	The study of the robustness of GNSS positioning against signal disturbances	**Scientific report** from the project granted by Warsaw University of Technology

[Rep32]	Sochacki M.	Development, fabrication and characterization of HBT phototransistor test structures for the UV detection with limited sensitivity to the visible spectrum range	**Scientific report** from the project granted by Warsaw University of Technology
[Rep33]	Sutkowski M	Nowoczesny system rejestracji wizerunku osób	**Paper Presented**: Międzynarodowa konferencja naukowa pt. „Nauka na rzecz bezpieczeństwa. Wyniki badań naukowych i prac rozwojowych"
[Rep34]	Szczepański P.	Controlling electromagnetic properties of photonic structures based on anisotropic metamaterials	**Paper Presented**: BIT's 9th Annual World Congress of Advanced Materials
[Rep35]	Szmidt J.	Development of a modular quantum computer infrastructure for special and military IT applications	**Scientific report** from the project granted by the National Centre for Research and Development
[Rep36]	Śmietana M.	Biopolymer materials with chemically and genetically programmed heavy metal selectivity for new generation ultra-sensitive biosensors	**Scientific report** from the project granted by the National Centre for Research and Development
[Rep37]	Śmietana M.	Heterogenous diamond biosensing nanoarchitectures: opto-electro-chemical interactions with antibody complexes	**Scientific report** from the project granted by the National Science Centre
[Rep38]	Śmietana M.	Optical analysis of electrochemical reaction products in picoliter volumes	**Scientific report** from the project granted by the National Science Centre
[Rep39]	Śmietana M.	Optical fiber biosensing systems for fast and early identification of inflammatory factors	**Scientific report** from the project granted by the National Science Centre
[Rep40]	Śmietana M.	Translucent titanium dioxide nanostructures deposited on substrates with complex geometry for photoconversion and sensorics	**Scientific report** from the project granted by the National Science Centre
[Rep41]	Tarenko J., Kamiński M., Taube A., Ekielski M., Kruszka R., Zadura M., Szerling A., Prystawko P., Bockowski M., Grzegory I.	Fabrication of ultralow bevel angle mesa structures for vertical GaN devices	**Poster**: 14th International Conference on Nitride Semiconductors
[Rep42]	Taube A., Borysiewicz M., Sadowski O., Wójcicka A., Tarenko J., Piskorski K., Wzorek M.	Development of high quality Schottky contacts to (001) -Ga_2O_3 by using amorphous (Ir,Ru)-Si and (Ir,Ru)-Si-O conductive layers	**Poster**: SPIE Photonics West
[Rep43]	Taube A., Kamiński M.	Optimization of Two-zone Step-Etched Junction Termination Structures for Vertical GaN Power Devices	**Poster**: 14th International Conference on Nitride Semiconductors
[Rep44]	Taube A., Sadowski O., Sankowska I., Pągowska K., Ekielski M., Michałowski P., Jankowska-Śliwińska J., Tarenko J., Szerling A., Prystawko P., Sierakowski K., Jaroszyński P., Bockowski M., Grzegory I.	Study of ultra high pressure annealing of Si-implanted GaN epilayers with different ion fluences	**Presentation**: SPIE Photonics West
[Rep45]	Wiśniewski P., Jasiński J., Stonio B., Mazurak A.	Characterization of resistive switching phenomena in thermal silicon oxide RRAM devices by means of small-signal measurements	**Presentation**: 2023 International Meeting for Future of Electron Devices, Kansai



Optoelectronics Division

10. CONFERENCES, SEMINARS AND MEETINGS

Number	Conference, seminars and meetings
[Con1]	9th International Symposium on Optical Materials (IS-OM'9), June 26–30, Tarrgona, Spain
[Con2]	12th International Conference on Microwave Materials and their Applications (MMA 2023), September 25–28, Mainz, Germany
[Con3]	13th International Conference on Image Processing and Communications (IP&C 2023), June 28–29, Online, Poland
[Con4]	14th Electron Technology Conference (ELTE 2023), April 18–21, Ryn, Poland
[Con5]	14th International Conference on Nitride Semiconductors (ICNS-14), November 12–17, Fukuoka, Japan
[Con6]	17th Conference Integrated Optics – Sensors, Sensing Structures and Methods (IOS2023), February 27 – March 03, Szczyrk, Poland
[Con7]	23rd Conference of Insulting Films on Semiconductors (INFOS 2023), June 27–30, Pizzo, Italy
[Con8]	30th International Conference Mixed Design of Integrated Circuits and Systems (MIXDES 2023), June 29–30, Kraków, Poland
[Con9]	45th International Microelectronics and Packaging Conference (IMAPS Poland 2023), September 24–27, Rzeszów, Poland
[Con10]	46th International Spring Seminar on Electronics Technology "Electronics Technology Innovations towards Green Electronics" (ISSE 2023), May 10–14, Online, Rumunia
[Con11]	BIT's 9th Annual World Congress of Advanced Materials 2023 (WCAM 2023), May 09–10, Tokyo, Japan
[Con12]	Conference on Lasers and Electro-Optics/Europe – European Quantum Electronics Virtual Conferences 2023 (CLEO/Europe-EQEC 2023), June 26-30, Munich, Germany
[Con13]	IEEE International Meeting for Future of Electron Devices, Kansai (IMFEDK 2023), November 16–17, Kyoto, Japan
[Con14]	IEEE/MTT-S International Microwave Symposium – IMS 2023, June11–16, San Diego, USA
[Con15]	Międzynarodowa konferencja naukowa pt. „Nauka na rzecz bezpieczeństwa. Wyniki badań naukowych i prac rozwojowych", May 25–26, Szczytno, Poland
[Con16]	PhotonIcs and Electromagnetics Research Symposium (PIERS 2023), July 03–06, Praga, Czech Republic
[Con17]	SpacE FPGA Users Workshop, 5th Edition (SEFUW 2023), March 14–16, ESTEC, Noordwijk, Holand
[Con18]	SPIE BiOS 2023: Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues XXI (SB23), January 28 – February 03, San Francisco, USA
[Con19]	SPIE Defense + Commercial Sensing: Infrared Imaging Systems: Design, Analysis, Modeling, and Testing XXXIV (DCS SPIE), April 30 – May 05, Orlando, Florida, USA
[Con20]	SPIE European Workshop on Optical Fibre Sensors (EWOFS 2023), May 23–26, Mons, Belgium
[Con21]	SPIE Photonics West 2023 (Photonic West 2023), January 28 – February 02-, San Francisco, USA
[Con22]	The 2023 International Meeting for Future of Electron Devices, Kansai (IMFEDK 2023), November 16–17, Kyoto, Japan
[Con23]	The European Conference Physics of Magnetism 2023 (PM'23), June 26–30, Poznań, Poland

[Con24] Twelfth International Conference on Image Processing Theory, Tools and Applications (IPTA 2023), October 16–19, Paris, France

[Con25] XII Konferencja Techniki Próżni (PTP 2023), April 19–21, Ryn, Poland

[Con26] XLV seminarium „System oceny zgodności wyrobów elektronicznych i elektrotechnicznych", October 26–27, Zegrze, Poland

[Con27] XV Konferencja Naukowo-Techniczna Podstawowe Problemy Metrologii (PPM'23), May 18–19, Gliwice, Poland

[Con28] XX Konferencja Światłowody i ich zastosowania (TAL 2023), September 11–14, Lublin, Poland

[Con29] XXXVth URSI General Assembly and Scientific Symposium (URSI GASS), August 19–26, Sapporo, Japan

11. AWARDS

[Award1] Beck Romuald Bartłomiej, **President's of the Republic of Poland Gold Medal for Long-Term Service**, (Medal Złoty za Długoletnią Służbę), October 10

[Award2] Bieniek Aleksandra, **Best Poser Award on ELTE Conference 2023** (Nagroda za najlepszą prezentację plakatową pt. „Zintegrowane lasery jednoczęstotliwościowe do zastosowań w układach żyroskopowych" na XIV Konferencji Naukowej Technologia Elektronowa ELTE 2023), April 21

[Award3] Janaszek Bartosz, **Best Oral Presentation on ELTE Conference 2023** (Nagroda za najlepszą prezentację ustną pt. „Kształtowanie właściwości optycznych metamateriałów anizotropowych" na XIV Konferencji Naukowej Technologia Elektronowa ELTE 2023), April 21

[Award4] Janik Monika, **Winner of the "Best of the best WUT"** competition (Laureat konkursu „Najlepsi z najlepszych PW"), April 12

[Award5] Janik Monika, **WUT'S Rector Individual 1st degree award for scientific achievements for work on the development of modern sensor structures** (Nagroda indywidualna I stopnia JM Rektora PW za prace nad rozwojem nowoczesnych struktur czujnikowych), October 10

[Award6] Jasiński Jakub Maciej, Mazurak Andrzej Igor, Mroczyński Robert Paweł, Wiśniewski Piotr, **WUT'S Rector Collective 2nd degree award for scientific achievements in the 2021/2022 academic year** (Nagroda zespołowa II stopnia JM Rektora PW za osiągnięcia naukowe w roku akademickim 2021/2022), October 2

[Award7] Kalenik Jerzy, **President's of the Republic of Poland Gold Medal for Long-Term Service**, (Medal Złoty za Długoletnią Służbę), October 10

[Award8] Kamiński Maciej, **Best Paper Award of 14th International Conference on Nitride Semiconductors** (Nagroda za najlepszą pracę: Vertical GaN Trench-MOSFETs Fabricated on Ammonothermally Grown Bulk GaN Substrates, ED4-2, 2023, 14th International Conference on Nitride Semiconductors 2023, referat wygłoszony), November 17

[Award9] Salski Bartłomiej Wacław, Kopyt Paweł, Karpisz Tomasz, Krupka Jerzy, Pacewicz Adam, Cuper Jerzy, Krysicki Mateusz: **Ministry of Education and Science Prizes for Significant achievements in the field of implementation activities** (Nagroda Ministra edukacji i nauki za: Znaczące osiągnięcia w zakresie działalności wdrożeniowej), February 19

[Award10] Skotnicki Tomasz, **European SEMI Award and Special Service Award** (Nagroda European SEMI Award za wkład w rozwój mikroelektroniki w Europie), February 15

[Award11] Szymańska Agnieszka Elżbieta, **President's of the Republic of Poland Silver Medal for Long-Term Service**, (Medal Srebrny za Długoletnią Służbę), October 10

[Award12] Śmietana Mateusz Jakub, Koba Marcin, Janik Monika, Burnat Dariusz, Gabler Tomasz, Pituła Emil, **WUT'S Rector Collective 1st degree award for scientific achievements for work on the development of modern optical and electrochemical sensors** (Nagroda zespołowa I stopnia JM Rektora PW za prace nad rozwojem nowoczesnych czujników optycznych i elektrochemicznych), October 10