

Contents

| | |
|-----|--|
| 3 | Introduction |
| 5 | Yesterday – Today – Tomorrow |
| 9 | KNOW Warsaw Academic Chemical Consortium – a Leading National Research Centre in Chemistry |
| 12 | Organization Chart of the Faculty of Chemistry |
| 15 | Chair of Analytical Chemistry |
| 19 | Chair of Chemical Technology |
| 27 | Chair of Inorganic Chemistry and Solid State Technology |
| 37 | Chair of Polymer Chemistry and Technology |
| 45 | Department of Catalysis and Organometallic Chemistry |
| 51 | Department of Drug Technology and Biotechnology |
| 59 | Department of High-Energetic Materials |
| 63 | Department of Microbioanalytics |
| 71 | Department of Organic Chemistry |
| 75 | Department of Physical Chemistry |
| 83 | Laboratory of Technological Processes |
| 87 | PhD Projects at the Faculty of Chemistry |
| 148 | Other PhD Projects at the Faculty of Chemistry |
| 151 | Index of PhD Students |

Research & Science 2015

Faculty of Chemistry
Warsaw University of Technology
January 2015

Editorial team

Zbigniew Brzózka
Ewa Stefaniak
Ewa Szczygieł
Małgorzata Zielińska

Graphics design/DTP
Studio AZ



The Faculty of Chemistry of Warsaw University of Technology

The Faculty of Chemistry is one of the oldest faculties of the Warsaw University of Technology (WUT). It was founded in 1898 as one of three faculties of the Russian Polytechnic Institute, but on November 15, 1915, Warsaw University of Technology - one of the first Polish technical universities was established and it was then when one started to conduct studies in Polish at the Faculty. The year 2015 will be a time of celebrating the 100th Anniversary of the Revival of the Faculty of Chemistry and the whole Warsaw University of Technology.

At present, the Faculty of Chemistry is one of three best chemical faculties at technical universities in Poland. Research conducted at the Faculty embodies a full spectrum of chemistry, some of the scientific areas are:

- technology of functional materials and materials of special properties
- chemical technology and catalysis
- polymer technology and processing
- technology of explosives
- biotechnology
- technology of pharmaceuticals and cosmetics
- analytical chemistry and material characterization.

The Faculty of Chemistry is located on the main campus in two buildings: the Chemistry Building, Noakowskiego Street 3 and the Chemical Technology Building, Koszykowa Street 75. The Faculty has at its disposal many didactic facilities. One of them

is the Zawadzki Auditorium - the oldest and largest traditional auditorium at WUT - named after Prof. Józef Zawadzki who was highly deserved for the Faculty. A specific feature of our Faculty are student laboratories in which practical experiments are conducted within basic courses in inorganic chemistry, analytical chemistry, physical chemistry, organic chemistry, biochemistry, chemical technology, biotechnology as well as in the form of specialized and diploma laboratories.

In 2014, the Faculty of Chemistry provided intramural studies in chemical technology (master's and bachelor's degree courses) and biotechnology (master's and bachelor's degree courses) for almost 1300 students.

In addition to the aforementioned fields of study, we conduct PhD studies in pure chemistry, chemical technology and biotechnology for more than 100 PhD students.

The Faculty of Chemistry of Warsaw University of Technology participates in many international didactic and scientific programs. Their purpose is to improve the level of education and to adapt it to the curricula valid in the European Union. In this respect, educational cooperation with European universities within the Erasmus Program should be especially noted.

The academic staff of the Faculty of Chemistry consists of 52 professors (including 28 tenured professors), 68 assistant professors, senior readers and lectures.



Yesterday – Today – Tomorrow

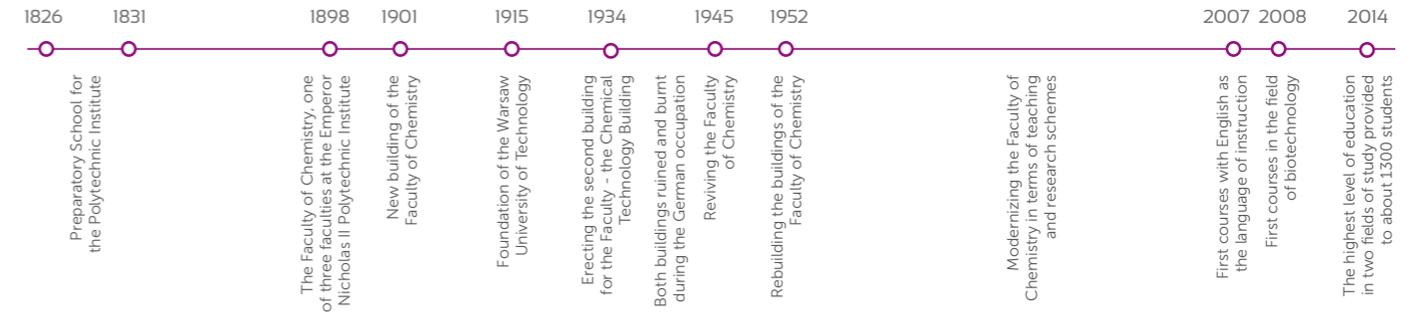
The Faculty of Chemistry – from the Past to the Present

The Faculty of Chemistry is one of the oldest faculties of the Warsaw University of Technology. It was established in 1898 as one of three faculties at the Emperor Nicholas II Polytechnic Institute - a technical university in the Russian partition of Poland, where classes were conducted in Russian. It was a continuation of the tradition of engineering education in chemistry provided by the Preparatory School for the Polytechnic Institute, which operated from 1826 to 1831, with Polish as the language of instruction.

At the established Faculty of Chemistry, Polish academics were in minority, although Polish students accounted for more than

70% of all students. In 1901, the Faculty was moved to the newly built Chemistry Building equipped with one of the largest auditoria at the Warsaw University of Technology, presently called the Prof. Zawadzki Auditorium.

In 1915, one of the first Polish technical universities - Warsaw University of Technology was founded. The courses were conducted in Polish at four faculties, with the Faculty of Chemistry as one of them. Prof. Tadeusz Miłobędzki became the first dean. The fast development of the Faculty started in 1918 after Poland's independence had been restored. Many scientists of Polish descent, who were affiliated with numerous universi-



ties across Europe, joined the academic staff. Additionally, chemists working for the industry got involved in teaching. The WUT academics jointly developed an original curriculum of chemical technology, with a reasonable balance of fundamental and applied knowledge. The Faculty became the center of scientific research for specialists whose achievements were fundamental in the world science and technology, those were: Józef Zawadzki, Jan Zawadzki, Kazimierz Smoleński, Ignacy Mościcki, Jan Czochralski, Tadeusz Miłobędzki, Wojciech Świętosławski, Stanisław Bretsznajder, Tadeusz Urbański, Tadeusz Wojno. In 1934, the Chemical Technology Building was erected to provide the venue for education in applied chemistry (chemical technology).

The activity of the Faculty was put to a halt during the German occupation. Both buildings were severely ruined and burnt. Numerous members of the staff were killed. Yet, even then, in the face of such atrocities, secret courses were delivered and diplomas in chemistry were awarded to 15 students.

The Faculty was revived in January 1945 and classes were conducted in replacement rooms. One started to rebuild the buildings and their restoration was completed in 1952.

Recently, with significant political changes leading to the democratization and economic growth of Poland, the Faculty has been modernized in terms of teaching and research schemes. The Faculty is divided in ten departments and one autonomous laboratory. They are as follows:

- Chair of Analytical Chemistry
- Chair of Chemical Technology
- Chair of Inorganic Chemistry and Solid State Technology



- Chair of Polymer Chemistry and Technology
- Department of Catalysis and Organometallic Chemistry
- Department of Drug Technology and Biotechnology
- Department of High-Energetic Materials
- Department of Microbioanalytics
- Department of Organic Chemistry
- Department of Physical Chemistry
- Laboratory of Technological Processes.

(The organization chart of the Faculty of Chemistry - page 12)

The academic staff of the Faculty of Chemistry consists of 121 members, including 28 full professors and 24 associate professors.

The research covers various fields of chemistry and technology, such as:

- Synthesis, technology and biotechnology of organic compounds for medicine, agriculture and household chemistry
- Technology of new and special materials (magnetics, high-temperature superconductors, synthetic metals, conducting polymers, applied and functional ceramics, explosive materials)
- Sustainable chemical technology and waste management
- Technology, manufacture and characterization of polymeric materials
- New energy sources and energy storage
- New analytical and bioanalytical techniques applied in medicine, environmental protection, and monitoring food products
- Miniature analytical systems (Lab-on-a-Chip) and chemical sensors
- Modern catalysis and design of new catalysts
- Basic research on physicochemical properties of new materials.

The Faculty of Chemistry has played an important role at the Warsaw University of Technology, as five professors of the Faculty were WUT rectors, and six professors have received the honorary degree of Doctor Honoris Causa. Commendable traditions of the Faculty of Chemistry were and are cultivated by the next generations of students and academics. Today, the Faculty is a large research and teaching center. Since 2007, courses with English as the language of instruction have been run and since 2008 courses in biotechnology, previously conducted by the Interfaculty Centre of Biotechnology, have been run. Moreover, the Faculty provides the highest level of education at BSc, MSc and PhD courses in chemical technology and biotechnology, conducted both in Polish and English, to about 1400 students.

In 2014, the academics of the Faculty published 179 articles in scientific journals submitted to the ISI Master Journal List and got 28 national patents for their inventions.

Research teams build and strengthen the Faculty's potential and their achievements confirm the Faculty's position as one of Poland's leading scientific and research units specializing in chemistry and chemical technology. Some of them were briefly characterized by their supervisors:

- Prof. Zbigniew Brzózka: Current projects focus on interdisciplinary research to develop microfluidic systems suitable for a human carcinoma cell culture and anticancer drug screening. This is an example of modern cell engineering to develop cellular models that can replace animals in drug screening and toxicological tests (see page 66).
- Prof. Urszula Domańska-Żelazna: We focus on physical chemistry, especially on thermodynamics of phase equilibria, VLE, LLE, SLE, high pressure SLE, activity coefficients at infinite dilution, physico-chemical properties as density, viscosity, surface tension, calorimetry, separation science, correlation and prediction of physico-chemical properties of ionic liquids, fragrance materials, pharmaceuticals or hyperbranched polymers. We are also interested in the formulation of polymeric nanoparticles (NPs) with drugs and in the kinetics of drug release (see page 76).
- Prof. Zbigniew Florjańczyk: The main scientific interests of our group are connected with chemistry and technology of functional polymeric materials. This includes a development of new polymerization processes, especially



of those utilizing starting materials derived from renewable resources (carbon dioxide, lactic acid) and applied studies on functional polymers used as solid electrolytes in modern electrochemical devices, biodegradable materials for biomedical and agriculture applications and inorganic-organic hybrid polymers and nanocomposites of high thermal and mechanical stability (see page 42).

- Prof. Maciej Jarosz: Scientific interests focus on the preservation of cultural heritage (identification of natural products in works of art); food and pharmaceutical analysis; environmental speciation analysis; hyphenated analytical techniques (high performance separation techniques - LC and CE with mass spectrometric detection - ICP MS and ESI MS); chemical separation and preconcentration methods (see page 16).
- Prof. Janusz Lewiński: We have managed to develop new synthesis procedures of noncovalent porous materials derived from self-assembly of molecular zinc carbonate nanoclusters. Their perspective application is expected in processes or equipment in which a selective adsorption of gases is necessary (see page 48).
- Prof. Elżbieta Malinowska: Our research interests are in the areas of bioanalytical chemistry, electrochemical and optical biosensors. Current efforts are primarily focused on the following projects: studies of nanomaterials for bio-analytical applications, investigation of novel recognition layers and labels for biosensors based on DNA, aptamers and/or oligonucleotide analogues with either electrochemical or optical readouts as well as the development of flow injection systems for bioanalysis (see page 64).



- Prof. Adam Proń: Our group's research embraces chemistry of materials and nanomaterials with a special emphasis on the synthesis of organic and hybrid (organic/inorganic) semiconductors as well as high spin organic materials (magnetic organic semiconductors). These new materials are used for the fabrication of molecular electronic devices such as field effect transistors, light emitting diodes or photodiodes (see page 40).
- Prof. Gabriel Rokicki: Research interests of the group concern the synthesis and characterization of new polymers and materials based on carbon dioxide. Current scientific activities include the synthesis of aliphatic polycarbonates, biodegradable polyurethanes based on oligocarbonate diols. Another topic is the synthesis of non-isocyanate polyurethanes utilizing reaction of five- or six-membered cyclic carbonate monomers with aliphatic polyamines (see page 38).
- Prof. Mikołaj Szafran: We focus on designing advanced ceramics materials and composites based on colloidal chemistry with applications of new environmental friendly organic additives which can play a multiple role in the ceramic slurry. Our activity especially concerns elastic

ceramic-polymer composites for microwave applications, smart materials based on shear-thickening fluids for energy absorption, ceramic micro reactors, ceramic inks composition based on different nanopowders (see page 20).

- Prof. Władysław Wiczorek: Our scientific profile is mainly focused on the energy storage and conversion systems and technologies. That includes: electrolytes (liquid, gel and polymer electrolytes, new salts for battery applications, electrodic materials, novel batteries, supercapacitors and fuel cells (see page 32).

The Faculty, together with the Faculty of Chemistry of the University of Warsaw, constitute a scientific consortium called the Warsaw Academic Chemical Consortium (WACC). In 2012, the Consortium was awarded the status of a Leading National Scientific Centre (KNOW) by the Ministry of Science and Higher Education (see page 9). In University Ranking 2014, organized by "Perspektywy" and "Dziennik Gazeta Prawna", the Faculty of Chemistry of the Warsaw University of Technology won in the field of chemical technology.

The year 2015 will be a time of celebrating the 100th Anniversary of the Revival of the Faculty of Chemistry and the whole Warsaw University of Technology.



Warsaw Academic Chemical Consortium – a Leading National Research Centre in Chemistry (KNOW)

Two Polish leading scientific and academic centres, the Faculty of Chemistry, Warsaw University of Technology and the Faculty of Chemistry, University of Warsaw formed the Warsaw Academic Chemical Consortium which in 2012 received the status of a Leading National Research Centre (KNOW) in chemical sciences in the years 2012-2017 by the Ministry of Science and Higher Education.

Establishing the Warsaw Academic Chemical Consortium (WACC-KNOW Consortium) stems from its founders' unshaken conviction that chemistry as a scientific discipline is of key importance for contemporary science and research. It is the so-called "central science" located between two fundamental streams of modern studies - biologically important systems and material science. These two directions of research are crucial not only for the development of science itself but also for the development of our civilization.

The major aim of the Consortium is to support and promote the flagship areas of chemistry developed at the Faculties of Chemistry of both Warsaw University of Technology and University of Warsaw. The intention is to implement the results of research in the processes of designing and evaluation of novel products, methods of their manufacturing and to determine their structure as well as physical and chemical properties. Our projects focus on:

- Fundamental research in the areas of organic, inorganic, physical and theoretical chemistry

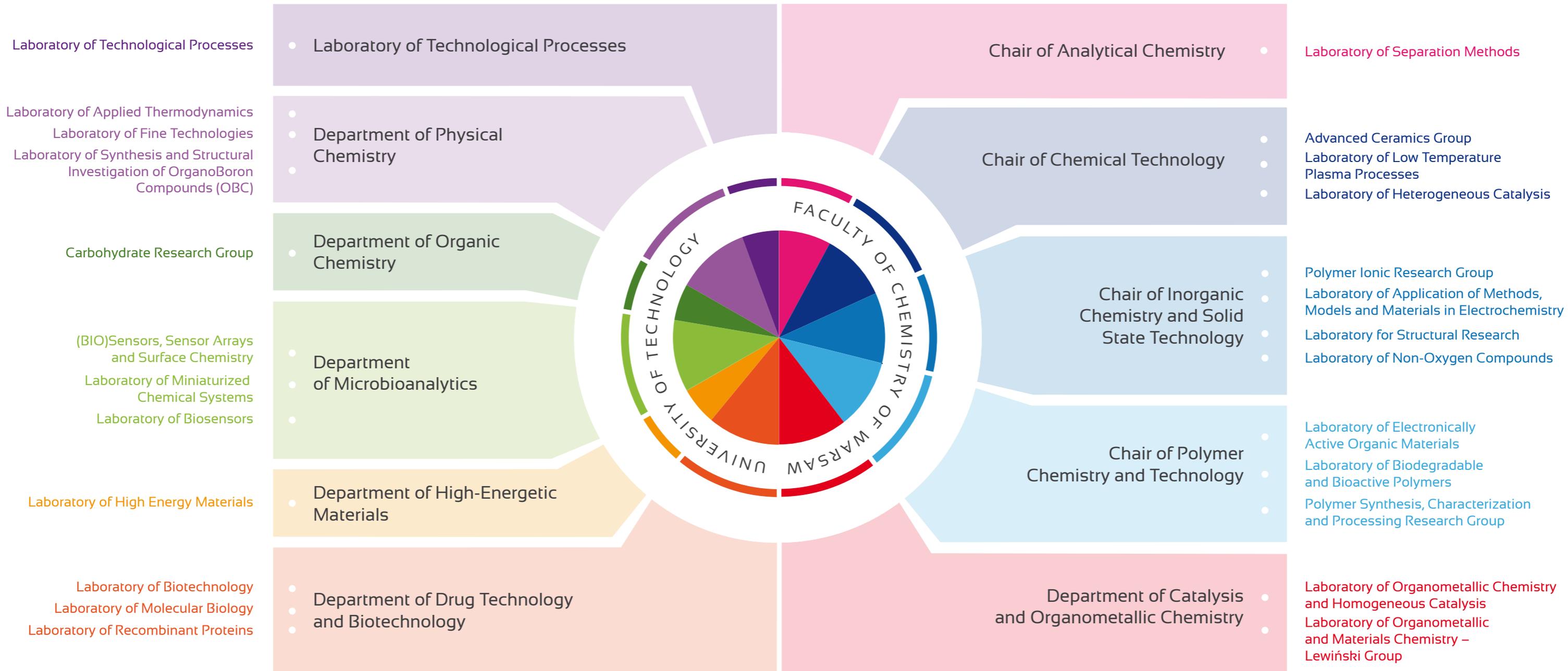
- Manufacturing, structure, properties and application of compounds of high biological value
- Advanced studies in the field of functional materials, including important issues related to new sources of energy
- Analytical and bioanalytical chemistry.

Contribution of the Faculty of Chemistry, WUT leads to many potential applications, including: fabrication of systems for organic electronics, organometallic catalysis, electrocatalysis, displays, sensors, development of new analytical methods, multidimensional approaches to NMR spectroscopy and alternate electrochemical energy technologies (batteries, low temperature fuel cells, photocells, biofuel cells, hydrogen storage). The above scientific topics correspond with the global trend of research related to comprehensive bioanalytics and medical diagnostic methods. The application of advanced materials and technologies will provide new miniaturized bioanalytical tools of enhanced selectivity and sensitivity, reaching lower detection limits and enabling an in-depth analysis of many types of bioanalytes (biomarkers, metabolites, enzymes). The development of tailored receptor layers by using nanotechnological approaches will be crucial for the unprecedented performances of (bio)sensors, as it will create a real alternative for currently used biochemical methods of analysis. Nowadays, a great deal of effort is being put into the diagnosis of cancer diseases and new methods of their treatment. The application of Lab-on-a-Chip devices can be very useful in testing a new anticancer

drug or in therapy procedures. The development of new microfluidic analytical devices, especially the ones coupled with cell culture modules, will help in the fabrication of high throughput screening systems which are highly competitive in comparison to other in vitro techniques.

The WACC-KNOW Consortium is recognized worldwide and the research conducted as part of its profile has a major impact on the world science, which is, for example, reflected in a great number of citations. Its members constitute an interdisciplinary group of experts involved both in basic and applied research, whose expertise is to complement each-other and give mutual support to provide a broader, more interdisciplinary perspective of looking at science, especially in research areas common for both partners of the Consortium (organic electronics, developing new substances with potential therapeutic properties, designing devices for early medical diagnosis, polymeric mate-

rials). Many scientists affiliated with the Consortium serve as editors or members of advisory committees in editorial teams of leading international journals. Moreover, our members have managed to file numerous patents (some of them at the European Patent Office) as well as to establish cooperation with top international and home research centers - leaders in chemical industry. The Consortium also aims at investing in the potential of young scientists, in their knowledge and skills related to applied chemistry linked with modern aspects of biosciences and biotechnology. It is to meet one of the most vital tasks assigned to institutions of higher education, namely to facilitate the transfer of knowledge to industry. The goals of the Consortium, fulfilled impeccably thanks to joint efforts of both Universities, are expected to give rise to the development of bold scientific ideas converted into innovative solutions in industry and medicine.



Organization Chart
Faculty of Chemistry

Laboratory of Separation Methods •

Chair of Analytical
Chemistry





Head

Maciej Jarosz

Staff

Ryszard Łobiński
Krzysztof Jankowski
Katarzyna Pawlak
Stawomir Oszwałdowski
Katarzyna Lech
Lena Ruzik

Current PhD students

Katarzyna Brama
Katarzyna Gibuła
Jacek Giersz
Wioletta Jakubczak
Magdalena Matczuk
Agata Miszczak
Monika Prządka
Monika Truskolaska
Katarzyna Witkoś
Justyna Wojcieszek

Former PhD students

Jan Krzysztof Abramski
Mohamed Abduelrahman
Ackacha
Iwona Biatas
Katarzyna Lech
Robert Lipka
Elżbieta Lipiec-Abramska
Katarzyna Pawlak
Maria Puchalska
Lena Ruzik
Rafał Ruzik
Anna Tyburska-Staniewska

Current research

- Capillary and nanochromatography coupled with ESI/APCI MS/MS in the examination of natural dyestuffs and historical works of art
- In vitro investigation of processing anticancer metallodrugs and tumor-targeting nanomaterials using a multidimensional analytical methodology
- Investigation of bioavailability/bioaccessibility of metal species from diet supplements; identification of low molecular bioligands responsible for the deactivation of toxic metals in plants
- Implementation of digitally controlled rotating field plasmas in analytical spectrochemistry
- Development of electrophoretic methods for the characterization of nanostructures

Selected publications

Lech K., Wilicka E., Witowska-Jarosz J., Jarosz M., *Early Synthetic Dyes – a Challenge for Tandem Mass Spectrometry*, Journal of Mass Spectrometry, 48, 141, 2013

Matczuk M., Prządka M., Aleksenko S.S., Czarnocki Z., Pawlak K., Timerbaev A.R., Jarosz M., *Metalomics for Drug Development: a Further Insight into Intracellular Activation Chemistry of a Ruthenium(III)-Based Anticancer Drug Gained Using a Multidimensional Analytical Approach*, Metallomics, 6, 147, 2014

Miszczak A., Roslon M., Zbroja G., Brama K., Szalacha E., Gawrońska H., Pawlak K., *SEC ICP MS and CZE ICP MS Investigation of Medium and High Molecular Weight Complexes Formed by Cadmium Ions with Phytochelatins*, Analytical and Bioanalytical Chemistry, 405, 4667, 2013

Ruzik L., *Speciation of Challenging Elements in Food by Atomic Spectrometry*, Talanta, 93, 18, 2012

Jankowski K., Reszke E., *Recent Developments in Instrumentation of Microwave Plasma Sources for Optical Emission and Mass Spectrometry: Tutorial Review*, Journal of Analytical Atomic Spectrometry, 28, 1196, 2013

Oszwałdowski S., Roberts K.P., Timerbaev A.R., *Capillary Zone Electrophoresis of Quantum Dots Dispersed in Mixed Micelles: New Evidence of the Concentration Effect*, Journal of Chromatography A, 1305, 320, 2013



Research profile

Cultural heritage preservation, identification of natural and synthetic dyes in art objects
Kinetic studies of cytotoxic drug complexes and nanoparticles with plasma transport proteins

Metallo-medical diagnosis

Food control, speciation analysis of food products

Characterization of metal deactivation mechanisms in plants

Plasma sources and sample introduction devices for plasma spectrometry

Characterization of semiconductor nanocrystals

Collaboration

Vernadsky Institute of Analytical Chemistry and Geochemistry, Moscow (Russia) – Andrei Timerbaev

Institute of Inorganic Chemistry, Vienna University (Austria) – Bernhard Keppler

College of Chemical Engineering and Materials Science, Zhejiang University of Technology (China) – Zhou Ying

Ertec-Poland, Wrocław (Poland) – Edward Reszke

Scientific awards

- Professor Andrzej Waksmundzki Medal - Award of the Polish Academy of Sciences
- Young Scientist Medal - Award of the Warsaw University of Technology
- 3 Awards of HM Rector of the Warsaw University of Technology for scientific activity (since 2010)

Research equipment

Mass spectrometers:

- ESI/APCI - MS/MS QqQ (Agilent Technologies)
- ESI - MS 1100 (Agilent Technologies)
- ICP MS 7500 (Agilent Technologies)

Chromatographs HPLC:

- 3 of Agilent Technologies, Perkin Elmer, Waters
- Capillary HPLC system of Agilent Technologies
- Nanospray-Chip for ESI MS of Agilent Technologies

Capillary electrophoresis systems:

- Agilent Technologies
- Prince

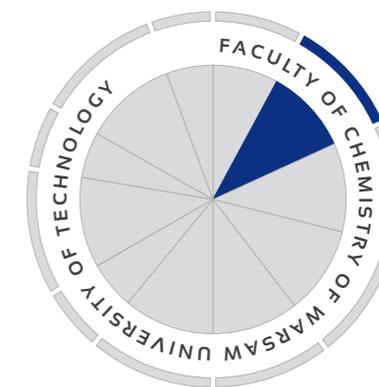
Optical emission spectrometers:

- Integra XL ICP-OES (GBC Scientific Equipment)
- MIP 750MV MIP-OES (Analab)



- Advanced Ceramics Group
- Laboratory of Heterogeneous Catalysis
- Laboratory of Low Temperature Plasma Processes

Chair of Chemical
Technology



Advanced Ceramics Group



Head

Mikołaj Szafran

Staff

Paweł Falkowski
Paulina Wiecińska
Janusz Sokółowski
Ewa Bobryk
Marta Łukaszuk
Roman Szerszeniewski

Current PhD students

Milena Zalewska
Agnieszka Antosik
Emilia Pawlikowska
Aleksandra Kędzierska
Emilia Pietrzak
Małgorzata Głuszek

Former PhD students

Agnieszka Szudarska
Anna Danelska
Magdalena Gizowska
Paulina Wiecińska
Paweł Falkowski
Krzysztof Perkowski
Katarzyna Jach
Dariusz Jach
Wojciech Lipiec
Paweł Wiśniewski

Current research

- Ceramic-polymer composites for microwave applications
- Synthesis and application of organic additives in shaping advanced ceramic materials
- UV-curing polymers in the fabrication of thick ceramic films and ceramic microreactors
- Smart materials based on shear-thickening fluids
- Elaboration of ceramic inks composition

Selected publications

Wiecinska P., Mizerski T., Szafran M., *Monoacryloyl Esters of Carbohydrates: Synthesis, Polymerization and Application in Ceramic Technology*, Carbohydrate Polymers, 111, 610, 2014

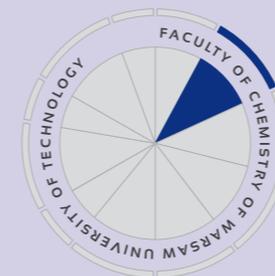
Szudarska A., Mizerski T., Sakka Y., Suzuki T., Szafran M., *Fabrication of Textured Alumina by Magnetic Alignment via Gelcasting Based on Low-Toxic System*, Journal of the European Ceramic Society, 34 (15), 3841, 2014

Wiecinska P., Graule T., Szafran M., *L-ascorbic Acid as a New Activator in Fabrication of Ceramics by Techniques Using in Situ Polymerization*, Journal of the European Ceramic Society, 34, 1581, 2014

Falkowski P., Grzelak A., *Effect of Solvents on Curing Process of Photopolymerizable Ceramic Suspensions*, Archives of Metallurgy and Materials, 58, 1411, 2013

Falkowski P., Bednarek P., Danelska A., Mizerski T., Szafran M., *Application of Monosaccharides Derivatives in Colloidal Processing of Aluminum Oxide*, Journal of the European Ceramic Society, 30, 2805, 2010

Bednarek P., Szafran M., *Thermal Decomposition of Monosaccharides Derivatives Applied in Ceramic Gelcasting Process Investigated by the Coupled Dta/Tg/Ts Analysis*, Journal of Thermal Analysis and Calorimetry, 109, 773, 2012



Research profile

Ceramic-polymer and ceramic-metal composites
Ceramic inks
Saccharides in ceramic technology
Shear-thickening fluids
Gelcasting
Colloidal processing
Porous ceramic materials
UV curable ceramic suspensions

Collaboration

NIMS – National Institute for Materials Science, Tsukuba (Japan)
EMPA – Swiss Federal Laboratories for Materials Science, Dübendorf (Switzerland)
ICV – The Institute of Ceramics and Glass, Madrid (Spain)
ISTEC-CRN – Institute of Science and Technology for Ceramics, Faenza (Italy)

Scientific Awards

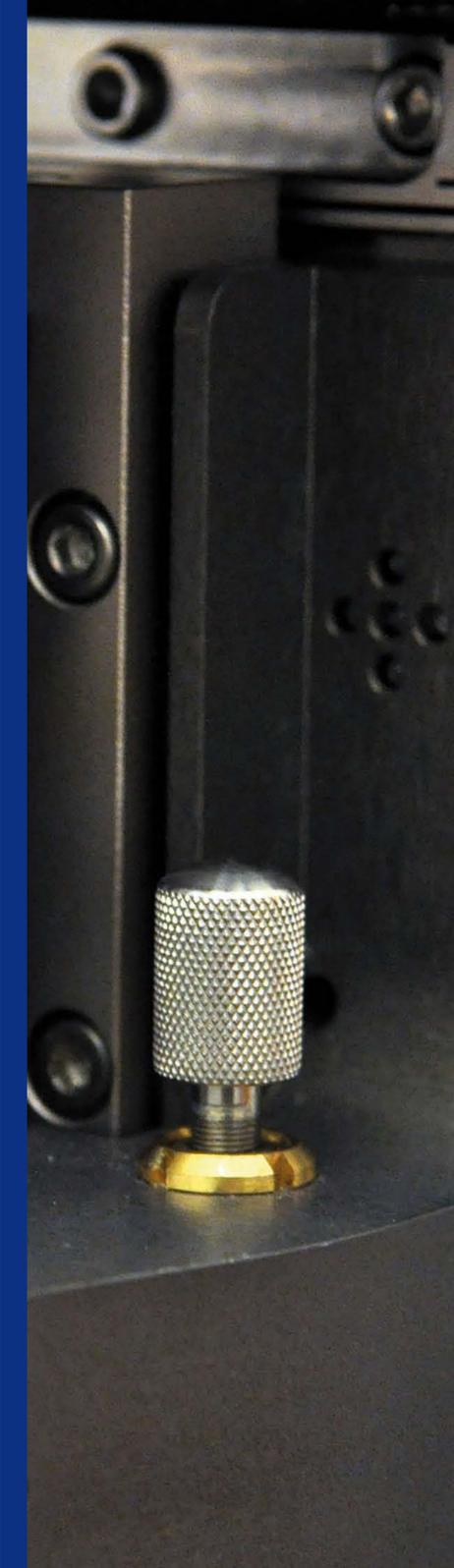
- Mikołaj Szafran was elected a new member of the World Academy of Ceramics, 2014
- Award of the Polish Ceramic Society – Janusz Sokółowski for industrial implementation of the research results, 2011
- Best poster award – Magdalena Gizowska during the E-MRS Fall Meeting, 2010

Research equipment

- Kinexus Pro Rheometer
- Zetasizer Nano ZS
- Nikon light microscope
- Retsch ball mills
- Carbolite chamber and tube furnaces

Additional activity

- Start-up of the factory which produces sintered lightweight aggregate on the basis of technology developed by Janusz Sokółowski
- Co-organization of the symposia at the E-MRS Fall Meeting Conference in the years: 2008, 2009, 2010, 2012, 2013, 2014
- Co-operation with industrial partners: Polsport S.A. (Bielsko-Biala), IEn Oddział Ceramiki Cerel (Boguchwała)





Head

Marek Marczewski

Staff

Wioletta Raróg-Pilecka
Elżbieta Truskiewicz
Marek Gliński
Piotr Winiarek
Urszula Ulkowska
Hanna Marczevska

Current PhD students

Magdalena Zybert
Agnieszka Czajka

Former PhD students

Dariusz Szmigiel
Elżbieta Truskiewicz
Ewa Iwanek
Agnieszka Jakubiak
Antoni Migdat
Osazuwa Osawaru
Juan Carlos Colmenares
Justyna Szkuta
Agata Purzycka
Agnieszka Mikotajska
Magdalena Litwinowicz
Marta Zezula
Dorota Olszewska
Emilia Piesio
Anna Kamińska
Urszula Ulkowska
Elżbieta Kamińska

Current research

- Designing and development of cobalt catalysts for ammonia synthesis and ruthenium catalysts for the methanation of carbon oxides
- Catalytic transfer hydrogenation over modified magnesium oxide – chemo- and diastereoselectivity aspects
- Green chemistry. Chemical recycling of polymer waste
- Acid-base catalysis
- Designing selective hydrogenation reactions

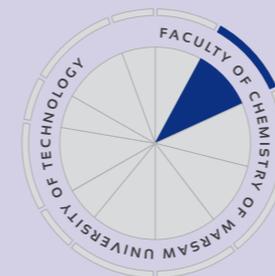
Selected publications

Zybert M., Truskiewicz E., Mierzwa B., Raróg-Pilecka W., *Thermal Analysis Coupled with Mass Spectrometry as a Tool to Determine the Cobalt Content in Cobalt Catalyst Precursor Obtained by Co-Precipitation*, *Thermochemica Acta* 584, 31, 2014

Karolewska M., Truskiewicz E., Wścisel M., Mierzwa B., Kępiński L., Raróg-Pilecka W., *Ammonia Synthesis Over a Ba and Ce-promoted Carbon-Supported Cobalt Catalyst. Effect of the Cerium Addition and Preparation Procedure*, *Journal of Catalysis* 303, 130, 2013

Marczewski M., Kamińska E., Marczevska H., Godek M., Rokicki G., Sokołowski J., *Catalytic Decomposition of Polystyrene. The Role of Acid and Basic Center*, *Journal of Applied Catalysis B. Environmental* 129, 236, 2013

Gliński M., Zalewski G., Burno E., Jerzak A., *Catalytic Ketonization Over Metal Oxide Catalysts. XIII. Comparative Measurements of Activity of Oxides of 32 Chemical Elements in Ketonization of Propanoic Acid*, *Applied Catalysis A: General*, 470, 278, 2014



Research profile

Metallic and metal oxide catalysts
Supported catalysis. Active carbon
as a support in catalytic systems

Hydrogenation processes: selective hydro-
genation, hydrogen transfer reactions

Ketonization reactions

Acid and basic solid catalysts

Green chemistry processes

Polystyrene recycling

Research equipment

- Surface Area and Porosity Analyzer ASAP 2020 - Micromeritics Instrument Co.
- Thermobalance STA 449 coupled with QMS 403C Aeolos – Netzsch
- IR (FTIR) Spectrometer – Nicolet 6700
- ESR Spectrometer

Certificates

- W. Raróg-Pilecka, E. Truskiewicz – Individual Course of NETZSCH Education & Training Department 2009, Warsaw (Poland)

Collaboration

Institute of Physical Chemistry, Polish Academy of Sciences, Warsaw (Poland)

Institute of Low Temperature and Structure Research, Polish Academy of Sciences, Wroclaw (Poland)

New Chemical Syntheses Institute, Puławy (Poland)

Faculty of Biotechnology and Food Science, Lodz University of Technology (Poland)

Scientific Awards

- Wioletta Raróg-Pilecka – Scholarship from the Foundation for Polish Science, 2003-2004
- Elżbieta Truskiewicz – Scholarship of the "Start" Programme, Foundation for Polish Science, 2008



Head

Krzysztof Krawczyk

Current research

- Destruction of volatile organic compounds
- Plasma and plasma-catalytic processing of particularly stable substances and environmentally harmful and toxic materials present in industrial wastes
- The couple of methane to higher hydrocarbons at the atmospheric pressure under gliding discharges and barrier discharge conditions
- Ozone synthesis
- Deposition of antimicrobial coating on polymers

Staff

Stawomir Jodzis
Michał Młotek
Zenobia Rżanek-Boroch
Bogdan Ulejczyk

Current PhD students

Ewelina Reda
Bogdan Wnęk
Małgorzata Majdak

Former PhD students

Agnieszka Górską
Michał Młotek
Anna Opalska
Joanna Ruszniak

Selected publications

Młotek M., Sentek J., Krawczyk K., Schmidt-Szałowski K., *The Hybrid Plasma-Catalytic Process for Non-Oxidative Methane Coupling to Ethylene and Ethane*, Applied Catalysis A: General 366, 232, 2009

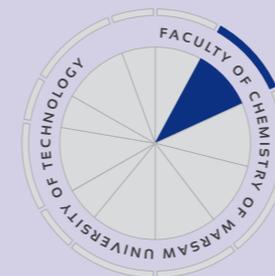
Krawczyk K., Młotek M., Ulejczyk B., Schmidt-Szałowski K., *Methane Conversion with Carbon Dioxide in Plasma-Catalytic System*, Fuel, 117, 608, 2014

Ulejczyk B., Krawczyk K., Młotek M., Schmidt-Szałowski K., Nogaj Ł., Kuca B., *Decomposition of Carbon Tetrachloride in the Reactor of Dielectric Barrier Discharge with Different Power Suppliers*, The European Physical Journal - Applied Physics, 61(2), 24324p1, 2013

Jodzis S., *Application of Technical Kinetics for Macroscopic Analysis of Ozone Synthesis Process*, Industrial & Engineering Chemistry Research, 50, 6053, 2011

Rżanek-Boroch Z., Dziadczyk P., Czajkowska D., Krawczyk K., Fabianowski W., *Plasma Deposition of Antimicrobial Coating on Organic Polymer*, The European Physical Journal - Applied Physics 61(2), 24316p1, 2013

Jodzis S., *Temperature Effects Under Ozone Synthesis Process Condition*, The European Physical Journal - Applied Physics, 61(2), 24319p1, 2013



Research profile

Decomposition of stable or toxic substances in non-equilibrium plasma
Surface of polymers treatment
Ozone synthesis
Reaction of nitrous oxide in non-equilibrium plasma
Methane coupling to C2 hydrocarbons in plasma catalytic system
Thin film deposition under plasma condition

Collaboration

Technische Universität Braunschweig (Germany)
National Institute of Public Health, National Institute of Hygiene, Food Safety Department, Warsaw (Poland)
Military University of Technology, Warsaw (Poland)
ERTEC Poland, Wrocław (Poland)

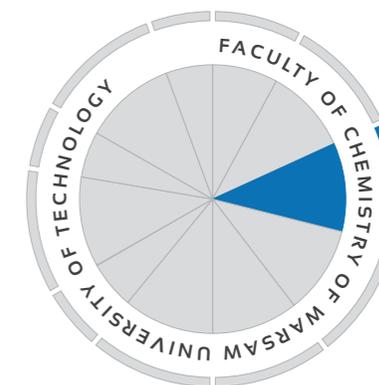
Research equipment

- Oscilloscope Tektronix TDPO 3034 with current and voltage probes
- Gas chromatograph Agilent 6890N
- Nitrogen oxides analyzer Uras 10B
- FTIR Nicolette spectrometer
- Numerous digital oscilloscopes with measuring equipment



- Laboratory for Structural Research
- Laboratory of Application of Methods, Models and Materials in Electrochemistry
- Polymer Ionic Research Group
- Laboratory of Non-Oxygen Compounds

Chair of Inorganic
Chemistry and Solid
State Technology



Laboratory for Structural Research



Head

Janusz Zachara

Current research

- Structural chemistry of lithium, sodium and magnesium salts and electrolytes for the use in rechargeable batteries
- The hierarchy of intermolecular interactions in crystal structures of boronic acids, their derivatives and co-crystals
- Structural, electronic and energetic studies of arsenic(III) oxide polymorphs and intercalates
- Structural studies of organometallic compounds containing main-group and transition metals
- Development of bond-valence vector model

Selected publications

Zachara J., *Novel Approach to the Concept of Bond-Valence Vectors*, *Inorganic Chemistry*, 46(23), 9760, 2007

Lesiuk M., Balawender R., Zachara J., *Higher Order Alchemical Derivatives from Coupled Perturbed Self-Consistent Field Theory*, *Journal of Chemical Physics*, 136, 034104, 2012

Guńka P.A., Dranka M., Piechota J., Żukowska G.Z., Zalewska A., Zachara J., *As₂O₃ Polymorphs: Theoretical Insight into Their Stability and Ammonia Templated Claudetite II Crystallization*, *Crystal Growth & Design*, 12, 5663, 2012

Plewa-Marczewska A., Trzeciak T., Bitner A., Niedzicki L., Dranka M., Żukowska G.Z., Marcinek M., Wieczorek W., *New Tailored Sodium Salts for Battery Applications*, *Chemistry of Materials*, 26, 4908, 2014

Madura I.D., Czerwińska K., Jakubczyk M., Pawełko A., Adamczyk-Woźniak A., Sporzyński A., *Weak C-H...O and Dipole-Dipole Interactions as Driving Forces in Crystals of Fluorosubstituted Phenylboronic Catechol Esters*, *Crystal Growth & Design*, 13, 5344, 2013

Kozłowska A., Dranka M., Zachara J., Pump E., Slugovc C., Skowerski K., Grela K., *Chelating Ruthenium Phenolate Complexes: Synthesis, General Catalytic Activity, and Applications in Olefin Metathesis Polymerization*, *Chemistry: A European Journal*, 20, 14120, 2014

Staff

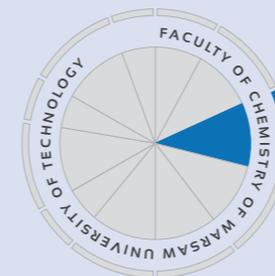
Izabela Madura
Andrzej Ostrowski
Maciej Dranka
Piotr Guńka

Current PhD students

Piotr Guńka
Karolina Czerwińska
Michał Hapka

Former PhD students

Monika Mazur



Research profile

Structural chemistry
Inorganic chemistry
Crystal engineering
Periodic quantum mechanical computations
Single crystal X-ray diffraction
Powder diffraction
Rietveld analysis

Collaboration

Center for Advanced Radiation Sources,
The University of Chicago (USA) – Yu-Sheng
Chen

Faculty of Chemistry, Adam Mickiewicz
University (Poland) – Andrzej Katrusiak

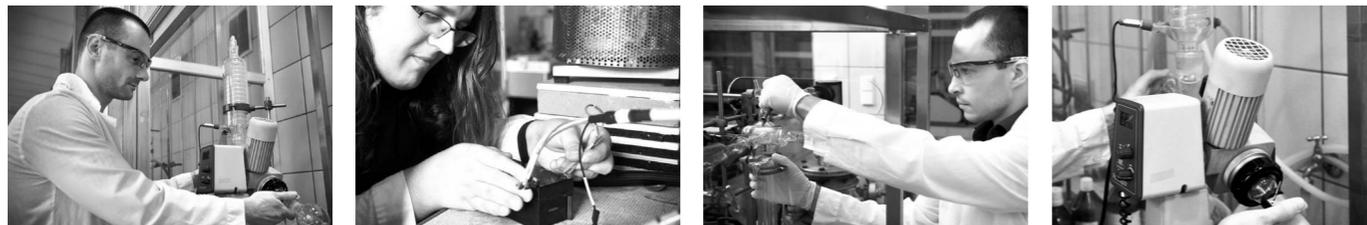
Organometallic Synthesis Laboratory,
Faculty of Chemistry, University of Warsaw
(Poland) – Andrzej Katrusiak,

Faculty of Chemistry, Rzeszow University of
Technology (Poland) – Jan Kalembkiewicz

Research equipment

- Gemini A Ultra X-ray Diffraction System from Agilent Technologies
- Seifert HZG-4 Diffractometer for powder diffraction measurements
- High Pressure and High Temperature Equipment





Head

Maciej Stanisław Siekierski

Current research

- Novel fuel cell electrolytes
- Biocompatible conductive hydrogels
- Lead acid batteries diagnostics and models
- Hybrid polymeric electrolytes
- Advanced applications of immittance spectroscopy

Selected publications

Piszc M., Marczewski M., Żukowska G.Z., Wójcik J., Wieczorek W., Siekierski M., *Optimization of Methylalumoxane Based Composite Polymeric Electrolytes for Lithium Battery Applications*, *Solid State Ionics* 33, 245, 2013

Siekierski M., Mroczkowska-Szerszeń M., Letmanowski R., Zabost D., Michał P., Żukowska G., Sasim E., Wieczorek W., Dudek M., Struzik M., *Synthetic Preparation of Proton Conducting Polyvinyl Alcohol and TiO₂-Doped Inorganic Glasses for Hydrogen Fuel Cell Applications*, *Electrochimica Acta* 104, 487, 2013

Piszc M., Marczewski M., Plewa-Marczewska A., Żukowska G.Z., Zalewska A., Pietrzykowski A., Siekierski M., *Hybrid Polymeric Electrolyte Based on Methylalumoxane*, *Journal of Power Sources* 195, 7495, 2010

Plewa-Marczewska A., Kalita M., Marczewski M., Siekierski M., *NMR Studies of Equilibriums in Electrolytes: Ionic Pairing in Glymes*, *Electrochimica Acta* 55, 1389, 2010

Hekselman A., Kalita M., Plewa-Marczewska A., Żukowska G.Z., Sasim E., Wieczorek W., Siekierski M., *Effect of Calix[6]Pyrrole Anion Receptor Addition on Properties of PEO-Based Solid Polymer Electrolytes Doped with LiTf and LiTfSI Salts*, *Electrochimica Acta* 55, 1298, 2010

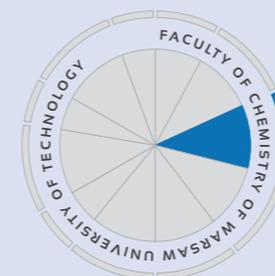
Marczewski M., Piszc M., Plewa-Marczewska A., Żukowska G.Z., Pietrzykowski A., Siekierski M., *Hybrid Polymeric Electrolyte Based on Methylalumoxane. Matrix Formation Reaction*, *Electrochimica Acta* 55, 1338, 2010

Current PhD students

Rafał Letmanowski
Piotr Ryś
Dariusz Zabost

Former PhD students

Michał Piszcz



Research profile

Novel fuel cell electrolytes – protonically conductive mid-temperature range glasses

Biocompatible conductive hydrogels and their composites as electrolytes and 3D electrodes for biofuel cells

Lead acid batteries - battery management and diagnostic systems based on the fuzzy logic algorithms

Lead acid batteries – impedance models of electrodes performance and processes

Integration of the electrochemical energy storage systems into industrial UPS systems

Hybrid polymeric electrolytes – towards their application in implantable microbatteries

Advanced applications of immittance spectroscopy – nonlinear systems analysis, pulse techniques and applications of the Fourier and Hilbert transform in the immittance data processing

Fractal immittance models of composite materials

Collaboration

Oil and Gas Institute - National Research Institute, Cracow, (Poland)

Institute of Power Engineering, Warsaw (Poland)

Faculty of Chemistry, University of Warsaw, (Poland)

Faculty of Electrical Engineering, Warsaw University of Technology (Poland)

Research equipment

- Modular electrochemical analyzer VMP3 (Biologic)





Head

Władysław Wieczorek

Staff

Regina Borkowska
Marta Kasprzyk-Niedzicka
Marek Marcinek
Maciej Marczewski
Leszek Niedzicki
Tomasz Trzeciak
Aldona Zalewska
Grażyna Zofia Żukowska

Current PhD students

Aneta Bernarkiewicz
Anna Bitner-Michalska
Ewelina Karpierz
Marta Kasprzyk-Niedzicka
Jędrzej Korczak
Anna Łatoszyńska
Paweł Łęzak
Tomasz Trzeciak
Piotr Wieczorek
Piotr Jankowski

Former PhD students

Artur Bac
Aurelia Błażejczyk
Michał Kalita
Marek Marcinek
Leszek Niedzicki
Anna Plewa-Marczewska
Jacek Stygar
Jarosław Syzdek
Grażyna Zofia Żukowska

Current research

- Nonaqueous proton conducting electrolytes and their application in supercapacitors
- Study on the electrochemical and thermal properties of solid polymer electrolytes based on lithium salts and poly(ethylene oxide)
- Synthesis and characterization of new anions for applications in electrolytes for lithium-ion and sodium-ion batteries
- Diagnostics of electrode-electrolyte interfaces in the new generation of lithium batteries

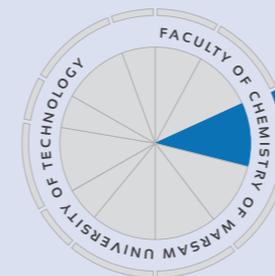
Selected publications

Plewa-Marczewska A., Trzeciak T., Bitner A., Niedzicki L., Dranka M., Żukowska G. Z., Marcinek M., Wieczorek W., *New Tailored Sodium Salts for Battery Applications*, Chemistry of Materials, 26 (17), 4908, 2014

Syzdek J. S., Armand M. B., Falkowski P., Gizowska M., Karłowicz M., Łukaszuk Ł., Marcinek M. Ł., Zalewska A., Szafran M., Masquelier Ch., Tarascon J. M., Wieczorek W. G., Żukowska G. Z., *Reversed Phase Composite Polymeric Electrolytes Based on Poly(Oxyethylene)*, Chemistry of Materials, 23 (7), 1785, 2011

Niedzicki L., Żukowska G. Z., Bukowska M., Szczeciński P., Grugeon S., Laruelle S., Armand M., Panero S., Scrosati B., Marcinek M., Wieczorek W., *New Type of Imidazole Based Salts Designed Specifically for Lithium Ion Batteries*, Electrochimica Acta, 55, 1450, 2010

Niedzicki L., Kasprzyk M., Kuziak K., Żukowska G. Z., Armand M., Bukowska M., Marcinek M., Szczeciński P., Wieczorek W., *Modern Generation of Polymer Electrolytes Based on Lithium Conductive Imidazole Salts*, Journal of Power Sources, 192, 612, 2009



Research profile

Gel, liquid and solid electrolytes
Synthesis of salts for new generation batteries
Diagnostics of electrolyte/metal interfaces
Raman spectra research
FT-IR spectra research
Ionic liquids
New electroactive materials development
Thermal analysis

Collaboration

European Research Institute Alistore
Member – <http://www.alistore.eu/>
Numerous partners in industry
40 Top European Universities
Several US Institutions and Universities
Current FP7 Projects:

- EUROLIION (The Netherlands) – <http://www.eurolion.eu/>
- SIRBAT, University of Liverpool (UK) – <http://www.liv.ac.uk/sirbatt/>

Numerous forms of collaboration with global industrial companies in the field

Scientific Awards

- Prime Minister of Poland Award 2011 for the best PhD thesis – Leszek Niedzicki
- Siemens Promotion Award 2011 for the best PhD thesis – Leszek Niedzicki
- Gold Chemistry Medal – Tomasz Trzeciak

Research equipment

- Biologic Science Instruments VMP3 multichannel potentiostat/galvanostat/Frequency Response Analyzer (FRA)
- Perkin Elmer System 2000 FT-IR spectrometer
- Nicolet Almega Dispersive Raman spectrometer
- High Vacuum drier lines
- Argon-filled gloveboxes (dryboxes)

Additional activity

- Global scientific and industrial collaboration in the field of storage and conversion systems
- Various activities including European educational project dedicated to talented students http://www.u-picardie.fr/mundus_MESC/



Laboratory of Non-Oxygen Compounds



Head

Stawomir Podsiadło

Current research

- Synthesis of novel environment friendly materials for photovoltaics and spintronics
- Synthesis of nanoparticles for electronics
- Single crystal growth of chalcogenides and nitrides for electronics

Selected publications

Bacewicz R., Antonowicz J., Podsiadło S., Schorr S., *Local Structure in $\text{Cu}_9\text{ZnSnS}_4$ Studied by the XAFS Method*, Solid State Communications, 177, 54, 2014

Podsiadło S., Białogłowski M., Matyszczak G., Marek P., Gebicki W., Bacewicz R., Stachowicz M., Dłuzewski P., Wozniak K., *Synthesis of Bulk Kesterite - a Prospective Photovoltaic Material*, European Journal of Inorganic Chemistry, 2014, 4730, 2014

Zajac M., Gosk J., Kaminska M., Twardowski A., Szyszko T., Podsiadło S., *Paramagnetism and Antiferromagnetism d-d Coupling in GaMnN Magnetic Semiconductor*, Applied Physics Letters, 79, 2432, 2001

Gebicki W., Strzeszewski J., Kamler G., Szyszko T., Podsiadło S., *Raman Scattering Study of $\text{Ga}_x\text{Mn}_x\text{N}$ Crystals*, Applied Physics Letters, 76, 3870, 2000

Zajac M., Gosk J., Grzanka E., Kaminska M., Twardowski A., Strojek B., Szyszko T., Podsiadło S., *Possible Origin of Ferromagnetism in $(\text{Ga},\text{Mn})\text{N}$* , Journal of Applied Physics, 93, 4715, 2003

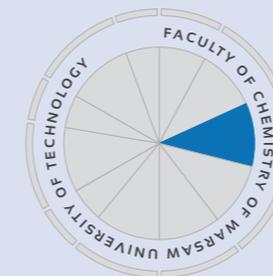
Paszkwicz W., Pelka J.B., Knapp M., Szyszko T., Podsiadło S., *Lattice Parameters and Anisotropic Thermal Expansion of Hexagonal Boron Nitride in the 10-297.5 K Temperature Range*, Applied Physics A: Materials Science and Processing, 75, 431, 2002

Current PhD students

Mohammad Fadaghi

Former PhD students

Paweł Dominik
Andrzej Pawelec
Grzegorz Weisbrod
Grzegorz Kamler
Tomasz Szyszko
Beata Strojek
Michał Kamiński



Research profile

Nanotechnology
Photovoltaics
Spintronics
Nitrides
Chalcogenides

Research equipment

- Horizontal tube furnace Carbolite CTF 12/65/550
- Vertical tube furnace Carbolite GVC 12/750
- Chamber furnace Carbolite ELF 11/6

Collaboration

Institute of Physics, Polish Academy of Sciences (Poland)

Faculty of Chemistry, University of Durham (UK)

Van der Waals-Zeeman Institute, University of Amsterdam (The Netherlands)

Department of Chemical Engineering, Kansas State University (USA)

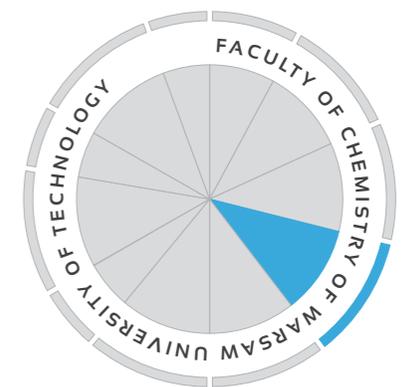
Scientific Awards

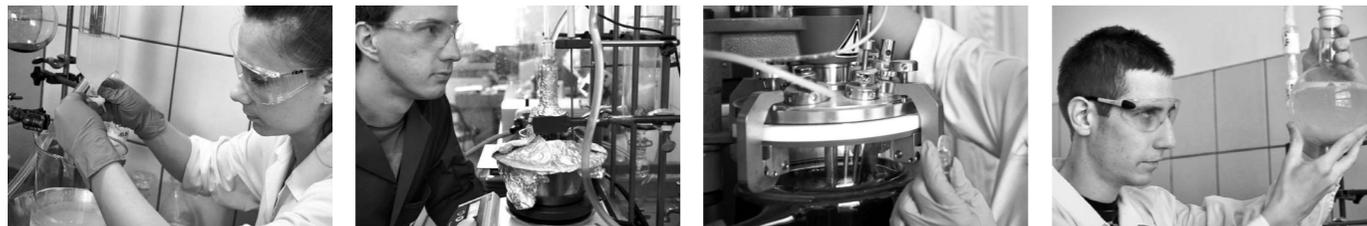
- Commendation for Maciej Białogłowski on the EMRS 2014 Fall Meeting (Warsaw, September 15-18) for an oral presentation: *Synthesis of Magnetic Doped Kesterite Single Crystals* given at Symposium N titled *Crystallography in materials science: Novel methods for novel materials*
- Scholarship of the Minister of Science and Higher Education for Maciej Białogłowski (2014/2015)



- Laboratory of Biodegradable and Bioactive Polymers
- Laboratory of Electronically Active Organic Materials
- Polymer Synthesis, Characterization and Processing Research Group

Chair of Polymer Chemistry and Technology





Head

Gabriel Rokicki

Current research

- Synthesis and characterization of novel polymeric materials
- Development of environmentally friendly technologies
- Development of materials with unique physicochemical properties

Staff

Paweł Parzuchowski
Mariusz Tryznowski
Kazimierz Dąbrowski

Current PhD students

Izabela Steinborn-Rogulska
Magdalena Mazurek
Edyta Wawrzyńska
Marcin Kaczorowski
Paweł Leszczyński

Former PhD students

Karolina Tomczyk
Monika Biernat
Mariusz Tryznowski
Piotr Jankowski
Joanna Przygórzcowska
Marta Pawłowska
Piotr Pawtowski
Tomasz Kowalczyk
Anna Piotrowska

Selected publications

Steinborn-Rogulska I., Parzuchowski P., Rokicki G., *Melt/Solid-State Polytransesterification Supported by an Inert Gas Flow – an Alternative Route for the Synthesis of High Molar Mass Poly(L-lactic Acid)*, *Polymer Chemistry*, 5, 5412, 2014

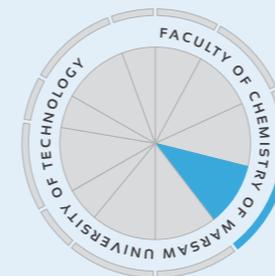
Brzozowska A., Paczesny J., Parzuchowski P., Kusznerczuk M., Nikiforov K., Rokicki G., Gregorowicz J., *Hyperbranched Polyesters Terminated with Alkyl Chains of Different Length at the Air/Water Interface and on Solid Substrates*, *Macromolecules*, 47, 5256, 2014

Gregorowicz J., Wawrzyńska E. P., Parzuchowski P. G., Fraś Z., Rokicki G., Wojciechowski K., Wieczorek S. A., Wiśniewska A., Plichta A., Dąbrowski K., Tryznowski M., *Synthesis, Characterization, and Solubility in Supercritical Carbon Dioxide of Hyperbranched Copolyester*, *Macromolecules*, 46, 7180, 2013

Tryznowski M., Tomczyk K. M., Fraś Z., Gregorowicz J., Rokicki G., Wawrzyńska E., Parzuchowski P. G., *Aliphatic Hyperbranched Polycarbonates – Synthesis, Characterization and Solubility in Supercritical Carbon Dioxide*, *Macromolecules*, 45, 6819, 2012

Tomczyk K. M., Guńka P. A., Parzuchowski P. G., Zachara J., Rokicki G., *Intramolecular Etherification of Five-Membered Cyclic Carbonates Bearing Hydroxyalkyl Groups*, *Green Chemistry*, 14, 1749, 2012

Rokicki G., Parzuchowski P., *ROP of Cyclic Carbonates and ROP of Macrocycles*. In: *Matyjaszewski K and Möller M (eds.) Polymer Science: A Comprehensive Reference*, 4, 247, 2012. Amsterdam: Elsevier BV



Research profile

Synthesis and characterization of polymers for biomedical applications – drug carriers, shape memory polymers, dental resins, biocompatible materials

Synthesis and characterization of hyperbranched polymers and polymer networks

Applications of renewable resources (carbon dioxide, glycerol, plant oils, etc.) for the synthesis of new polymers and polymer networks

Development of new environmentally friendly technologies and polymer recycling

Synthesis and copolymerization of heterocyclic monomers – cyclic carbonates and lactones

Solubility of hyperbranched polymers in supercritical carbon dioxide

MALDI-TOF mass spectrometry of polymeric materials

Synthesis and characterization of biodegradable polymers

Collaboration

Institute of Physical Chemistry, Polish Academy of Sciences, Warsaw (Poland)

Faculty of Chemistry, University of Warsaw (Poland)

The Centre of Molecular and Macromolecular Studies, Polish Academy of Sciences, Łódź (Poland)

The Centre of Polymer and Carbon Materials, Polish Academy of Sciences, Zabrze (Poland)

Research equipment

- Bruker ULTRAFLEX MALDI-TOF mass spectrometer
- Automatic laboratory reactor IKA LR 2000
- Biorad FTS 165 FTIR spectrometer





Head

Adam Proń

Current research

- Synthesis of low and high molecular weight organic semiconductors and metals
- Synthesis of high spin organic compounds
- Preparation of inorganic semiconductor nanocrystals and their hybrids with organic semiconductors and metals
- Structural, spectroscopic, magnetic, electronic and electrochemical characterization of the obtained materials
- Development of “all organic” or hybrid (organic/inorganic) field effect transistor, light emitting diodes, photodiodes and photovoltaic cells

Staff

Irena Kulszewicz-Bajer
Małgorzata Zagórska
Adam Proń
Ireneusz Wielgus
Piotr Bujak

Current PhD students

Grzegorz Gąbka
Kamil Kotwica
Ewa Kurach
Renata Rybakiewicz
Łukasz Skórka
Monika Góra

Former PhD students

Krzysztof Bieńkowski
Katarzyna Buga
Paweł Gawryś
Rafał Pokrop
Izabela Różalska

Selected publications

Kulszewicz-Bajer I., Louarn G., Djurado D., Skorka L., Szymanski M., Mevellec J. Y., Rols S., Pron A., *Vibrational Dynamics in Dendritic Oligoarylamines by Raman Spectroscopy and Incoherent Inelastic Neutron Scattering*, Journal of Physical Chemistry B, 118 (19), 5278, 2014

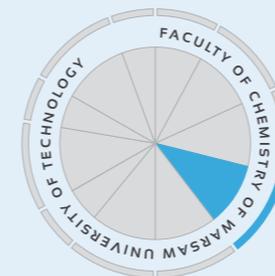
Maurel V., Skorka L., Onofrio N., Szewczyk E., Djurado D., Dubois L., Mouesca J. M., Kulszewicz-Bajer I., *Ferromagnetic Spin Coupling Through the 3,4'-Biphenyl Moiety in Arylamine Oligomers - Experimental and Computational Study*, Journal of Physical Chemistry B, 118 (27), 7657, 2014

Gąbka G., Bujak P., Giedyk K., Ostrowski A., Malinowska K., Herbich J., Golec B., Wielgus I., Pron A., *A Simple Route to Alloyed Quaternary Nanocrystals Ag-In-Zn-S with Shape and Size Control*, Inorganic Chemistry, 53, 5002, 2014

Bujak P., Kulszewicz-Bajer I., Zagórska M., Maurel V., Wielgus I., Pron A., *Polymers for Electronics and Spintronics*, Chemical Society Reviews, 42, 8895, 2013

Kurach E., Kotwica K., Zapala J., Knor M., Nowakowski R., Djurado D., Toman P., Pflieger J., Zagórska M., Pron A., *Semiconducting Alkyl Derivatives of 2,5-Bis(2,2'-Bithiophene-5-yl)-1,3,4-Thiadiazole. Effect of the Substituent Position on the Spectroscopic, Electrochemical and Structural Properties*, Journal of Physical Chemistry C, 117, 15316, 2013

Pron A., Reghu R. R., Rybakiewicz R., Cybulski H., Djurado D., Grazulevicius J. V., Zagórska M., Kulszewicz-Bajer I., Verilhac J. M., *Triarylamine Substituted Arylene Bisimides as Solution Processable Organic Semiconductors for Field Effect Transistors. Effect of Substituent Position on Their Spectroscopic, Electrochemical, Structural and Electrical Transport Properties*, Journal of Physical Chemistry C, 115, 15008, 2011



Research profile

Design and synthesis of organic semiconductors

Design and synthesis of organic ferromagnets

Inorganic nanocrystals synthesis and functionalization

Organic electrochemistry and spectroelectrochemistry

Magnetic studies of high spin materials

Fabrication of test organic electronic devices

Research equipment

- Spectrophotometer Cary 5000
- 2 potentiostats

Collaboration

Atomic Energy Commission, Grenoble (France) – David Djurado

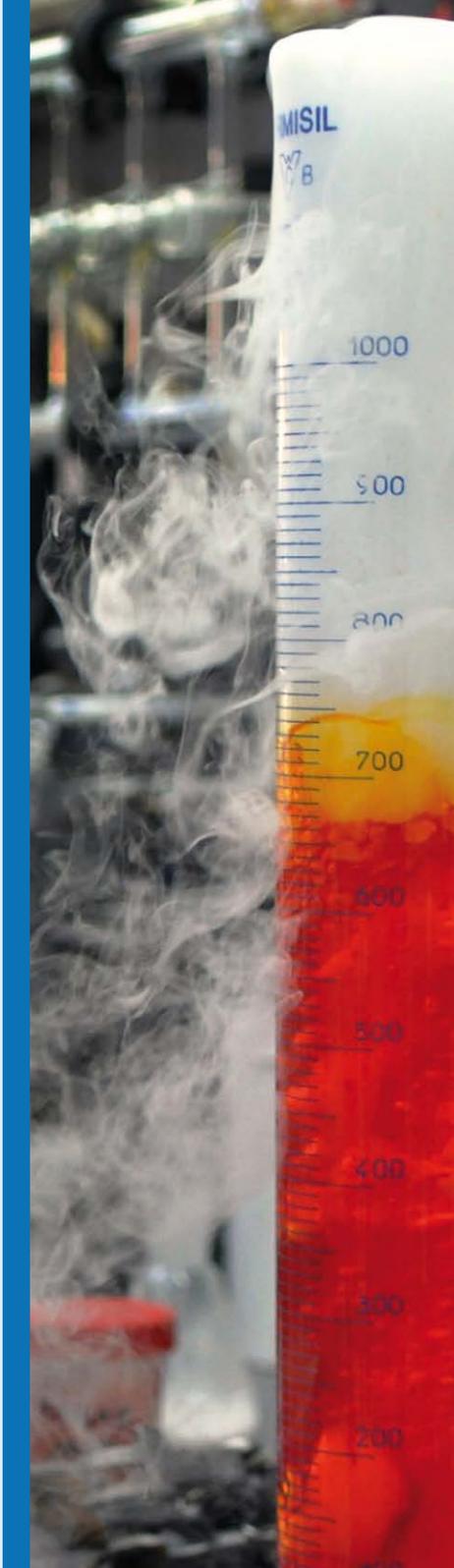
University of Nantes (France) – Guy Louarn and Serge Lefrant

Lodz University of Technology (Poland) – Jacek Ulański

Institute of Physical Chemistry, Polish Academy of Sciences (Poland) – Robert Nowakowski

Scientific Awards

- Prize of the Foundation for Polish Science 2002 – Adam Proń
- Zawadzki Medal of the Polish Chemical Society 2011 – Adam Proń





Head

Zbigniew Florjańczyk

Staff

Ewa Zygadło-Monikowska
Andrzej Plichta
Maciej Dębowski
Norbert Langwald

Current PhD students

Anna Kundys
Anita Frydrych
Konrad Żurawski
Katarzyna Rucińska

Former PhD students

Cezary Dębek
Marcin Sobczak
Michał Kędzierski
Anna Lasota
Edyta Wielgus-Barry
Andrzej Plichta
Aneta Affek
Andrzej Wolak
Aleksandra Cwil
Maciej Dębowski
Marcin Affek
Anna Tomaszewska
Krzysztof Łokaj
Justyna Ostrowska
Elżbieta Chwojnowska

Current research

- Studies of polymer electrolytes capable of the fast ionic transport in electrochemical devices
- Utilization of ROP and ATRP in polymer synthesis
- Inorganic-organic hybrid polymers and their composites
- Biodegradable polymers
- Processing and modification of polymeric materials

Selected publications

Zygadło-Monikowska E., Florjańczyk Z., Kubisa P., Biedroń T., Sadurski W., Puczyłowska A., Langwald N., Ostrowska J., *Lithium Electrolytes Based on Modified Imidazolium Ionic Liquids*, International Journal of Hydrogen Energy, 39, 2943, 2014

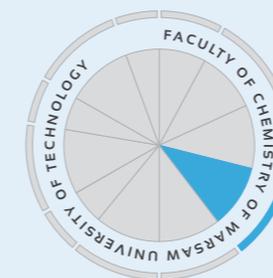
Florjańczyk Z., Józwiak A., Kundys A., Plichta A., Dębowski M., Rokicki G., Parzuchowski P., Lisowska P., Zychewicz A., *Segmental Copolymers of Condensation Polyesters and Polylactide*, Polymer Degradation and Stability, 97, 1852, 2012

Bury W., Chwojnowska E., Justyniak I., Lewiński J., Affek A., Zygadło-Monikowska E., Bąk J., Florjańczyk Z., *Investigations on the Interaction of Dichloroaluminum Carboxylates with Lewis Bases and Water: an Efficient Road Toward Oxo- and Hydroxoaluminum Carboxylate Complexes*, Inorganic Chemistry, 51, 737, 2012

Florjańczyk Z., Dębowski M., Plichta A., Cwil A., Affek M., Chwojnowska E., Kania A., *Polymer Composites Based on Reactive Carboxylate-Alumoxanes*, Macromolecular Symposia, 308, 77, 2011

Plichta A., Florjańczyk Z., Kundys A., Frydrych A., Dębowski M., Langwald N., *On the Copolymerization of Monomers from Renewable Resources: L-lactide and Ethylene Carbonate in the Presence of Metal Alkoxides*, Pure and Applied Chemistry, 86, 733, 2014

Plichta A., Lisowska P., Kundys A., Zychewicz A., Dębowski M., Florjańczyk Z., *Chemical Recycling of Poly(Lactic Acid) via Controlled Degradation with Protic (Macro)Molecules*, Polymer Degradation and Stability, 108, 288, 2014



Research profile

Modification of polymer electrolytes ionic transport properties with boron and aluminum compounds

Application of new ionic liquids in lithium-ion conducting electrolytes

Synthesis of novel polymeric materials as electrolyte matrices for lithium-ion batteries

ATRP methods as a tool for preparation of functional polymers

Immobilization of drugs on polymeric matrices

ROP of heterocyclic and heterounsaturated monomers

Synthesis, characterization and processing of biodegradable polymers

Synthesis and characterization of inorganic-organic hybrid polymers and nanocomposites

Collaboration

Centre of Molecular and Macromolecular Studies, Polish Academy of Sciences (Poland)

Faculty of Pharmacy with the Laboratory Medicine Division, Department of Inorganic and Analytical Chemistry, Medical University of Warsaw (Poland)

Faculty of Chemistry, Department of Technology and Materials Chemistry, Rzeszów University of Technology (Poland)

Faculty of Chemistry, Institute of Polymer and Dye Technology, Lodz University of Technology (Poland)

Scientific Awards

- Medals of the Polish Chemical Society: Stanislaw Kostanecki Medal, 2008, and Ignacy Mościcki Medal, 2010
- Medal of the Association of the Polish Inventors and Rationalizers: Tadeusz Sendzimir Honorary Medal of SPWiR, 2012
- 1st degree Team Award of HM Rector of the Warsaw University of Technology, 2008 – Zbigniew Florjańczyk, Ewa Zygadło-Monikowska, Andrzej Plichta

Research equipment

- Zetasizer Nano ZS (Malvern)
- Universal Mechanical Test Frame Instron 5566 (Instron)
- HAAKE MiniLab II Micro Compounder (Thermo Scientific)
- Triple-detector GPC/SEC Viscotec TDAmx system (Malvern)
- FTIR microscope Nicolet 6700 (Thermo Scientific)



- Laboratory of Organometallic Chemistry and Homogeneous Catalysis
- Laboratory of Organometallic and Materials Chemistry – Lewiński Group

Department of Catalysis and Organometallic Chemistry





Head

Antoni Pietrzykowski

Staff

Piotr Buchalski
Włodzimierz Buchowicz
Andrzej Kozioł
Antoni R. Kunicki
Wanda Ziemkowska

Current PhD students

Łukasz Banach
Dariusz Basiak
Eliza Jaśkowska
Joanna Jureczko
Jakub Jurkowski
Roman Pocholski
Piotr Urbański
Agata Włodarska

Former PhD students

Piotr Buchalski
Lidia Bukowska
Artur Cebulski
Beata Herbaczyńska
Andrzej Kozioł
Barbara Kryza-Niemiec
Kinga Leszczyńska
Maciej Marczewski
Ewa Olędzka
Tomasz Radzyński
Tomasz Skrok
Stawomir Szumacher

Current research

- Synthesis of cyclopentadienylnickel complexes with N-heterocyclic carbenes and their application in C-C bond forming reactions
- Alkylaluminum, -gallium and -indium derivatives of diols, dicarboxylic acids, amides, and boroxines, and their activity in polymerization
- Synthesis, structure, and properties of nickelacyclic compounds
- Organoaluminum compounds as the precursors of nanosized aluminum oxide
- Organometallic hydrides for hydrogen storage and energetic materials

Selected publications

Buchowicz W., Banach Ł., Conder J., Guńka P. A., Kubicki D., Buchalski P., *Anion Exchange in $[Ni(\eta^5-C_5H_4R)(Cl)(NHC)]$. Counterion Effect on the Structure and Catalytic Activity*, Dalton Transaction, 43, 5847, 2014

Kozioł A., Jerzykiewicz L. B., Justyniak I., Lis T., Pasynkiewicz S., Pietrzykowski A., *New Ionic Fluorenylnickel Complexes: Synthesis and Solid State Structure*, Journal of Organometallic Chemistry, 767, 22, 2014

Jaśkowska E., Justyniak I., Cyrański M. K., Adamczyk-Woźniak A., Sporzyński A., Zygadło-Monikowska E., Ziemkowska W., *Benzoxaborolate Ligands in Group 13 Metal Complexes*, Journal of Organometallic Chemistry, 732, 8, 2013

Buchowicz W., Herbaczyńska B., Jerzykiewicz L., Lis T., Pasynkiewicz S., Pietrzykowski A., *Triple C-H Bond Activation of a Nickel-Bound Methyl Group. Synthesis and X-ray Structure of a Carbide Cluster $(NiCp)6(\mu_6-C)$* , Inorganic Chemistry, 51, 8292, 2012

Ziemkowska W., Cyrański M.K., Kunicki A. R., *Alkylaluminum Derivatives of Diphenic Acid: Novel Aluminium Carboxylates*, Inorganic Chemistry, 48, 7006, 2009

Buchalski P., Grabowska I., Kamińska E., Suwińska K., *Synthesis and Structures of η^9 -Nickelfluorenyllithium Complexes*, Organometallics, 27, 2346, 2008



Research profile

Formation and cleavage of metal-carbon bonds
Polymerization of olefins and heterocyclic monomers catalyzed with metal complexes
Organometallic functional materials
Carbon-hydrogen bond activation by metal complexes
Organometallic functional materials
Organometallics as precursors of nanosized metal oxides
Olefin metathesis in metal coordination spheres
Metal clusters

Collaboration

Faculty of Chemistry,
University of Warsaw (Poland)
Faculty of Chemistry,
University of Wrocław (Poland)
Faculty of Chemistry, Adam Mickiewicz
University, Poznań (Poland)
North University of Baia Mare, Baia Mare
(Romania)

Scientific Awards

- Team Award of HM Rector of the Warsaw University of Technology for Scientific Achievements in 2005-2006 – A. Pietrzykowski, P. Buchalski, W. Buchowicz
- Individual Award of HM Rector of the Warsaw University of Technology for Scientific Achievements in 2011 – W. Buchowicz
- Individual Award of HM Rector of the Warsaw University of Technology for Scientific Achievements in 2010 – P. Buchalski

Research equipment

- 400 MHz NMR Spectrometer
- Agilent Technologies 7820A GC System
- Vacuum Schlenk lines



Laboratory of Organometallic and Materials Chemistry – The Lewiński Group



Head

Janusz Lewiński

Staff

Karolina Zelga
Wojciech Bury
Daniel Prochowicz
Elżbieta Chwojnowska
Agnieszka Grala

Current PhD students

Arkadiusz Kornowicz
Marcin Kubisiak
Adam Tulewicz
Abdul Raheem Keeri
Krzysztof Budny-Godlewski
Małgorzata Wolska
Adam Świerkosz
Łukasz Mąkowski
Szymon Komorski
Tomasz Pietrzak

Former PhD students

Maciej Dranka
Witold Śliwiński
Paweł Horeglad
Ewa Tratkiewicz
Wojciech Marciniak
Izabela Dranka
Tomasz Kaczorowski
Tomasz Kopec
Piotr Goś
Iwona Justyniak
Emil Bojarski
Marek Kościelski

Current research

- Inorganic and organometallic chemistry
- Activation of small molecules
- Photoluminescent materials
- ZnO quantum dots
- Microporous materials
- Molecular magnetism

Selected publications

Sokołowski K., Bury W., Justyniak I., Fairén-Jiménez D., Sołtys K., Prochowicz D., Yang S., Schröder M., Lewiński J., *Permanent Porosity Derived from the Self-Assembly of Highly Luminescent Molecular Zinc Carbonate Nanoclusters*, *Angewandte Chemie International Edition*, 52, 13414, 2013

Lewiński J., Śliwiński W., Dranka M., Justyniak I., Lipkowski J., *Reactions of [ZnR₂(L)] Complexes with Dioxigen: A New Look at an Old Problem*, *Angewandte Chemie International Edition*, 45, 4826, 2006

Kaczorowski T., Justyniak I., Lipińska T., Lipkowski J., Lewiński J., *Metal Complexes of Cinchonine as Chiral Building Blocks: A Strategy for the Construction of Nanotubular Architectures and Helical Coordination Polymers*, *Journal of the American Chemical Society*, 131, 5393, 2009

Lewiński J., Dranka M., Bury W., Śliwiński W., Justyniak I., Lipkowski J., *From Discrete Linear ZnBu₂ Molecules to 1D Coordination Polymers and 2D Fabrics*, *Journal of the American Chemical Society*, 129, 3096, 2007

Lewiński J., Dutkiewicz M., Lesiuk M., Śliwiński W., Zelga K., Justyniak I., Lipkowski J., *Solid State Conversion of the Solvated Dimer [tBuZn(μ-OtBu)(THF)]₂ to a Long Overlooked Trimeric [tBuZnOtBu]₃ Species*, *Angewandte Chemie International Edition*, 49, 8266, 2010

Sokołowski K., Bury W., Justyniak I., Cieślak A. M., Wolska M., Sołtys K., Dziegielewska I., Lewiński J., *Activation of CO₂ by tBuZnOH Species: Efficient Routes to Novel Nanomaterials Based on Zinc Carbonates*, *Chemical Communications*, 49, 5271, 2013



Research profile

Fundamental inorganic and organometallic chemistry
Functional materials
Nanomaterials
Supramolecular chemistry
Mechanochemistry
Asymmetric catalysis
Polymerization of cyclic esters
Bioimaging

Collaboration

University of Cambridge (UK) – Oren Scherman, Andrew Wheatley
École Polytechnique Fédérale de Lausanne (Switzerland) – Michael Grätzel
McGill University, Montreal (Canada) – Tomislav Friščić

Scientific Awards

- Maria Skłodowska-Curie Scientific Award of the Polish Academy of Sciences, 2008
- Award of HM Rector of the Warsaw University of Technology, 2011
- Laureate of the Master Programme of the Foundation for Polish Science, 2013



- Laboratory of Biotechnology
- Laboratory of Molecular Biology
- Laboratory of Recombinant Proteins

Department
of Drug Technology
and Biotechnology



Laboratory of Biotechnology



Head

Maria Bretner

Current research

- Design and synthesis of compounds with potential biological activity
- Measurements of the influence of exogenous factors on the elastic properties of living cells
- Developing methods for the study of protein-ligand interaction
- Exploration of microorganisms and enzymes with the best properties for biocatalysis, useful in the industrial applications of regio- and/or stereoselective transformation of heterocyclic compounds
- Testing cytotoxic and pro-apoptotic properties of synthesised compounds against selected cell lines, and antimicrobial properties using collection of Gram-positive, Gram-negative bacteria, yeasts and fungi

Staff

Michał Fedoryński
Joanna Gtówczyk-Zubek
Tomasz Kobiela
Anna Kowalkowska
Edyta Łukowska-Chojnacka
Małgorzata Milner-Krawczyk
Zbigniew Ochal
Monika Wielechowska
Tadeusz Zdrojewski

Current PhD students

Paweł Borowiecki
Danuta Konczak
Konrad Chojnacki
Anna Sobiepanek

Former PhD students

Agnieszka Kuś
Adam Wawro
Włodzimierz Tszysznicz

Selected publications

Borowiecki P., Wawro A.M., Wińska P., Wielechowska M., Bretner M., *Synthesis of Novel Chiral TBBt Derivatives with Hydroxyl Moiety. Study on Inhibition of Human Protein Kinase CK2 and Cytotoxicity Properties*, European Journal of Medicinal Chemistry, 84, 364, 2014

Gyenis L., Kuś A., Bretner M., Litchfield D. W., *Functional Proteomics Strategy for Validation of Protein Kinase Inhibitors Reveals New Targets for a TBB-Derived Inhibitor of Protein Kinase CK2*, Journal of Proteomics, 81, 70, 2013

Makowska M., Łukowska-Chojnacka E., Wińska P., Kuś A., Bilińska-Chomik A., Bretner M., *Design and Synthesis of CK2 Inhibitors*, Molecular and Cellular Biochemistry, 356, 91, 2011

Wojciechowski K., Orczyk M., Gutberlet T., Trapp M., Marcinkowski K., Kobiela T., Geue, *Unusual Penetration of Phospholipid Mono- and Bilayers by Quillaja Bark Saponin Biosurfactant*, BBA - Biochimica et Biophysica Acta, 1838, 1931, 2014

Kobiela T., Lelen-Kaminska K., Stepulak M., Lekka M., Malejczyk M., Arct J., Majewski S., *The Influence of Surfactants and Hydrolyzed Proteins on Keratinocytes Viability and Elasticity*, Skin Research and Technology, 19, 200, 2013

Borowiecki P., Milner-Krawczyk M., Plenkiewicz J., *Chemoenzymatic Synthesis and Biological Evaluation of Enantiomerically Enriched 1-(b-hydroxypropyl)imidazolium- and Triazolium-Based Ionic Liquids*, Beilstein Journal of Organic Chemistry, 9, 516, 2013



Research profile

Biophysical chemistry
Protein-protein and protein-ligand interactions
Study of the selectivity of enzymes
Enzymatic kinetics
Overproduction of heterologous proteins in bacterial systems
Bioproduction of metabolites
Synthesis of heterocycles
Characterization of microorganisms

Research equipment

- Quartz microbalance with dissipation monitoring
- Chromathography systems ACTA Purifier, Shimadzu
- Atomic force microscope combined with fluorescence microscope for measurements in liquids
- Gel imaging for fluorescence applications G:Box Syngene
- High speed laboratory centrifuge with cooling, ThermoScientific

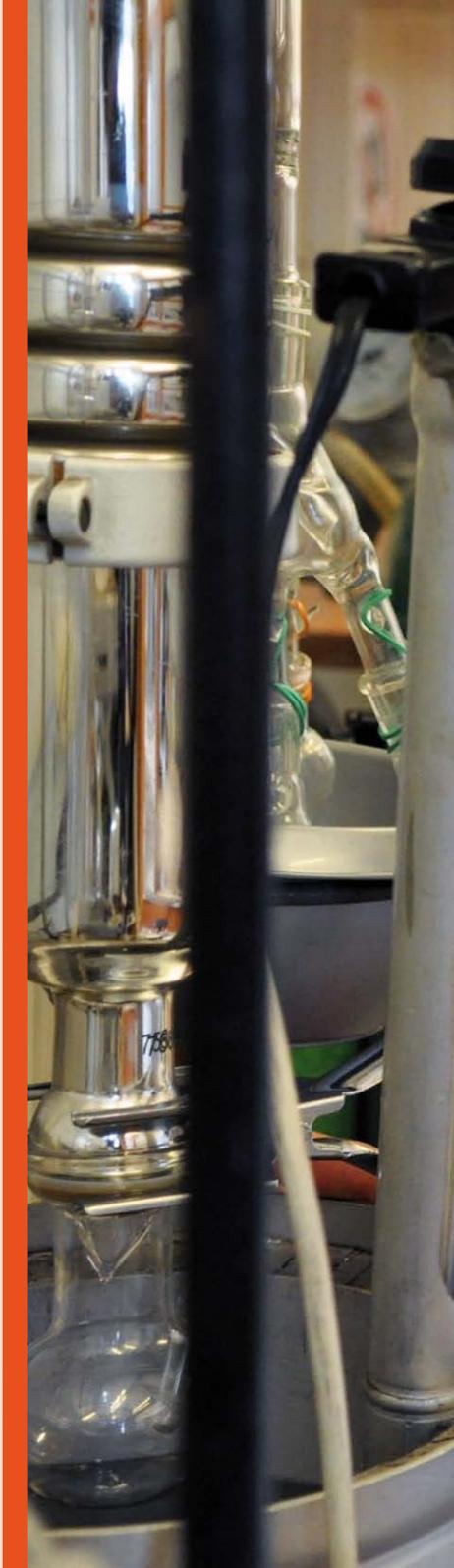
Collaboration

Institute of Organic Chemistry, Polish Academy of Sciences, Warsaw (Poland)

Institute of Biocybernetics and Biomedical Engineering, Polish Academy of Sciences, Warsaw (Poland)

Institute of Biochemistry and Biophysics, Polish Academy of Sciences, Warsaw (Poland)

Institute of Nuclear Physics, Polish Academy of Sciences, Cracow (Poland)





Head

Magdalena
Rakowska-Boguta

Current research

- Systematic measurements of activity and expression levels of enzymes involved in glucose metabolism in yeast mutants with altered levels of tRNA transcription grown under various growth conditions.
- Effect of Maf1, repressor of tRNA transcription, on ethanol production and oxidative metabolism in yeast
- Purification of pyruvate kinase from yeast
- Identification of proteins interacting with pyruvate kinase in yeast
- 2-Phenylethanol production in yeast

Selected publications

Cieśla M., Mierzejewska J., Adamczyk M., ÖstlundFarrants A. & Boguta M., *Fructose Bisphosphatealdolase is Involved in the Control of RNA Polymerase III-Directed Transcription*, BBA Molecular Cell Research, 1843, 1103, 2014

Turowski T., *The Impact of Transcription on Posttranscriptional Processes in Yeast*, Gene 526, 23, 2013

Karkusiewicz I., Turowski T. W., Graczyk D., Towpik J., Dhungel N., Hopper A. K., Boguta M., *Maf1 Protein, Repressor of RNA Polymerase III, Indirectly Affects tRNAProcessing*, The Journal of Biological Chemistry, 286(45), 39478, 2011

Graczyk D., Debski J., Muszyńska G., Bretner M., Lefebvre O., Boguta M., *Casein Kinase II-Mediated Phosphorylation of General Repressor Maf1 Triggers RNAPolymerase III Activation*, Proceedings of the National Academy of Sciences of the United States of America, 108(12), 4926, 2011

Adamczyk M., van Eunen K., Bakker B. M., Westerhoff H. V., *Enzyme Kinetics for Systems Biology When, Why and How*, Methods in Enzymology, 500, 233, 2011

Lukowska-Chojnacka E., Mierzejewska J., *Enzymatic Hydrolysis of Esters Containing Tetrazole Ring*, Chirality 2014, submitted for printing

Staff

Jolanta Mierzejewska
Matgorzata Adamczyk

Current PhD students

Sylwester Czmiel

Former PhD students

Tomasz Turowski



Research profile

Investigation of the link between glucose metabolism and tRNA transcription pathway in yeast by using molecular and biochemical approach

System biology approach used in the study of glycolysis and gluconeogenesis in yeast mutants

Yeast enzymes purification

Identification of proteins interacting with protein target by using affinity chromatography and mass spectrometry

Increase of ethanol production by applying specific yeast mutants

Increase of 2-phenylethanol production by applying DNA recombination for creation new yeast strains

Collaboration

Institute of Biochemistry and Biophysics, Polish Academy of Sciences, Warsaw (Poland)

Laboratory of Technological Processes, Warsaw University of Technology, Warsaw (Poland)

Department of Physical Chemistry, Warsaw University of Technology, Warsaw (Poland)

Institute of Nuclear Chemistry and Technology, Warsaw (Poland)

Scientific Awards

- Jolanta Mierzejewska – beneficiary of the Parent/Bridge Programme of the Foundation for Polish Science, 2013
- Tomasz Turowski – beneficiary of the conference scholarship of the RNA Society, 2012
- Tomasz Turowski awarded for the poster during the EMBO Young Scientists Forum, 2011

Research equipment

- Protein purification system
- Protein gelelectrophoresis system
- PCR amplification
- DNA electrophoresis system
- Incubators for bacterial and yeast cultures



Laboratory of Recombinant Proteins



Head

Joanna Cieśla

Current research

- Studies on thymidylate synthase phosphorylation
- Investigation of protein-protein interactions among enzymes involved in thymidylate synthesis and the co-localization of these enzymes in cancer cells
- Site-directed mutagenesis of thymidylate synthase and purine nucleoside phosphorylase in the studies of inhibition mechanism
- Overproduction of heterologous proteins in bacteria
- Bioproduction of lactic acid in bacteria

Selected publications

Antosiewicz A., Senkara E., Cieśla J., *Quartz Crystal Microbalance with Dissipation and Microscale Thermophoresis as Tools for Investigation of Protein Complex Formation Between Thymidylate Synthesis Cycle Enzymes*, *Biosensors and Bioelectronics*, 64, 36, 2015

Cieśla J., Fraczyk T., Rode W., *Phosphorylation of Basic Amino Acid Residues in Proteins: Important but Easily Missed*, *Acta Biochimica Polonica*, 58, 137, 2011

Cieśla J., Jagielska E., Dąbrowska M., Maley F., Rode W., *Binding and Repression of Translation of the Cognate mRNAs by Rat and Trichinella Spiralis Thymidylate Synthases, Apparently Disconnected Phenomena, Are Not Prevented by dUMP, N⁵,10-Methylenetetrahydrofolate or 5-Fluoro-dUMP*, W: Jansen G, Peters GJ (eds.) *Chemistry and Biology of Pteridines and Foliates*, 91, SPS Verlagsgesellschaft mbH, Heilbronn, 2007

Cieśla J., Fraczyk T., Zieliński Z., Sikora J., Rode W., *Altered Mouse Leukemia L1210 Thymidylate Synthase, Associated with Cell Resistance to 5-Fluoro-dUrd, Is Not Mutated but Rather Reflects Posttranslational Modification*, *Acta Biochimica Polonica*, 53, 189, 2006

Staff

Patrycja Wińska
Anna Kulińska

Current PhD students

Anna Antosiewicz
Elżbieta Senkara
Katarzyna Skierka
Emil Furmanek
Karolina Chreptowicz
Róża Pitruska



Research profile

Protein phosphorylation
Protein-protein interactions
Site-directed mutagenesis
Enzyme kinetics
Overproduction of heterologous proteins in bacterial systems
Lactic acid bioproduction

Collaboration

Department of Biochemistry, Nencki Institute of Experimental Biology, Polish Academy of Sciences (Poland)

Department of Biophysics, University of Warsaw (Poland)

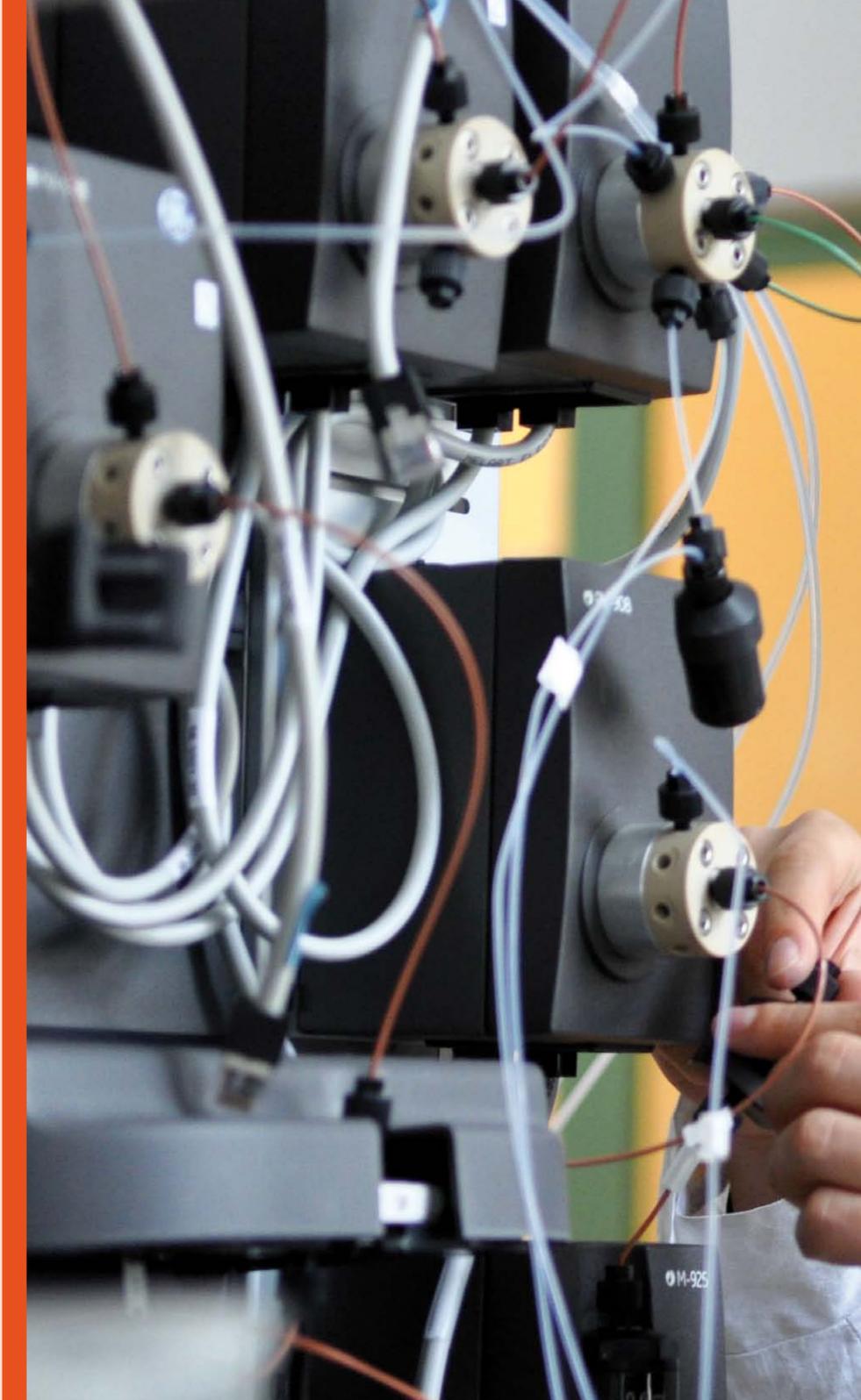
Institute of Biochemistry and Biophysics, Polish Academy of Sciences (Poland)

Research equipment

- 2D Electrophoresis System with Lcool Thermostat, Kucharczyk Techniki Elektroforetyczne
- Refrigerated Centrifuge MPW-351R
- Miniprotean Electrophoresis System, BioRad

Certificates

- Certified Project Management Associate IPMA Level D (Joanna Cieśla)



Laboratory of High Energy Materials •

Department
of High-Energetic
Materials



Laboratory of High Energy Materials



Head

Andrzej Książczak

Current research

- Development of effective solid heterogeneous and homogeneous propellants
- Formulation of gun propellants
- Analysis and characterization of hazardous materials
- Criminality
- Synthesis of high energy materials

Staff

Paweł Maksimowski
Wincenty Skupiński
Wojciech Pawłowski
Waldemar Tomaszewski
Tomasz Gotofit
Katarzyna Cieślak

Current PhD students

Katarzyna Cieślak
Angelika Zygmunt
Katarzyna Gańczyk
Bartosz Zakościelny
Anna Kasztankiewicz

Former PhD students

Tomasz Gotofit
Dariusz Ostaszewski
Joanna Adamiak
Joanna Szczygielska
Anna Zalewska

Selected publications

Maksimowski P., Szczygielska J., Skupiński W., *Comparison of the Crystals Obtained by Precipitation of CL-20 with Different Chemical Purity*, Propellants, Explosives, Pyrotechnics, 38, 791, 2013

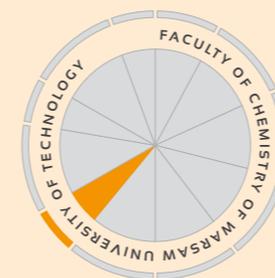
Maksimowski P., Golofit T., *4,10-Dinitro-2,6,8,12-Tetraoxa-4,10-Diazatetracyclo[5.5.0.0.5.0.0.3.11] Dodecane Synthesis*, Journal of Energetic Materials, 31(3), 224, 2013

Golofit T., Maksimowski P., Biernacki A., *Optimization of Potassium Dinitramide Preparation; Propellants, Explosives, Pyrotechnics*, 38, 261, 2013

Adamiak J., Kalinowska-Alichniewicz D., Maksimowski P., Skupiński W., *Characterization of a Novel Solid Catalyst, $H_3PO_4/MoO_3/SiO_2$, and Its Application in Toluene Nitration*, Journal of Molecular Catalysis A: Chemical, 351, 62, 2011

Maksimowski P., Duda M., Tomaszewski W., *2-Acetyl-4,6,8,10,12-Pentanitro-Heksaażaisowurtzitan (PNAIW) Preparation and Properties*, Propellants Explosives Pyrotechnics, 36, 320, 2011

Zalewska A., Pawłowski W., Tomaszewski W., *Limits of Detection of Explosives as Determined with IMS and Field Asymmetric IMS Vapour Detectors*, Forensic Science International, Vol 226, Issue 1, 168, 2013



Research profile

Development of technology for the production of components for propellants
Thermal analysis of hazardous materials
Trace analysis in criminology
Granulation of nitrocellulose
Formulation of propellants

Collaboration

Chemical Works "NITRO-CHEM" S.A., Bydgoszcz (Poland)
Special Production Plant "Pronit", Pionki (Poland)
Special Production Plant "Gamrat", Jasto (Poland)
Institute of Industrial Organic Chemistry, Warsaw (Poland)

Scientific Awards

1st Grade Award in the second contest for the best scientific work and research in the area of defense, for a research paper on *Development of modern technology, high-energy and insensitive explosives in the large laboratory scale*. The work was carried out within the consortium consisting of Military University of Technology, Warsaw University of Technology, Plant "Nitrochem" in Bydgoszcz, Bumar.

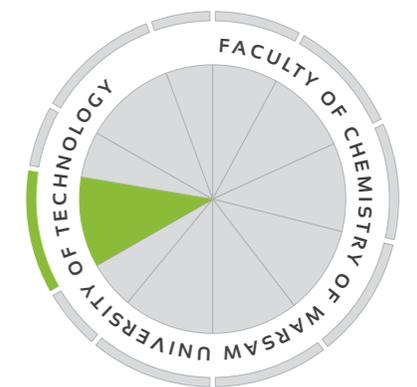
Research equipment

- Scanning microcalorimeter DSC Q2000 TA Instruments
- Spectrophotometer Nicolet FTIR 6700
- Gas chromatograph GC-MS Agilent 5975C Series GC / MSD
- HPLC Agilent 1260 Infinity
- Helium pycnometer AccuPyc II 1340



- Laboratory of Biosensors
- Laboratory of Miniaturized Chemical Systems
- (BIO)Sensors, Sensor Arrays and Surface Chemistry

Department
of Microbioanalytics





Head

Elżbieta Malinowska

Current research

- Development of sensors and biosensors based on electrochemical, optical and mass detection techniques
- Synthesis, modification and stabilization of nanostructures (quantum dots, metallic nanoparticles, graphene) for bioanalytical studies
- Studies on the application of native DNA, aptamers and DNA analogues in receptor layers of DNA biosensors
- Synthesis and application of novel nanoparticles and metallocomplexes as proteins' labels with catalytic activity
- Development of (bio)sensors with polymeric ion-selective membranes

Staff

Łukasz Górski
Mariusz Pietrzak
Robert Ziółkowski

Current PhD students

Agnieszka Bala
Marcin Drozd
Marta Jarczewska
Kamila Konopińska
Joanna Zajda

Former PhD students

Ewa Grygotowicz-Pawlak
Monika Mroczkiewicz
Katarzyna Wyglądacz
Aleksy Matusevich

Selected publications

Konopińska K., Pietrzak M., Malinowska E., *Manganese Porphyrins – Studies on Their Potential Use for Protein Labeling*, *Microchemical Journal*, 115, 1, 2014

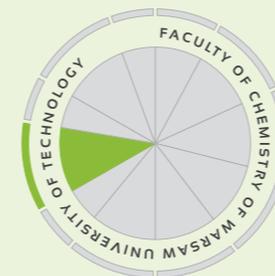
Bell-Vlasov A. K., Zajda J., Eldourghamy A., Malinowska E., Meyerhoff M. E., *Polyion Selective Polymeric Membrane-based Pulstrode as a Detector in Flow Injection Analysis*, *Analytical Chemistry*, 86 (8), 4041, 2014

Jarczewska M., Ziółkowski R., Górski Ł., Malinowska E., *Electrochemical Uranyl Cation Biosensor with DNA Oligonucleotides as Receptor Layer*, *Bioelectrochemistry*, 96, 1, 2014

Ziółkowski R., Jarczewska M., Górski Ł., Malinowska E., *Oligonucleotide-based Electrochemical Biosensor for Hg²⁺ Using Methylene Blue as a Redox Indicator*, *Journal of the Electrochemical Society*, 160 (9), B152, 2013

Konopińska K., Pietrzak M., Malinowska E., *Studies on the Construction and Operation of Miniaturized Potentiometric Biosensors*, *Journal of Solid State Electrochemistry*, 17 (6), 1665, 2013

Drozd M., Pietrzak M., Malinowska E., *Studies on Voltammetric Determination of Cadmium in Samples Containing Native and Digested Proteins*, *Analytica Chimica Acta*, 819, 65, 2014



Research profile

Nanomaterials in bioanalytical applications
DNA, aptamers and oligonucleotide analogues as receptors
Labels for immuno- and DNA sensors
Polymeric membrane ion-selective electrodes
Self-assembled monolayers
Enzymatic systems for bioanalysis

Collaboration

University of Michigan (USA) –
Mark E. Meyerhoff

Max Planck Institute of Colloids and Interfaces (Germany) – Gerald Brezesinski

Aarhus University (Denmark) –
Elena E. Ferapontova

Institute of Physical Chemistry, Polish Academy of Sciences (Poland) – Piotr Zarzycki

Scientific Awards

- 1st grade Team Award of HM Rector of the Warsaw University of Technology for Scientific Achievements in the years 2012-2013
- 2nd grade Team Award of HM Rector of the Warsaw University of Technology for Scientific Achievements in the years 2007-2008





Head

Zbigniew Brzózka

Staff

Michał Chudy
Artur Dybko
Ilona Grabowska-Jadach
Elżbieta Jastrzębska

Current PhD students

Sameer Deshmukh
Maja Haczyk
Radosław Kwapiszewski
Agnieszka Michalczuk
Karolina Maciejewska
Katarzyna Tokarska
Ewelina Tomecka
Kamil Żukowski

Former PhD students

Alicja Filipowicz-Szymańska
Ilona Grabowska
Elżbieta Jędrych
Marcin Juchniewicz
Karina Kwapiszewska
Natalia Lewandowska
Joanna Łopacińska
Maciej Skolimowski
Dorota Stadnik
Iwona Wyzkiewicz

Current research

- Development of microfluidic systems for cell culture, migration, cytotoxicity tests and the evaluation of photodynamic therapy (PDT) procedures
- Investigations on microsystems for Multicellular Tumor Spheroid (MCTS) formation, culture and analysis; development of microfluidic-based in vivo-like cellular models for drug screening and toxicological tests
- Development of a microfluidic cardiac cell culture model
- Research on biological activity of quantum dots (QDs)
- Development and fabrication of microdevices with a contactless conductivity detector

Selected publications

Kwapiszewska K., Michalczuk A., Rybka M., Kwapiszewski R., Brzózka Z., *A Microfluidic-Based Platform for Tumour Spheroid Culture, Monitoring and Drug Screening, Lab on a Chip*, 14, 2096, 2014

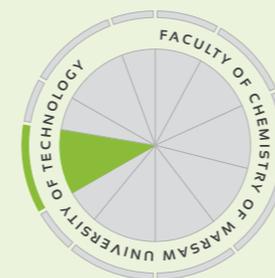
Kwapiszewski R., Szczudłowska J., Kwapiszewska K., Dybko A., Brzózka Z., *Effect of Downscaling on the Linearity Range of a Calibration Curve in Spectrofluorimetry*, *Analytical and Bioanalytical Chemistry*, 406, 4551, 2014

Jastrzębska E., Flis S., Rakowska A., Chudy M., Jastrzębski Z., Dybko A., Brzózka Z., *A Microfluidic System to Study the Cytotoxic Effect of Drugs: the Combined Effect of Celecoxib and 5-Fluorouracil on Normal and Cancer Cells*, *Microchimica Acta*, 180, 895, 2013

Ziółkowska K., Stelmachowska A., Kwapiszewski R., Chudy M., Dybko A., Brzózka Z., *Long-Term Three-Dimensional Cell Culture and Anticancer Drug Activity Evaluation in a Microfluidic Chip*, *Biosensors and Bioelectronics*, 40, 68, 2013

Jędrych E., Flis S., Sofinska K., Jastrzębski Z., Chudy M., Dybko A., Brzózka Z., *Evaluation of Cytotoxic Effect of 5-Fluorouracil on Human Carcinoma Cells in a Microfluidic System*, *Sensors and Actuators B: Chemical*, 160, 1544, 2011

Ziółkowska K., Kwapiszewski R., Brzózka Z., *Microfluidic Devices as Tools for Mimicking the In Vivo Environment*, *New Journal of Chemistry*, 35, 979, 2011



Research profile

Lab-on-a-chip for biological studies
Microfabrication technologies: soft lithography, replica molding, wet etching, micromilling
2D and 3D cell culture and analysis
Drug screening and toxicological tests
Analysis of intracellular enzymes
Microscopy imaging
Flow cytometry
Optical detection

Collaboration

Department of Pharmacy, University of Copenhagen (Denmark) – Jorg Peter Kutter
Department of Biomedical Engineering, Lund University (Sweden) – Thomas Laurell
Laboratory of Microsystems, École Polytechnique Fédérale de Lausanne (Switzerland) – Philippe Renaud
Department of Pharmacology, National Medicines Institute (Poland) – Zenon Jastrzebski
Faculty of Chemistry, Wrocław University of Technology (Poland) – Kazimiera Wilk

Scientific Awards

- 1st Degree Team Award of HM Rector of the Warsaw University of Technology for Scientific Achievements, 2013

Research equipment

- Scanning Electron Microscope Hitachi TM-1000
- Confocal Microscope Olympus FluoView FV10i
- Laser Measuring Microscope Olympus Lext OLS4000
- Flow Cytometer BD FACS Calibur
- CNC Micromilling Machine





Head

Wojciech Wróblewski

Current research

- Potentiometric sensor arrays for the analysis of pharmaceuticals – release and taste masking effect studies
- Electrochemical studies of coordination properties of synthetic tailored oligopeptides and neutral peptides of biological importance (e.g. beta-amyloid)
- Application of organoboron receptors in recognition and sensing of various analytes
- Interaction of biomolecules at liquid-gas, liquid-liquid and liquid-solid interfaces
- Mechanism of interaction of saponins with biological membranes using Langmuir monolayer and bilayer models

Staff

Patrycja Ciosek
Urszula Wawrzyniak
Kamil Wojciechowski

Current PhD students

Paweł Ćwik
Martyna Jańczyk
Aleksandra Kezwoń
Marta Orczyk
Iwona Ufnalska
Małgorzata Wesoty
Magdalena Wiloch

Former PhD students

Patrycja Ciosek
Renata Toczyłowska-Mamińska
Marta Żubrowska
Anna Kutyła-Olesiuk

Selected publications

Ciosek P., Wróblewski W., *Sensor Arrays for Liquid Sensing – Electronic Tongue Systems*, *Analyst*, 132, 963, 2007

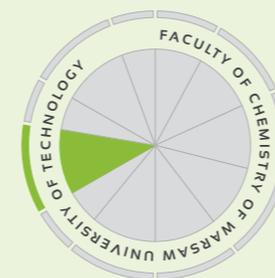
Wojciechowski K., *Hydration Energy or Hydration Force? Origin of Ion-specificity in Ion Selective Electrodes*, *Current Opinion in Colloid & Interface Science*, 16, 601, 2011

Wojciechowski K., Orczyk M., Gutberlet T., Trapp M., Marcinkowski K., Kobiela T., Geue T., *Unusual Penetration of Phospholipid Mono- and Bilayers by Quillaja Bark Saponin Biosurfactant*, *Biochimica et Biophysica Acta – Biomembranes*, 1838, 1931, 2014

Kezwoń A., Wojciechowski K., *Interaction of Quillaja Bark Saponins with Food-Relevant Proteins*, *Advances in Colloid and Interface Science*, 209, 185, 2014

Ciosek P., Wróblewski W., *Potentiometric Electronic Tongues for Foodstuff and Biosamples Recognition – an Overview*, *Sensors*, 11, 4688, 2011

Witkowska Nery E., Jastrzębska E., Żukowski K., Wróblewski W., Chudy M., Ciosek P., *Flow-Through Sensor Array Applied to Cytotoxicity Assessment in Cell Cultures for Drug-Testing Purposes*, *Biosensors and Bioelectronics*, 51, 55, 2014



Research profile

New architecture of sensors and biosensors
Sensor arrays, (bio)electronic tongues, hybrid electronic tongues
Flow-through and flow-injection analysis with sensor detection
Chemometrics
Langmuir monolayers, bilayers
Colloids and interfaces
Surface tension and surface rheology
Biosurfactants, especially saponins

Collaboration

Helmholtz-Zentrum Berlin (Germany)
Paul Scherrer Institute (Switzerland)
Queen Mary University of London (UK)
Universitat Autònoma de Barcelona (Spain)

Scientific Awards

- Go8 European Fellowship – Patrycja Ciosek
- Grant for Outstanding Young Scientists of the Polish Ministry of Science and Higher Education – Patrycja Ciosek

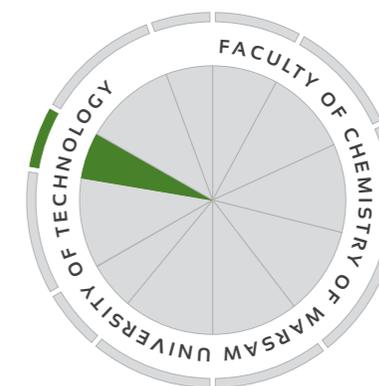
Research equipment

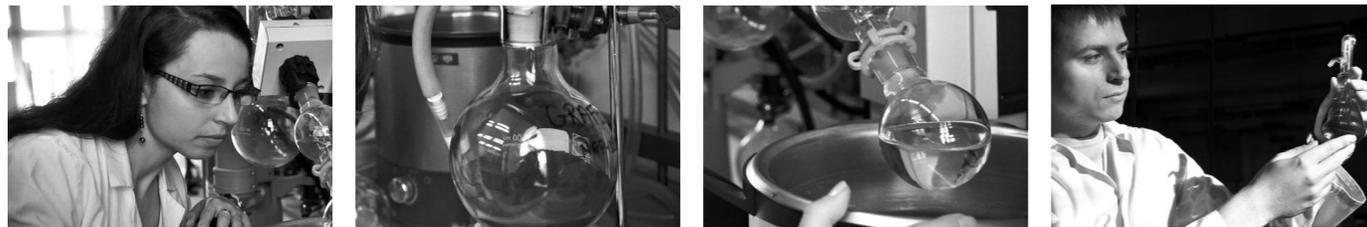
- Multichannel potentiostats, multichannel millivoltmeters
- Spectrophotometers, spectrofluorometer, microplate reader
- Drop Shape Analysis tensiometers
- Dynamic Light Scattering instrument
- Electrokinetic (zeta) Potential analyzer



Carbohydrate Research Group •

Department
of Organic Chemistry





Head

Wojciech Sas

Current research

- Synthesis of monocyclic and bicyclic iminosugars from protected and unprotected sugars employing intramolecular 1,3-dipolar cycloaddition of N-(3-alkenyl)nitrones as the key steps
- Synthesis of nucleoside analogues possessing 1,2,3-triazole linker between nucleobase and sugars or iminosugars
- Synthesis of hybrids sugar-fullerene by 1,3-dipolar cycloaddition of sugar-nitrile oxides, sugar-azides and sugar azomethine ylides
- Synthesis of functional sugars and iminosugars and the studies of their biological or catalytic activity

Selected publications

Koszytkowska-Stawińska M., Sas W., *Synthesis of Novel NH-1,2,3-Triazolo-Nucleosides by the Banert Cascade Reaction*, *Tetrahedron*, 69, 2619, 2013

Mironiuk-Puchalska E., Rowicki T., Sas W., Koszytkowska-Stawińska M., *Convenient Synthesis of Epimeric Indolizidines by the Intramolecular 1,3-Dipolar Cycloaddition of a Sugar Derived N-(3-Alkenyl)Nitron*, *Tetrahedron*, 69, 9826, 2013

Koszytkowska-Stawińska M., Mironiuk-Puchalska E., Rowicki T., *Synthesis of 1,2,3-Triazolo-Nucleosides via the Tost-triazole N-Alkylation*, *Tetrahedron*, 68, 214, 2012

Koszytkowska-Stawińska M., Mironiuk-Puchalska E., Sas W., *Synthesis of 1-Pyrroline 1-Oxides Analogous to Pseudouridine*, *Tetrahedron Letters*, 52, 1866, 2011

Koszytkowska-Stawińska M., De Clercq E., Balzarini J., *Synthesis and Antiviral Activity Evaluation of Acyclic 2'-Azanucleosides Bearing a Phosphonomethoxy Function in the Side Chain*, *Bioorganic and Medical Chemistry*, 17, 3756, 2009

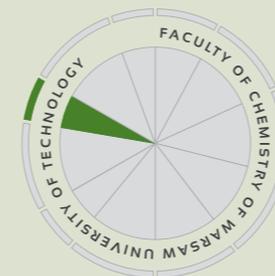
Koszytkowska-Stawińska M., Sas W., De Clercq E., *Synthesis of Aza-Analogues of Ganciclovir*, *Tetrahedron*, 62, 2006

Staff

Mariola Koszytkowska-Stawińska
Ewa Mironiuk-Puchalska
Magdalena Popławska
Agnieszka Horbaczewska-Juchniewicz
Tomasz Rowicki

Current PhD students

Adriana Przerwa
Maciej Malinowski



Research profile

Intramolecular 1,3-dipolar cycloaddition of sugar-derived N-(3-alkenyl)nitrones

Sugar-derived 7-oxa-1-azabicyclo[2.2.1]heptanes as substrates for diversity oriented synthesis of monocyclic and bicyclic iminosugars

Synthesis of nucleoside analogues with 1,2,3-triazole linker by the use of alkylation of triazoles and by the use of Banert cascade

Employment of Banert cascade for synthesis of iminosugar-derived nucleosides with 1,2,3-triazole linker

Studies of 1,3-dipolar cycloaddition of sugar-derived nitrile oxides and azides to C60 fullerene

Examination of iminosugar inhibitory activity of glycosidases

Synthesis of sugar-based organocatalysts and examination of their catalytic activity

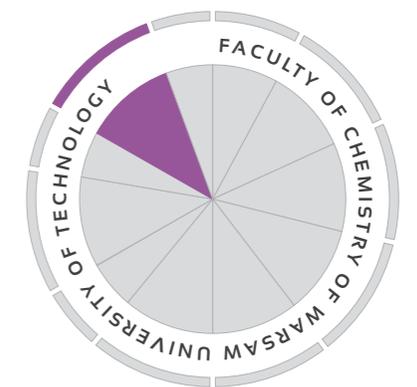
Research equipment

- Medium pressure liquid chromatograph



- Laboratory of Applied Thermodynamics
- Laboratory of Fine Technologies
- Laboratory of Synthesis and Structural Investigation of OrganoBoron Compounds (OBC)

Department
of Physical Chemistry





Head

Urszula Domańska-Żelazna

Staff

Tadeusz Hofman
Marek Królikowski
Marta Królikowska
Andrzej Marciniak
Kamil Padaszyński
Aneta Pobudkowska-Mirecka
Halina Szatyłowicz
Maciej Zawadzki

Current PhD students

Mohammed Halayqa
Marcin Okuniewski
Patrycja Okuniewska
Mateusz Reda
Olga Stasyuk
Elena Vadimovna Lukoshko
Michał Wlazło

Former PhD students

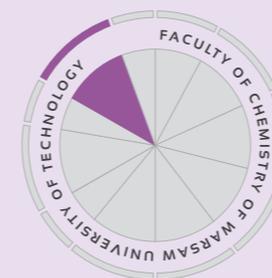
Ewa Bogel-Łukasik
Rafał Bogel-Łukasik
Marek Królikowski
Marta Królikowska
Joanna Łachwa
Andrzej Marciniak
Małgorzata Marciniak
Dobrochna Matkowska
Piotr Morawski
Kamil Padaszyński
Aleksandra Pelczarska
Aneta Pobudkowska-Mirecka
Maciej Zawadzki
Zuzanna Żotek-Tryznowska

Current research

- Physicochemical properties of ionic liquids and their mixtures with molecular solutes; Measurements of activity coefficients at infinite dilution – estimation of selectivity and capacity for different extraction problems. Development of extraction processes i.e. extraction of sulfur compounds from diesel oil, extraction of *t*-butanol from water
- Study of ionic liquids – water systems as a working system for absorption cooling
- Thermodynamic modeling of complex molecular systems (including polar compounds and ionic liquids) with modern tools of applied chemical thermodynamics: molecular-based equations of state (i.e. SAFT, cell-hole theories), COSMO, UNIFAC, DISQUAC
- Molecular geometry as a source of physicochemical information: quantum-mechanical calculations of hydrogen bonded systems

Selected publications

- Padaszyński K., Domańska U., *Thermodynamic Modeling of Ionic Liquid Systems: Development and Detailed Overview of Novel Methodology Based on the PC-SAFT*, Journal of Physical Chemistry B 116, 5002, 2012
- Domańska U., Wlazło M., *Effect of the Cation and Anion of the Ionic Liquid on Desulfurization of Model Fuels*, Fuel 134, 114, 2014
- Domańska U., Lukoshko E. V., Królikowski M., *Separation of Thiophene from Heptane with Ionic Liquids*, Journal of Chemical Thermodynamics 61, 126, 2013
- Szatyłowicz H., Sadlej-Sosnowska N., *Characterizing the Strength of Individual Hydrogen Bonds in DNA Base Pairs*, Journal of Chemical Information and Modeling 50, 2151, 2010
- Domańska U., Zawadzki M., Królikowski M., *Heat Capacity, Excess Molar Volumes and Viscosity Deviation of Binary Systems of *N*-Octylisoquinolinium Bis{(Trifluoromethyl)Sulfonyl}Imide Ionic Liquid*, Zeitschrift für Physikalische Chemie, 227, 217, 2013
- Marciniak A., *Influence of Cation and Anion Structure of the Ionic Liquid on Extraction Processes Based on Activity Coefficients at Infinite Dilution. A Review*, Fluid Phase Equilibria 294, 213, 2010



Research profile

Thermodynamic of liquid mixtures
Phase equilibria: vapor – liquid,
liquid – liquid, solid – liquid
Excess molar volumes and enthalpies of mixing
Thermodynamics of associated solutions
Physicochemical properties: DSC, density, viscosity, surface tension

Collaboration

University of KwaZulu – Natal (South Africa)
University of Aveiro (Portugal)
University of Lorraine (France)
University of Rostock (Germany)
University of Delhi (India)

Scientific Awards

- Warsaw University of Technology Scientific award for U. Domańska-Żelazna, 2014
- Jan Zawadzki's Medal for Urszula Domańska-Żelazna, 2014
- Awards of HM Rector of the Warsaw University of Technology in the years 1969-2014
- 2nd Degree Award of the Ministry of Science and Higher Education, 1989 for U. Domańska-Żelazna
- 1st Degree Award of the Ministry of Science and Higher Education, 1993,2006 for U. Domańska-Żelazna
- Ministry Stipend for Young Scientists: A. Pobudkowska-Mirecka, A. Marciniak, M. Królikowski, M. Królikowski and K. Padaszyński

Research equipment

- Titration Microcalorimeter – TA Inst TAM III
- HPLC/UV-Vis – Agilent Technologies 1200
- GC/FID,TCD – Perkin Elmer 500
- DSC 1 Star Sytems with liquid nitrogen cooling – Mettler Toledo
- Densimeter, Viscometer – Anton Paar





Head

Janusz Serwatowski

Current research

- Synthesis and characterization of organometallic compounds containing main group metals (boron, aluminum, lithium, silicon, germanium, tin). Scaling up processes
- The metalation and halogen-lithium exchange reaction in aromatic and heteroaromatic compounds - mechanism and application in synthesis
- Elaboration of new synthetic procedures employing metalated aromatic and heteroarylboranes as the key reagents en route to highly functionalized compounds including systems potentially applicable in material chemistry
- Studies on structure-reactivity relationships with a special emphasis on X-ray experimental techniques and theoretical calculations
- Physicochemical studies of obtained compounds and their application in material chemistry, for example as luminescence, porous materials or as biologically active reagents

Staff

Marek Dąbrowski
Tomasz Kliś
Sergiusz Luliński

Current PhD students

Krzysztof Durka
Krzysztof Gontarczyk
Agnieszka Górską
Paweł Kurach
Mateusz Urban

Former PhD students

Kinga Kacprzak
Tomasz Kliś
Sergiusz Luliński
Rafał Moszczyński-Pętkowski
Agnieszka Wilimowicz

Selected publications

Kliś T., Durka K., Serwatowski J., Woźniak K., *Influence of the Silyl Group on the Reactivity of Some Ortho-Lithiated Aryl Alkyl Sulfides*, *Organometallics* 32 (11), 3145, 2013

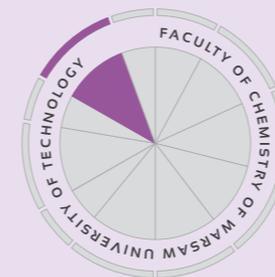
Kliś T., Durka K., Górská A., Serwatowski J., Woźniak K., *Formation of Dilithiated Bis-(1H-Pyrazol-1-yl)Alkanes and Their Application in the Synthesis of Diboronic Acids*, *Tetrahedron Letters*, 55, 1234, 2014

Kliś T., Dąbrowski M., Durka K., Serwatowski J., Woźniak K., *Substituent Effect on Benzylic Lithiation of Sulfides. Synthesis of Diboronic Acids Derived from Aryl-Alkyl Sulfides*, *Tetrahedron* 69 (15), 3159, 2013

Borowska E., Durka K., Luliński S., Serwatowski J., Woźniak K., *On the Directing Effect of Boronate Groups in the Lithiation of Boronated Thiophene*, *European Journal of Organic Chemistry*, 2208, 2012

Durka K., Jarzemska K. N., Kamiński R., Luliński S., Serwatowski J., Woźniak K., *Nanotubular Hydrogen-Bonded Organic Framework Architecture of 1,2-Phenylenediboronic Acid Hosting Ice Clusters*, *Crystal Growth&Design*, 13, 4181, 2013

Wesela-Bauman G., Cieciewicz P., Durka K., Luliński S., Serwatowski J., Woźniak K., *Heteroleptic (2-Fluoro-3-Pyridyl)Arylboronic 8-Oxyquinolates for the Potential Application in OLEDs*, *Inorganic Chemistry*, 52, 10846, 2013



Research profile

Synthesis of organoboron compounds
Bimetallic boro-lithio compounds and their application in synthesis

Metalation and halogen-lithium exchange reaction

Luminescence boronate complexes in OLED devices

Porous covalent organic frameworks

Structural and theoretical studies of organoboron compounds

Interaction of organoboron compounds with biologically active reagents

Collaboration

Aldrich Chemical Company, Milwaukee, Wisconsin (USA)

Crystallochemistry Laboratory, Department of Chemistry, University of Warsaw (Poland)

Department of Chemistry, Department of Molecular Physics, Lodz University of Technology, (Poland)

Department of Pharmaceutical Microbiology, Medical University of Warsaw (Poland)

Scientific Awards

- Scientific Award of HM Rector of the Warsaw University of Technology for the research group: J. Serwatowski, M. Dąbrowski, T. Kliś, S. Luliński, 2008
- The 1st prize for Krzysztof Durka for a poster presentation: *Complexes of diboronic acids and boranthrene systems with 8-hydroxyquoline - towards the luminescence materials*, the 54th Polish Crystallographic Meeting, Wrocław, Poland, 2013
- The 1st prize for Krzysztof Durka for an oral presentation: *Experimental, structural and theoretical studies of arylboronic azaesters. Towards the investigation of the nature of B-N interaction*, Polish Chemical Society Meeting, Łódź, 2009

Research equipment

- Double Beam Spectrophotometer UV-VIS, Hitachi UV2300II.
- Gas chromatography-mass spectrometry (GCMS), Perkin-Elmer Clarus 580 (GC), Clarus 560S (MS)

Additional activity

- Collaboration with the Aldrich Chemical Company: development of preparative procedures of organometallic compounds



Laboratory of Synthesis and Structural Investigation of OrganoBoron Compounds (OBC)



Head

Andrzej Sporzyński

Current research

- Boronic acids and benzoxaboroles as molecular receptors for saccharides, amino acids and inorganic anions. Biological activity of selected compounds
- Synthesis and characterization of novel boronic acids and their derivatives. Multinuclear NMR characterization, calculation of chemical shifts
- Molecular and crystal structure of organoboron compounds. Influence of hydrogen bonds and weak interactions on the supramolecular structures
- Determination of acidity of organoboron compounds by experimental methods and calculations
- Equilibria in solutions of organoboron compounds

Selected publications

Adamczyk-Woźniak A., Cyrański M. K., Żubrowska A., Sporzyński A., *Benzoxaboroles – Old Compounds with New Applications*, Journal of Organometallic Chemistry, 694, 3533, 2009

Cyrański M. K., Jezierska A., Klimentowska P., Panek J. J., Sporzyński A., *Impact of Intermolecular Hydrogen Bond on Structural Properties of Phenylboronic Acid: Quantum Chemical and X-ray study*, Journal of Physical Organic Chemistry, 21, 472, 2008

Cyrański M. K., Klimentowska P., Rydzewska A., Serwatowski J., Sporzyński A., Stępień D. K., *Towards a Monomeric Structure of Phenylboronic Acid: the Influence of Ortho-Alkoxy Substituents on the Crystal Structure*, CrystEngComm 14, 6282, 2012

Adamczyk-Woźniak A., Borys K. M., Madura I. D., Pawełko A., Tomecka E., Żukowski K., *Lewis Acidity and Sugar Receptor Activity of 3-Amino-Substituted Benzoxaboroles and Their Ortho-Aminomethylphenylboronic Acid Analogues*, New Journal of Chemistry, 37, 188, 2013

Madura I. D., Czerwińska K., Jakubczyk M., Pawełko A., Adamczyk-Woźniak A., Sporzyński A., *Weak C-H...O and Dipole-Dipole Interactions as Driving Forces in Crystals of Fluorosubstituted Phenylboronic Catechol Esters*, Crystal Growth & Design, 13, 5344, 2013

Gierczyk B., Kaźmierczak M., Schroeder G., Sporzyński A., *¹⁷O NMR Studies of Boronic Acids and Their Derivatives*, New Journal of Chemistry, 37, 1056, 2013

Staff

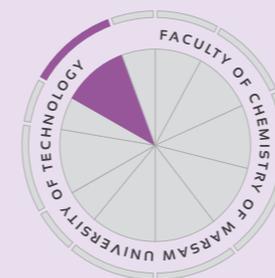
Agnieszka Adamczyk-Woźniak
Ewa Kaczorowska

Current PhD students

Krzysztof Borys
Alicja Matuszewska

Former PhD students

Michał Jakubczyk
Agnieszka Lewandowska
Michał Lewandowski
Anna Żubrowska



Research profile

Boronic acids
Benzoxaboroles
Molecular and crystal structure
Multinuclear NMR
Acidity
Synthesis

Collaboration

Faculty of Chemistry, Adam Mickiewicz University, Poznań (Poland)

Faculty of Chemistry, University of Opole (Poland)

Faculty of Chemistry, University of Gdansk (Poland)

Vanderbilt University, Nashville, Tennessee (USA)

Charles University, Prague (Czech Republic)

Scientific Awards

- Fellowship of the Minister of Science and Higher Education for Young Outstanding Scientists – Agnieszka Adamczyk-Woźniak, 2013
- Diamond Grant from the Minister of Science and Higher Education for the project *Synthesis and investigation of properties and applications of novel benzoxaboroles* – Krzysztof M. Borys, 2013
- Silver Medal in Chemistry (the 2nd prize) in the Gold Medal in Chemistry 2012 contest for the best bachelor thesis in Poland in the field of chemistry, organized by the Institute of Physical Chemistry, Polish Academy of Sciences – Krzysztof M. Borys
- Team Scientific Awards of HM Rector of the Warsaw University of Technology (3 times)

Research equipment

- Argon and vacuum lines
- Laboratory equipment for organic and organometallic synthesis
- Cryostat

Additional activity

- The OBC group organized EuroBoron 6 – 6th Triennial European Conference on Boron Chemistry, held from the 8th to 13th September 2013 in Radziejowice, Poland



Laboratory of Technological Processes •

Laboratory
of Technological
Processes





Head

Ludwik Synoradzki

Staff

Grzegorz Brzozowski
Janusz Budnicki
Krzysztof Bujnowski
Krzysztof Dzieńis
Barbara Filipiak
Agnieszka Gadomska-Gajadhur
Halina Hajmowicz
Adam Jackowicz
Dominik Jańczewski
Anna Jerzak
Krzysztof Kobryń
Renata Przedpętska
Paweł Ruśkowski
Bartłomiej Rybak
Agnieszka Sobiecka
Jerzy Wisiański
Marek Wtostowski
Roman Zadrozny
Krzysztof Zawada
Paweł Żuk

Current PhD students

Sylwia Czarnocka-Śniadana
Agnieszka Gadomska-Gajadhur
Agnieszka Sobiecka
Krzysztof Zawada
Aleksandra Kruk

Former PhD students

Dominik Jańczewski
Przemysław Kruk
Tomasz Rowicki
Robert Woźniak
Agnieszka Adamczyk
Paweł Ruśkowski
Jerzy Wisiański
Urszula Bernaś

Current research

- Research and development of chemical and biochemical technologies. Novel molecular level approaches to the process control. Transfer of ideas from research labs to the production scale. Process design and scaling-up, optimization with the aid of DOE. Experimental multi-tone manufacturing
- Chiral dicarboxylic acids. Resolution auxiliaries and building blocks for pharmaceutical and cosmetic industries. Manufacturing of tartaric and glutamic acid derivatives. Structural research on the Baltic amber and its applications in cosmetic industry
- Synthesis and applications of biodegradable polymers. Polylactide (PLA) encapsulation of active substances. Drug delivery systems (DDS). Scaffolds for the knee cartilage. Model pilot PLA installation
- Anticorrosion agents. Development and manufacturing of alkylsalicylaldoximes. Ikorol products line
- Structural and mechanistic studies on new antibacterial rifamycin antibiotics

Selected publications

Synoradzki L., *Laboratory of Technological Processes as an Element of Polytechnical Education*, *Przemysł Chemiczny* 82, 1345, 2003

Synoradzki L., Bernaś U., Ruśkowski P., *Application of Tartaric Acid and of O-Acyl Tartaric Acids and Anhydrides. Resolution of Racemates*, *TAAD Part 2, Organic Preparations and Procedures International* 40, 163, 2008

Bernaś U., Hajmowicz H., Madura I. D., Majcher M., Synoradzki L., Zawada K., *Direct Synthesis of Monoacyltartaric Acids and Novel Mono(Benzoyl)Tartaric Anhydride: Unusual Cases in Tartaric Acid Acylation*, *TAAD Part 5, Arkivoc* (xi), 1, 2010

Bujnowski K., Synoradzki L., Zevaco T. A., Dinjus E., Augustynowicz-Kopec E., Napiórkowska A., *Rifamycin Antibiotics - New Compounds and Synthetic Methods. Part IV. Study of the Reaction of 3-Formylrifamycin SV with Secondary Amines and Ketones*, *Tetrahedron*, in print, 2014

Gadomska A.A., Warych I., Ruśkowski P., Synoradzki L., *Manufacturing of Polylactide Nanospheres*, *Przemysł Chemiczny*, 93/8, 1000, 2014

Hajmowicz H., Wisiański J., Synoradzki L., *Direct Hydrolysis as a Method of Manufacture of DBTA*, *TAAD Part 9, Organic Process Research & Development*, 15, 427, 2011



Research profile

Process design, experimental production, scaling-up research (polylactide, chiral dicarboxylic derivatives)

Design of experiments (DOE) and process optimization

Resolution of racemates, tartaric and glutamic acid derivatives

Polylactic acid (polylactide), Baltic amber
Rifamycin antibiotics

Anticorrosion agents (ikorol)

Miniplants and automatic reactors (SCADA systems)

Chemical analysis lab – commercial service

Collaboration

Institute of Catalysis Research and Technology (IKFT), Karlsruhe Institute of Technology (KIT) (Germany)

Ipochem, Warsaw (Poland)

Novichem, Chorzów (Poland)

Sanofi Aventis (Germany)

Scientific Awards

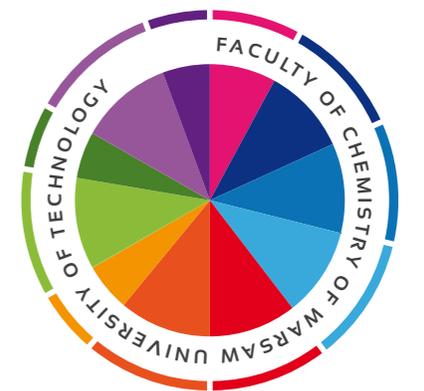
- Prize of the Warsaw University of Technology for successful transfer and commercialization of scientific research – Ludwik Synoradzki, 2009
- Scientific Awards of HM Rector of the Warsaw University of Technology

Research equipment

- Pilot plant installations
- Automated mini reactors and mini plants
- HPLC
- GPC
- GC-MS



PhD Projects at
the Faculty of Chemistry



Anna Antosiewicz



Project Title: Mutual Interactions and Complex Formation Between Human Thymidylate Synthase and Dihydrofolate Reductase, the Enzymes Involved in Thymidylate Biosynthesis

Group: Laboratory of Recombinant Proteins

Supervisor: Joanna Cieśla

Project Description: Thymidylate synthase (TS) and dihydrofolate reductase (DHFR) are indispensable enzymes involved in de novo thymidylate biosynthesis, necessary for DNA synthesis and repair. The purpose of the project is to expand the knowledge about thymidylate biosynthesis cycle and to investigate the formation of the metabolic complex consisted of TS and DHFR.

Perspective: TS and/or DHFR deficiency leads to cell death, making both enzymes highly important molecular drug targets in the chemotherapy of cancer, autoimmune diseases and infections (malaria, pneumonia). The information gathered in the project may be of great importance to designing new drugs.

Agnieszka Antosik

Project Title: Intelligent Materials for Energy Absorption and Protection of the Human Body

Group: Advanced Ceramics Group

Supervisor: Mikołaj Szafran

Project Description: The aim of the work is the elaboration of innovative liquid, in the form of gel and polymer composite materials, which rheological properties will change in a predictable and reversible way when the external force is applied.

Perspective: The result of the project will be the elaboration of innovative composite material which can find applications in the areas in which during a normal operation flexibility is required, but in emergency cases, for e.g. in a risk of injury, violent "hardening" occurs. The examples are: sport protectors or the human body armor.



Project Title: Electrochemical Sensors Based on DNA Analogues as Receptor Layers

Group: Laboratory of Biosensors

Supervisor: Elżbieta Malinowska

Project Description: The use of analogues of nucleic acid, such as peptide or locked nucleic acid (PNA or LNA) and phosphothioate oligonucleotide (PTO), as recognition elements in biosensors is an interesting area in analytical chemistry. Thanks to high chemical stability and resistance to enzymatic degradation, these molecules can serve as receptor layers of biosensors.

Perspective: The goal of this project is the development of electrochemical sensors, based on analogues of nucleic acid, selective towards heavy metal ions and DNA sequences. In case of PTO, the presence of a sulfur atom in its backbone can allow for the formation of self-organized monolayers on gold electrodes, as well as facilitate its interactions with small analytes.



Project Title: Half-Sandwich Nickel Complexes with N-Heterocyclic Ligands - Synthesis, Structure and Catalytic Activity in Selected Reactions

Group: Laboratory of Organometallic Chemistry and Homogeneous Catalysis

Supervisor: Włodzimierz Buchowicz

Project Description: The project concentrates on the specific class of organometallic nickel complexes. It comprises the preparation of designed organometallic compounds together with the investigation for new synthetic protocols and also determination of the relationship between structure of the ligands and catalytic activity in selected organic transformations.

Perspective: Carrying out the project will provide important information about the influence of the ligands on the catalytic activity of the half-sandwich nickel complexes. Also, new synthetic protocols for the synthesis of organometallic nickel complexes will allow for the preparation of new compounds which have been unobtainable by other methods.



Project Title: Application of Organometallic Compounds in the Synthesis of Nanostructured Materials

Group: Laboratory of Organometallic Chemistry and Homogeneous Catalysis

Supervisor: Wanda Ziemkowska

Project Description: In my research, I am focused on the synthesis of new, previously undescribed derivatives of organometallic compounds which may be used as precursors for nanostructured metal oxides.

Perspective: The use of specific organometallic compounds as precursors allows us to receive materials with unusual structures that can be useful, for example, in catalysis.

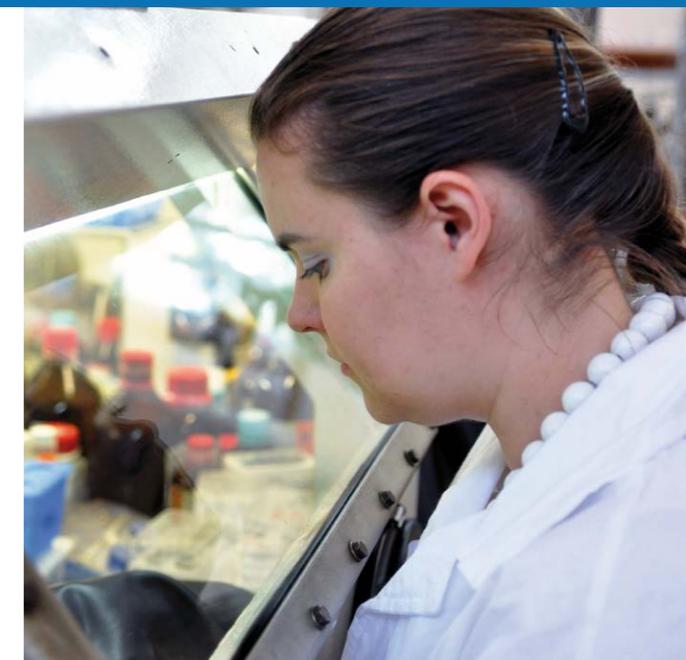
Project Title: Properties of Polymer Gel Electrolytes and Polymer Electrolytes Containing Anion/Cation Receptors and Inorganic Fillers

Group: Polymer Ionic Research Group (PIRG)

Supervisor: Władysław Wieczorek

Project Description: The aim of the project is to investigate physicochemical properties of polymer gel electrolytes based on poly(vinylidene fluoride - co - hexafluoro propylene) and polymer electrolytes based on poly(ethylene oxide) containing additives of cation and anion receptors and inorganic fillers.

Perspective: The results of the study may allow to create a new generation of lithium-ion cells based on polymer gel electrolytes or polymer electrolytes, characterized by better properties than cells used at present.



Anna Bitner-Michalska



Project Title: The Next Generation of Sodium Ion Batteries

Group: Polymer Ionic Research Group

Supervisor: Marek Marcinek

Project Description: New sodium salt synthesis of large anions with a delocalized charge (including "fluorine-free" green salts). Salt characterization and optimization of electrolytes in classical and non-conventional solvent compositions (including solid polymer electrolytes). Anode and cathode preparation, and compatibility studies with new types of electrolytes.

Perspective: Currently, sodium batteries are commercially available, but they operate at high temperatures. A challenge in sodium battery development is to reduce the operating temperature from 270 °C to room-temperature. We propose a modified electrolyte, composed of the new sodium salt, which is the main objective of this PhD thesis.

Krzysztof M. Borys



Project Title: Synthesis and Investigation of Properties and Applications of Novel Benzoxaboroles

Group: Laboratory of Synthesis and Structural Investigation of OrganoBoron Compounds (OBC)

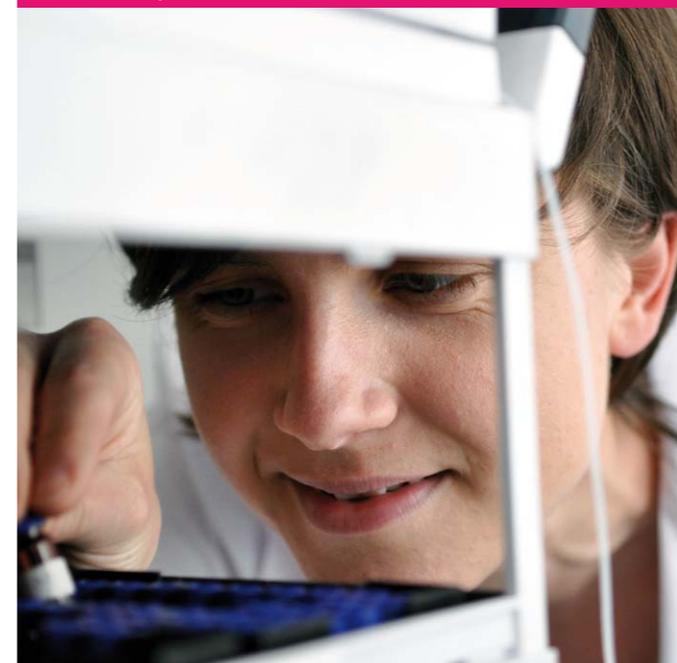
Supervisor: Andrzej Sporzyński

Co-Supervisor: Agnieszka Adamczyk-Woźniak

Project Description: The project is focused on benzoxaboroles - organoboron compounds, internal cyclic hemiesters of phenylboronic acids. Novel compounds of this class are synthesized to investigate them in terms of their properties and applications, for e.g. as molecular receptors and bioactive agents.

Perspective: Carrying out the project will give new insights into the chemistry of benzoxaboroles. Synthetic works may improve the known ways of their preparation, as well as lead to the new ones. Better understanding of the structural features can make applications of benzoxaboroles more rational and efficient.

Katarzyna Brama



Project Title: Use of Mass Spectrometry in Determination of Chromium and Vanadium Complexes in Garden Cress and Their Bioavailability for Humans

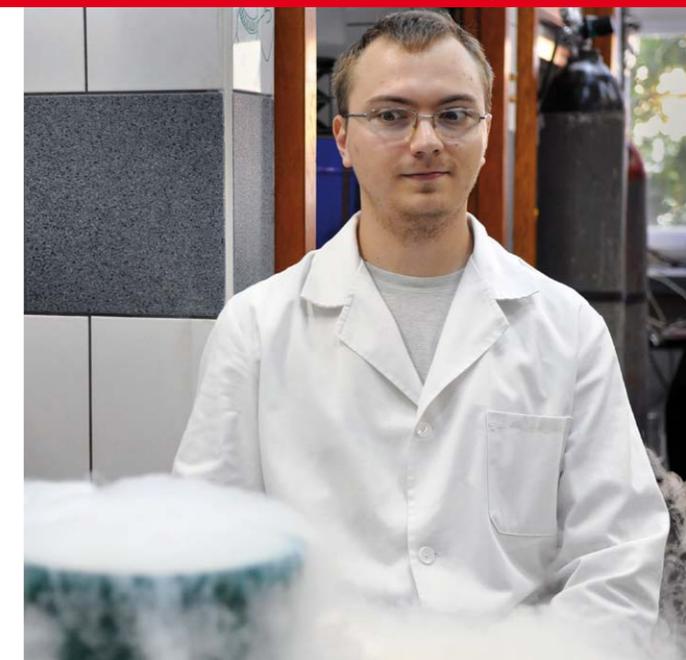
Group: Laboratory of Separation Methods

Supervisor: Katarzyna Pawlak

Project Description: The object of the study is garden cress enriched in Cr and V. In the project, extraction of Cr and V complexes and *in vitro* digestion of the sprouts will be performed. In order to separate and determine metal complexes, hyphenated techniques will be used: liquid chromatography or capillary electrophoresis hyphenated to ICP MS or ESI MS/MS.

Perspective: The ability of garden cress to accumulate of chromium and vanadium and the bioavailability of these elements for humans will be estimated. Results of the project could enable the assessment of capability of garden cress to serve as functional food in case of chromium and vanadium deficiency.

Krzysztof Budny-Godlewski



Project Title: Reactivity of Organometallic Compounds Towards Selected Paramagnetic Species

Group: Laboratory of Organometallic and Materials Chemistry – Lewiński Group

Supervisor: Janusz Lewiński

Project Description: Reactivity of selected paramagnetic species towards various organometallic compounds is being investigated. New organometallic products of these reactions are carefully examined. The results shed new light on the problem of homolytic activation of M-C bonds and its mechanism.

Perspective: Application of obtained new organometallic products in small molecules activation.

Project Title: Design and Synthesis of Casein Kinase Ck2 Inhibitors

Group: Laboratory of Biotechnology

Supervisor: Maria Bretner

Project Description: CK2 protein kinase is involved in the regulation of many cellular processes. 4,5,6,7-tetrabromobenzimidazole (TBBi) and 4,5,6,7-tetrabromobenzotriazole (TBBT) analogues are known CK2 inhibitors. It appears to be possible to obtain stronger CK2 inhibitors by attaching amino acids or short peptides which may fit into the active site even better.

Perspective: Reviewing the literature concerning methods of synthesis of benzotriazole and benzimidazole analogs and methods of protection and activation of amino acid functional groups. Development of methods for the synthesis of designed analogues. Determination of the effects of the synthesized compounds on the activity of CK2 and viability of cancer cells.



Project Title: Drawing Up Production Technology of Natural 2-phenylethanol

Group: Laboratory of Recombinant Proteins

Supervisor: Joanna Cieśla

Co-Supervisor: Jolanta Mierzejewska

Project Description: 2-phenylethanol (2-pe) is an aromatic alcohol widely used in food or cosmetic industry. Our experiments are focused on screening for the yeast strains that could produce 2-pe with satisfying productivity and optimize overall process – starting from 2-pe production up to obtaining the final purified product.

Perspective: Since the world 2-phenylethanol (2-pe) production is based mostly on chemical synthesis, which is reluctantly accepted by society, our goal is to develop the whole semi-technical scale technology for natural 2-pe production by yeast, which could be successfully enlarged and applied in industry.



Project Title: Studies on the Influence of the Preparation Methods of Magnesium Oxide on Its Physicochemical and Catalytic Properties

Group: Laboratory of Heterogeneous Catalysis

Supervisor: Marek Gliński

Project Description: A type of precursor of MgO and the conditions of MgO preparation influence greatly on physicochemical and acid-base properties of the surface of the catalyst, which is reflected in the catalytic activity of the prepared MgO.

Perspective: A quite new amorphous precursor of MgO has been synthesized. It has been shown that its decomposition leads to magnesium oxide with a very high surface area. It is expected that preparing MgO in such a way will have very promising catalytic properties.

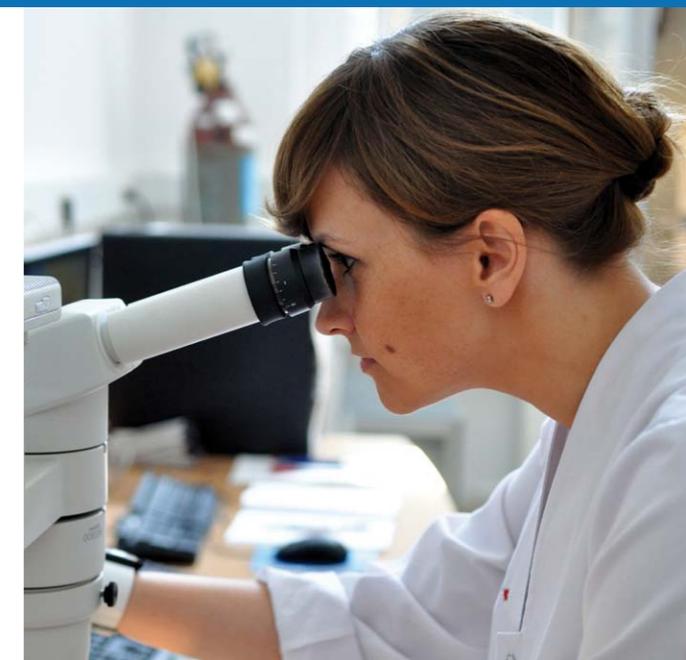
Project Title: Boron Coordination Sphere in View of Bond-Valence Vectors Model. Study of Structural Relations in the Crystalline Phases Within Phenylboronic Acid Derivatives

Group: Laboratory for Structural Research

Supervisor: Janusz Zachara

Project Description: Determination of crystal structures of phenylboronic acids derivatives by the use of X-ray single crystal method is conducted. Identification of weak intra- and intermolecular interactions and their impact on the organization of matter in the crystalline phase is studied. Boron coordination sphere is analyzed in view of the Bond-Valence Vectors Model.

Perspective: Structure correlation analysis with the application of the Bond-Valence Vectors Model in order to find basic parameters which decide about boron coordination sphere. Geometry of boron coordination sphere of compounds that deviated from the achieved and predicted results could be analyzed in terms of various strains introduced in the structures.





Project Title: Applying Systems Biology Approach for the Analysis of the Glucose Signalling Pathways in Yeast

Group: Laboratory of Molecular Biology

Supervisor: Magdalena Rakowska-Boguta

Co-supervisor: Małgorzata Adamczyk

Project Description: I am investigating the links between glucose signaling, carbon metabolism and transcriptional regulation by RNA polymerase II and RNA polymerase III in yeast *S. cerevisiae*, using a multidisciplinary approach.

Perspective: The project is implemented by employing methods such as RTqPCR, chromatin immunoprecipitation, proteomics with QconCAT technology and metabolic network modeling. Experimental data obtained during the project will be used to create a computerized replica of a biological process which will allow for the optimization of cellular functions in silico.



Project Title: Electrochemical Sensors Based on Self-Assembled Monolayers and Electrochemical Grafting

Group: (BIO)Sensors, Sensor Arrays and Surface Chemistry

Supervisor: Wojciech Wróblewski

Project Description: The aim of this project is a development of electrochemical sensors (particularly voltammetric). To achieve this goal, several methods of receptor layer fabrication are being compared. Those methods are most of all self-assembly and electrochemical grafting, because of their cost efficiency, moderate instrumental requirements and a relatively simple preparation protocol.

Perspective: The project is being carried out by studying and comparing properties of receptor layers formed with various methods. Since in our study we are utilizing boronic acid derivatives, selectivity of obtained receptor layers towards several carbohydrates is also being evaluated. Receptor layers properties are characterized mostly by means of electrochemical measurements.



Project Title: Affinity Acoustophoresis for On-Chip Screening and Isolation of Biomolecules and Cells

Group: Laboratory of Miniaturized Chemical Systems

Supervisor: Zbigniew Brzózka

Project Description: Pharmaceutical diagnostic industry has witnessed many new innovations. One of such innovations is affinity acoustophoresis for developing personalized medicine. This work entitles researching fundamental applications of affinity acoustophoresis for screening and isolation of different biomolecules based on their affinity towards a selected target.

Perspective: The realm of personalized medicine has become more and more popular owing to the increasing awareness of shortcomings in current treatment protocols. Hence, a better molecular understanding of biomolecules with novel specificities is required. Such molecules can be isolated from a library using a chip based ultrasound approach in a microfluidic format.



Project Title: Gold Nanoparticles (AuNPs) as Catalytic Labels in Immunoassays and Biosensing

Group: Laboratory of Miniaturized Chemical Systems

Supervisor: Elżbieta Malinowska

Project Description: AuNPs are capable of acting as catalysts similar to enzymes in oxidation-reduction processes. Their surface coatings reveal substantial influence on peroxidase activity. The main aim of the study concerns the synthesis of AuNPs stabilized with various ligands, optimization of reaction conditions, as well as selection of the most promising nanoparticles for further studies.

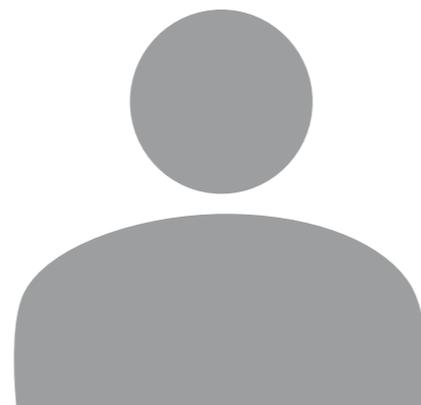
Perspective: Catalytic gold NPs may be applied as enzyme mimics in ELISA-type immunoassays owing to their robustness and stability. AuNPs revealing the most promising features will be modified with bioreceptors. As a result, an immunoassay based on antibody-catalytic nanoparticle bioconjugates will be developed and applied in sensing of selected bioanalytes.

Mohammad Fadaghi

Project Title: New Generation of Semiconductors with Kesterite
Group: Chair of Inorganic Chemistry and Solid State Technology
Supervisor: Stawomir Podsiadło

Project Description: The project is about a new generation of semiconductors in which kesterite will be used as an absorber, but we have to modify the structure by using a new metal element in crystal lattice and monitoring properties.

Perspective: According to this research, we can find a new kind of semiconductors with greater efficiency and with the cost of production lower than of the ones currently available in the market.



Anita Frydrych

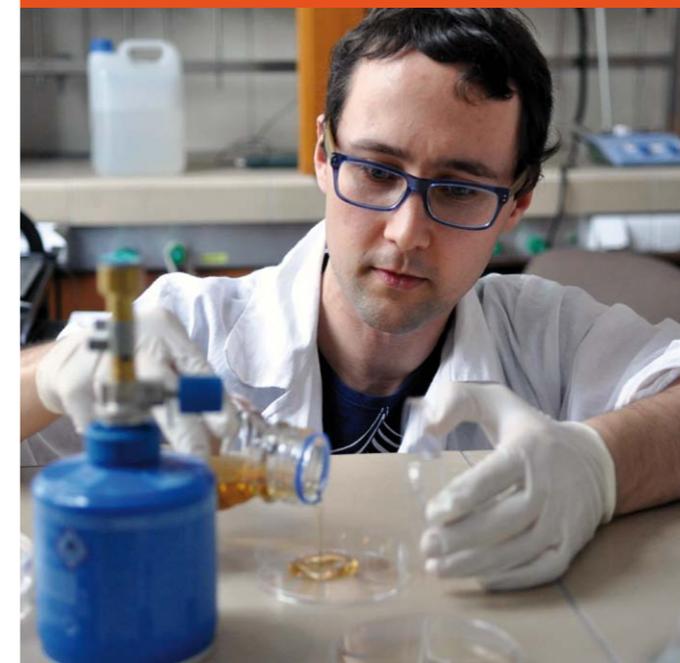


Project Title: Lactic Acid Oligomers in the Synthesis of Lactide and Biodegradable Polymers
Group: Polymer Synthesis, Characterization and Processing Research Group
Supervisor: Zbigniew Florjańczyk

Project Description: The purpose of the studies carried out within my PhD thesis is to prepare oligomers of lactic acid terminated solely by a hydroxyl or carboxyl groups and to use them as starting materials in copolymerization of different monomers. The starting oligomers were prepared by polycondensation of lactic acid with bi- and multifunctional compounds.

Perspective: The basic idea is to obtain and characterize a new family of biodegradable polymers consisting of a stiff polylactide core and flexible polyester, polycarbonate or polyether arms. These materials are expected to find practical application in agriculture and medicine in controlled release systems.

Emil Furmanek



Project Title: Applying Systems Biology Approach for the Analysis of the Glucose Signalling Pathways in Yeast
Group: Laboratory of Recombinant Proteins
Supervisor: Joanna Cieśla
Co-supervisor: Małgorzata Adamczyk

Project Description: Despite extensive studies, the biological principles behind the trigger mechanism of glucose-induced repression of oxidative metabolism in yeast still remain poorly understood. The project focuses on a newly discovered phenomenon of sugar metabolism regulation dependent on Maf1 protein, the negative regulator of RNA polymerase III.

Perspective: Applied systems biology approach, integration of experimental data and computer modeling will help to elucidate cell network properties, especially the mechanism of coupling carbon metabolism to Pol III transcription in eukaryotic cells. The research will have a strong impact on the development of modern metabolic engineering process.

Katarzyna Gańczyk



Project Title: The Study of Physicochemical Properties of the High – Energetic Binders in Rocket Fuel
Group: Laboratory of High Energy Materials
Supervisor: Andrzej Książczak

Project Description: The research consists in the determination of basic physicochemical properties of high-energetic binders, mixture of binders and other additives which are used in rocket fuel. The aim of this work is the examination of phase transitions and viscosity of these substances and mixtures.

Perspective: The research of appropriate high-energetic binders, which replace commonly used HTPB, has caused to improve the energy of rocket fuel. Moreover, smaller amounts of ammonium perchlorate can be used so that the rocket will be more difficult to detect.



Project Title: New Solution of Processable Organic and Hybrid (Organic/Inorganic) Functional Materials for Electronics, Optoelectronics and Spintronics
Group: Laboratory of Electronically Active Organic Materials
Supervisor: Adam Proń

Project Description: The project concerns the synthesis and characterization of new soluble inorganic semiconducting nanocrystals free of toxic elements, with a low (and tunable) energy band-gap and the interactions in hybrid systems containing inorganic nanocrystals and organic electroactive molecules.

Perspective: Preparation of prototype electronic devices used in light emitting diodes, field effect transistors and photovoltaic cells.



Project Title: Digitally Controlled Plasma as a New Excitation/Ionization Source in Optical Emission Spectrometry
Group: Laboratory of Separation Methods
Supervisor: Krzysztof Jankowski

Project Description: The main aim of the study is the application of freshly invented plasma source in analytical chemistry. The project involves design, construction and diagnostics of a miniature device which can be placed in a chip and may be a part of a miniature analytical system.

Perspective: Digitally controlled plasma source offers wide capabilities in shape modulating and is characterized by particularly low temperature (400-1600K). Thus, it can be miniaturized and may contribute to the construction of a new miniaturized measuring device which can be portable and much more cheaper than the existing apparatus.



Project Title: Design of Novel Materials to Three-Dimensional Printer Ink
Group: Advanced Ceramics Group
Supervisor: Mikołaj Szafran

Project Description: The process of making a 3D object of almost any shape, called 3D printing. Prices of a 3D printer are steadily decreasing, but 3D printer ink is still a costly barrier to common use. The objective of the project is to design ink by minimizing monomer content, increasing the depth of polymerization and substituting conventional materials with greener components.

Perspective: There are a lot of applications of the 3D printing process. Standard adoptions include: design visualization, rapid prototyping, metal casting, architecture, education, geospatial healthcare and entertainment. This makes the project vital with broad perspectives on deployment industry.



Project Title: Preparation and Characterization of Polyarylboric Acids and Their Application in Synthesis of Microporous Materials
Group: Laboratory of Fine Technologies
Supervisor: Sergiusz Luliński

Project Description: The aim of the work is a synthesis of polyarylboric acids containing thiophene, 2,2'-bithiophene and pyridine heterocycles. The research also includes a preparation of heteroarylsilanes with a number of heteroarylboric acid groups linked through a silicon atom.

Perspective: The obtained polyboronic acids should be useful reagents in organic synthesis and versatile building blocks in the preparation of highly porous and crystalline Covalent Organic Frameworks or Hydrogen Bonded Organic Frameworks. These materials could be interesting adsorbents for gas storage and separation.



Agnieszka Górska



Project Title: Lithiation Reactions of Pyrazole Derivatives
Synthesis of Diboronic Acids

Group: Laboratory of Fine Technologies

Supervisor: Janusz Serwatowski

Project Description: 5-membered nitrogen-containing heteroaromatics can often be functionalized efficiently by lithiation. Reactions of many 4-bromopyrazole derivatives with LDA and t-BuLi are investigated. Obtained lithium derivatives are reacted with various electrophiles such as: $B(OEt)_3$, $(CH_3)_3NCO$, Me_3SiCl , Me_2HSiCl to form corresponding substituted compounds.

Perspective: Cross-coupling reactions of organoboron compounds discovered by Suzuki are important in various fields of organic synthesis. Especially pyrazole derivatives are of great importance, as the pyrazole fragment is present in a large number of natural and synthetic ligands that interact with various enzymes and receptors of pharmacological significance.

Piotr Aleksander Guńka

Project Title: Structural Studies of Arsenic(III) Oxide Polymorphs and Intercalates

Group: Laboratory for Structural Research

Supervisor: Janusz Zachara

Project Description: Selective methods of As_2O_3 polymorphs crystallisation have been proposed and the first As_2O_3 intercalates with non-spherical ions have been obtained. The electron density of As_2O_3 has been studied experimentally and analysed with quantum chemistry methods, suggesting spatial dispersion of stereoactive arsenic lone electron pair.

Perspective: The research is an example of tackling complex problems of crystal and electronic structure of solids by ab initio computational methods as well as experimental techniques like X-ray diffraction. Not only does it lead to new materials with potential applications, but also clarifies the interplay of lone electron pairs with weak interactions.



Maja Haczyk



Project Title: Microsystems for Analyzing the Influence of Active Compounds with the Use of Cell Cultures

Group: Laboratory of Miniaturized Chemical Systems

Supervisor: Zbigniew Brzózka

Project Description: Microfluidics, also known as 'lab-on-a-chip' technology, has many benefits to toxicological studies of active compounds. The aim of this project is to create a microsystem and analyze the influence of active compounds such as nanoparticles (quantum dots, dendrimers, nanogold and nanosilver) with the use of human cell cultures in vitro.

Perspective: Nanotechnology is a developmental field of science, which started to play an important role in modern biology, medicine and cosmetology. Unfortunately, there is still a lack of reliable nanotoxicity assays. Therefore, there is a need to create an appropriate device to test the influence of nanoparticles on human cells in vitro.

Wioletta Jakubczak



Project Title: Development of Methods for the Study of Disorders of Ionic Equilibria and Genesis in Cancer Cells Treated with Cytostatics

Group: Laboratory of Separation Method

Supervisor: Katarzyna Pawlak

Project Description: The scientific goal of the project is to develop methods for testing of disorders of ionic equilibria in normal and tumor cells cultured in the presence of Pt and Au complexes with a cytostatic effect.

Perspective: The development of strategy for a performance test of metal complexes as cytostatics helps to accelerate research on the design of new, more effective treatment against cancer, improve preclinical testing and reduce a number of animal tests.

Mohammed Halayqa



Project Title: Formulation and Study of Biodegradable Nanoparticles Drug

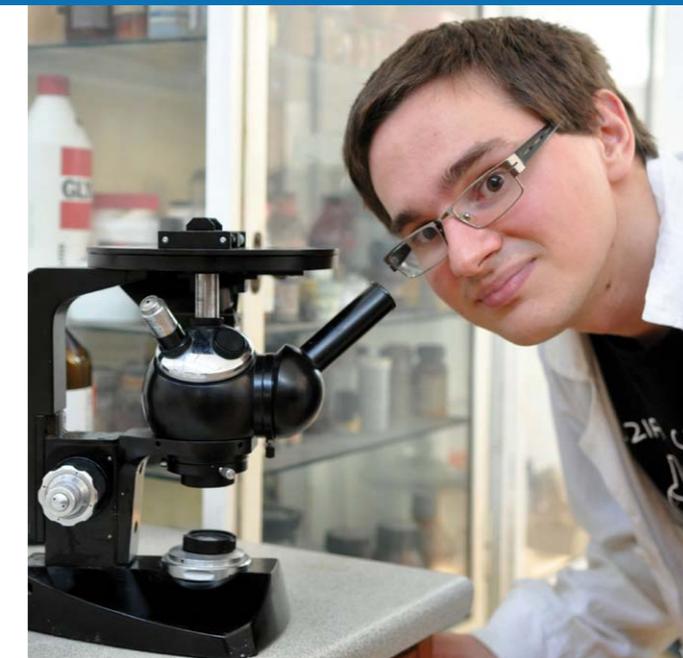
Group: Laboratory of Applied Thermodynamics

Supervisor: Urszula Domańska-Żelazna

Project Description: Formulation of polymeric nanoparticles as a drug delivery system. Identification and discussion of the impact of various formulation conditions on the size, morphology, zeta potential, drug loading and encapsulation efficiency of drug nanoparticles. In vitro study of the drug release from nanoparticles in phosphate-buffered saline solution.

Perspective: In perspective, the obtained results will allow to confirm the application of nanoparticles as drug carrier systems in the treatment of various diseases.

Piotr Jankowski



Project Title: SEI-Layer Creation Mechanisms and New Precursor Additives

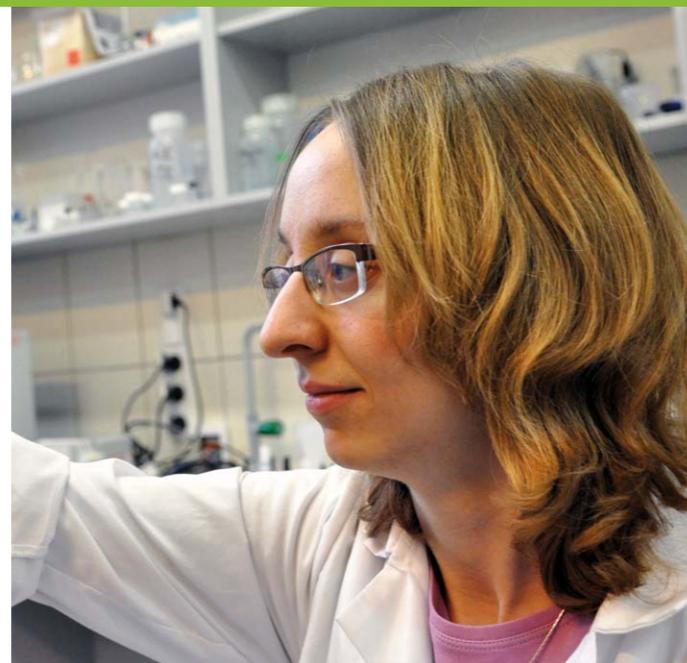
Group: Polymer Ionics Research Group

Supervisor: Władysław Wieczorek

Co-supervisor: Patrik Johansson

Project Description: Electrolytes used in Li-ion batteries are not stable against the anode. This causes a formation of layer comprising products of electrolyte decomposition—SEI. It is usually highly resistive and dimensionally unstable. The properties of the SEI-layer can be improved by applying additives with high reduction potential.

Perspective: Testing new additives by electrochemical and spectroscopic means aims at developing compounds to their commercial application in Li-ion as well as in Na-ion batteries. The support of analysis by computations enables to understand the mechanism of SEI creation and it could help in designing better structures of additive compounds.



Project Title: Application of Nucleic Acids as Receptor Layers in Biosensors

Group: Laboratory of Biosensors

Supervisor: Elżbieta Malinowska

Project Description: The research is focused on the analysis of the properties of nucleic acid monolayers and the interaction between DNA and RNA molecules with metal cations, proteins and bacteria cells. The study also involves the optimization of DNA/RNA surface immobilization methods and working parameters of nucleic acid - based biosensors.

Perspective: The designed biosensors could be applied in the future for environmental studies and clinical diagnosis as well as a reference method in the standard analysis of biological samples. One of the main challenges will be the development of miniaturized DNA sensors and arrays, which could be distinguished with high accuracy, portability and simplicity of use.



Project Title: Reactions of Group 13 Metal Trialkyls with Carboxylic Acids, Acid Amides and Benzoxaboroles

Group: Laboratory of Organometallic Chemistry and Homogeneous Catalysis

Supervisor: Wanda Ziemkowska

Project Description: The main aim of the investigation was a synthesis of novel complexes of 13 group metal trialkyls. One used dicarboxylic acids, benzoxaboroles and monoamides of dicarboxylic acids as ligands. A number of compounds that show a variety of coordination modes, stoichiometries and molecular structures have been obtained and fully characterized.

Perspective: The obtained compounds are potential precursors of nanomaterials in materials science. Aluminum complexes can be applied as precursors of nano-alumina, supports for polymerization catalysts and components in polymers. Thermal decomposition and the hydrolysis of the complexes lead to novel functional materials.



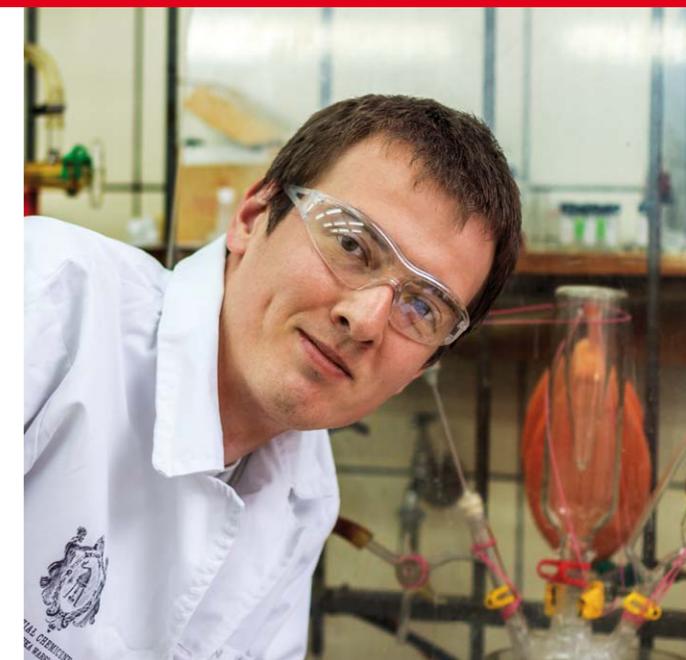
Project Title: Research Synthesis and Properties of Nano Graphene and Nanometal Oxides (Al, Ti) Modified Selected Metal Salts or Organometallic Compounds

Group: Laboratory of Organometallic Chemistry and Homogeneous Catalysis

Supervisor: Antoni R. Kunicki

Project Description: The research focuses on a surface modification of graphene metal salts and/or organometallic compounds. One of the issues is the functionalization of graphene and its properties. The material obtained is characterized by: a highly developed surface area, low particle agglomeration, high conductivity, biological activity.

Perspective: Graphene-based nanocomposites can be used in chemical industry in a variety of processes requiring high-performance catalysts with a broad spectrum and simultaneously resistant poisoning. Further directions applications are a new generation of electronic and optoelectronic; solar cells; for the construction of sensors; as sorbent materials.



Project Title: Synthesis of Aluminum Hydride and Its Complexes with Electron Donors and the Use of the Obtained Compounds as Additives to Solid Rocket Fuels and as Reducing Agents of Organic Compounds

Group: Laboratory of Organometallic Chemistry and Homogeneous Catalysis

Supervisor: Antoni Pietrzykowski

Project Description: The aim of this project is to develop technology for the preparation of unsolvated aluminum hydride with parameters optimal for the production of solid rocket fuels. The aim is also to examine the aluminum hydride and its complexes as reducing agents for selective reduction reactions of organic compounds.

Perspective: Obtaining rocket fuel with high performance characteristics for military applications. Preparation of novel aluminum hydride complexes allowing for conducting a selective reduction of organic compounds used in pharmacology.

Marcin Kaczorowski

Project Title: Composite Materials Comprising Dilatant Fluids
Group: Laboratory of Biodegradable and Bioactive Polymers
Supervisor: Gabriel Rokicki

Project Description: Dilatant fluids are non-Newtonian fluids. Their viscosity increases dramatically after reaching critical shear rate. This effect is known as shear-thickening. The goal of this project is to obtain dilatant fluids with good properties and then immobilize them in a polymer matrix. Resulting composites will be tested for the suppression of energy.

Perspective: Composites comprising dilatant fluids can be used in sports protectors, dampers or bulletproof vests. Dilatant fluids are obtained from relatively low-cost materials (polypropylene or polyethylene glycols and silica), so final products can have an attractive price.



Ewelina Karpierz

Project Title: The Characteristic of New Type of Electrolytes Containing Ionic Liquids and Glymes
Group: Polymer Ionic Research Group
Supervisor: Władysław Wieczorek

Project Description: The project concerns the research into the field of physicochemical properties of a new class of liquid and solid electrolytes for secondary batteries containing the ionic liquids and glymes instead of organic solvents.

Perspective: The results of my research may enable the development of a new generation of secondary batteries with much better properties in comparison with the commercially available ones.



Monika Karpińska

Project Title: Physicochemical and Thermodynamic Studies of Ionic Liquids for the Application in the Absorption Refrigeration
Group: Laboratory of Applied Thermodynamics
Supervisor: Urszula Domańska-Zelazna

Project Description: This project focuses on the basic physicochemical and thermodynamic studies of ionic liquids and their binary systems with alcohols. It investigates the influence of the structure of cation and anion on the physicochemical and thermodynamic properties of binary systems as well as it allows to select the best systems for applications in cooling technologies.

Perspective: Studies of binary systems of ionic liquids with alcohols complements thermodynamic databases and specifying potential applications of the ionic liquids in the field of sorption cooling. The results allow for a further development of thermodynamic models (ModUNIFAC, DISQUAC) which are helpful in predicting thermodynamic properties of pure compounds.



Anna Kasztankiewicz

Project Title: The Use of Energetic Binders for Solid Rocket Propellants
Group: Laboratory of High Energy Materials
Supervisor: Paweł Maksimowski

Project Description: The research is based on the synthesis of energetic binders with azido groups (BAMO, AMMO). In a following stage their copolymerization is carried out to energetic thermoplastic elastomers. The use of these binders allows to replace less energetic HTPB which is applied in current solid rocket fuels.

Perspective: One is planning to compose solid rocket fuel based on the received energetic binders.



Aleksandra Kezwoń

Project Title: Modification of Proteins as a Potential Source of New Macromolecules with Amphiphilic Character

Group: Laboratory of (Bio)sensors, Sensor Arrays and Surface Chemistry

Supervisor: Kamil Wojciechowski

Project Description: The primary objective of the project is the exploration of a potential amphiphilic character of novel protein and (oligo)peptide forms. The project comprises the analysis of the surface activity, rheological properties, emulsification ability and ability to form foams of different proteins/polypeptides chains in native and modified forms.

Perspective: The results obtained in the project will constitute a compendium of knowledge about surface activity of the amphiphiles of natural origin as well as their ability of emulsion/foam formation and stabilization. This should open new possibilities of obtaining bio-based surfactants with controlled properties and bio-compatibility.



Aleksandra Kędzierska

Project Title: Ceramic-Metal Composites Produced by Gelcasting Route

Group: Advanced Ceramics Group

Supervisor: Mikotaj Szafran

Project Description: Ceramic-metal composites will be produced with a gelcasting method. The application of heteroflocculation effect in colloidal processing will solve the problem of obtaining complicated shapes of composite bodies with homogeneous dispersion of metal reinforcement. One will use metal particles at nano and micro scale.

Perspective: The obtained composites, thanks to nano- and microsized reinforcement, will be characterized by very good mechanical properties. The gelcasting method will allow to produce final products with complicated shape without costly mechanical working.



Szymon Komorski



Project Title: Synthesis and Reactivity of Alkylzinc Pyrazolate Derivates

Group: Laboratory of Organometallic and Materials Chemistry – Lewiński Group

Supervisor: Janusz Lewiński

Project Description: The project comprises of two steps. Initially, diethylzinc was reacted with various pyrazole derivatives, which provided a range of structurally characterized alkylzinc pyrazolate compounds. Secondly, the latter were reacted with water, oxygen and air, then zinc pyrazolate metallamacrocycles of varied nuclearity and cavity size were produced.

Perspective: Metallamacrocycles, which are cyclic metal-organic clusters, are interesting thanks to their fascinating molecular architecture and their potential applications as sensors for small molecules or magnetic and electroluminescence materials. Derivatives of 1-H-pyrazole are particularly effective proligands for the construction of zinc metallamacrocycles.

Kamila Konopińska

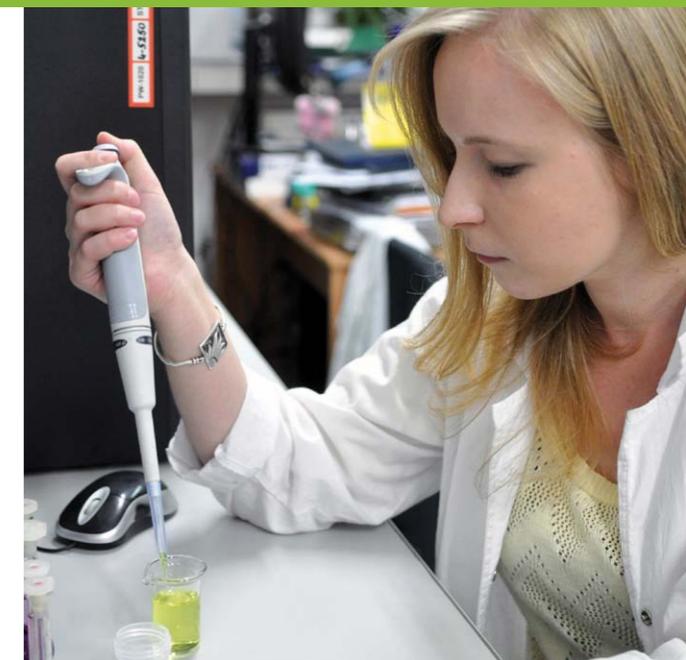
Project Title: Studies on the Application of Selected Complexes of Porphyrins in the Role of Protein Labeling

Group: Laboratory of Biosensors

Supervisor: Elżbieta Malinowska

Project Description: Determination of proteins with the use of chemical sensors usually requires the application of labeled biomolecules. (Metallo)porphyrins appear to be promising labeling tools, since their presence may be monitored by using various detection techniques, improving thereby the reliability of the analysis and widening the range of a linear response.

Perspective: The project concerns the studies on selected (metallo)porphyrins in terms of their usage as biomolecules labels for application in affinity biosensors. Tetraphenylporphyrin and its complexes with metal cations are conjugated with model proteins or antibodies and are characterized by means of spectrophotometry, spectrofluorimetry and electrochemical techniques.



Danuta Kończak



Project Title: The Excretion Profile of Anti-Asthmatic Drugs in the Context of Anti-Doping Research

Group: Laboratory of Biotechnology

Supervisor: Maria Bretner

Project Description: Anti-asthmatic drugs, such as inhaled glucocorticosteroids and b-2-agonists, are permitted by the World Anti-Doping Agency and used by athletes. In order to discriminate between allowed and prohibited ingestion, the excretion profile (EP) of a drug should be known. The aim of the project is to determine the EP of the most commonly used anti-asthmatic drugs.

Perspective: Nowadays, anti-doping laboratories struggle to detect anti-asthmatic drugs in order to give unequivocal answers if the anti-doping rules have been violated. The knowledge of a drug EP after inhalation and administration by forbidden routes will provide unambiguous interpretations of the results of anti-doping tests.

Jędrzej Konrad Korczak



Project Title: The Study on the Electrochemical and Thermal Properties of the Solid Polymer Electrolytes Based on Lithium Salts and Poly(ethylene oxide)

Group: Polymer Ionic Research Group

Supervisor: Władysław Wieczorek

Project Description: Solid polymer electrolytes - preparation via solvent-casting and hot-pressing technique, the main activities: ionic conductivity (electrochemical impedance spectroscopy), lithium cation transference number (Bruce-Vincent method), electrochemical stability (cyclic voltammetry), FT-infrared and Raman spectroscopy, differential scanning calorimetry.

Perspective: A change of lithium salt anion, its concentration and preparation technique can improve the parameters of solid polymer electrolyte and hence the whole lithium-ion battery (e.g. conductivity – energy density, lithium transference number – loss of energy, etc.).

Kamil Kotwica



Project Title: New Solution for Processable Organic Functional Materials for Electronics, Optoelectronics

Group: Laboratory of Electronically Active Organic Materials

Supervisor: Adam Proń

Project Description: The synthesis and characterization of new organic semiconductors based on vat dyes. Their application as active layers in electronic and optoelectronic devices.

Perspective: Obtaining a new family of new solution processable organic semiconductors suitable for the application in a field effect transistor or light emitting diodes.

Aleksandra Kruk



Project Title: The Use of Biodegradable Polymers for Biomedical Applications

Group: Laboratory of Technological Processes

Supervisor: Ludwik Synoradzki

Project Description: Controlled drug delivery systems (DDS) are a modern form of pharmaceuticals. One of the forms of DDS showing wide application are polymeric nanoparticles, an example of which are polymeric nanospheres. Polylactide is a natural, biodegradable and biocompatible polymer which can be successfully used for biomedical applications.

Perspective: So far, one has managed to obtain polylactide spheres containing drugs, for example neomycin. The next step will be the use of polylactide to obtain porous materials for biomedical applications. Polylactide can also be used as a bioresorbable scaffold – medium for a cell culture of bone and cartilage tissue used in biomedical engineering.

Project Title: Linear and Multi-Arm Star Copolymers of L-lactide

Group: Polymer Synthesis, Characterization and Processing Research Group

Supervisor: Zbigniew Florjańczyk

Co-Supervisor: Andrzej Plichta

Project Description: The aim was the synthesis and characterization of chemically modified polylactides (PLA) under the conditions of technological process of PLA manufacturing. The purpose was to obtain branched forms of PLA and triblock copolymers based on PLA, containing various condensation polyesters as a flexible middle segment in the presence of different catalysts.

Perspective: It is expected that changing PLA structure will influence the melt viscosity, mechanical properties (elasticity, resilience), thermal and barrier properties as well as biodegradation rate of the series of biodegradable polymers - PLA derivatives which are in majority from renewable resources. Such materials could be used in medicine or as packaging.



Project Title: Determination and Speciation of Metals in Samples of Tissues and Human Body Fluids

Group: Laboratory of Separation Methods

Supervisor: Katarzyna Pawlak

Project Description: The aim of the study is to examine interactions between tissues and metal complexes – components of human body fluids. Determination of kinetic interactions and the identification of the compounds constituting the adducts will determine the kinetics of interaction and the role of these compounds in the transport of metal complexes within the body.

Perspective: The developed method, conditions and measurements could be used in the studies of anticancer drugs and other metal complex. My research will contribute to improving the quality of life in people suffering from civilization diseases, and will support preclinical studies.



Project Title: Synthesis, Characterization and Application of New Hyperbranched Polymers

Group: Laboratory of Biodegradable and Bioactive Polymers

Supervisor: Paweł Parzuchowski

Project Description: Hyperbranched polymers (HBPs) have been known and extensively investigated for over two decades. However, there are still areas that need to be explored. HBPs exhibit unique chemical and physical properties. The aim of this work is the synthesis, characterization and application of HBPs in the areas of drug delivery systems, polymer composites, etc.

Perspective: New hyperbranched polymers will be synthesized, preferably from renewable resources. Their structure and physico-chemical properties will be determined. They will be studied as potential components of supercritical CO₂ soluble drug delivery systems, parts of polymer and wood composites or polymeric carbon dioxide absorbents.



Project Title: Protonic Conductive Superionic Glasses As a New Class of Electrolytes for Fuel Cells Working in The Medium Temperature Range

Group: Laboratory of Application of Methods, Models and Materials in Electrochemistry

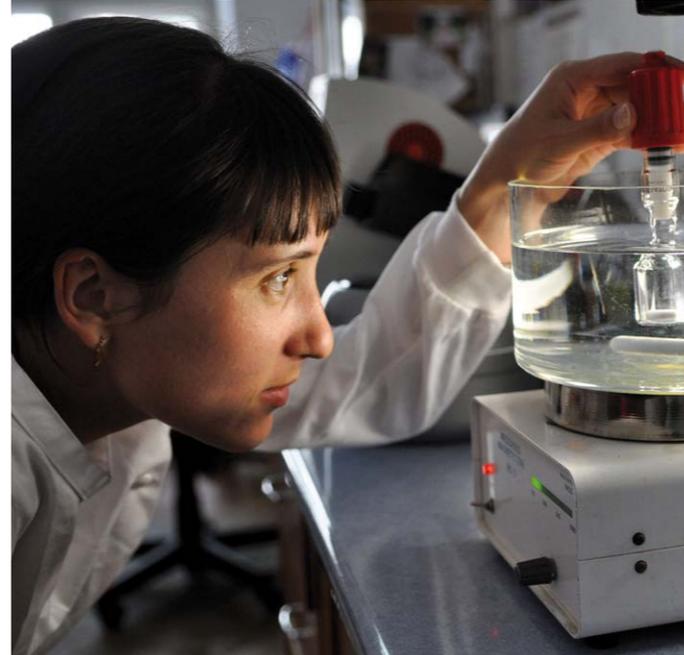
Supervisor: Władysław Wieczorek

Project Description: The project relates to the process of obtaining pure and commercially available electric and thermal energy from a single device which is a hydrogen fuel cell. For this purpose, a modern proton conductive solid glassy electrolyte has been designed. Additionally, the electrolyte must be modified by polymeric, ceramic and salt additives.

Perspective: A new generation of electrolyte may be used in a fuel cell which can be attached to the natural gas installation. As a consequence, it can supply energy to individual households or entire estates. This kind of system may work in places where the access to energy is difficult. Otherwise, it can be just an emergency support system (in hospitals, banks).



Elena Lukoshko



Project Title: Physicochemical Properties of Ionic Liquids for Extractive Purposes, e.g. Extraction of Sulfur- and Nitrogen-Containing Compounds from Fuels

Group: Laboratory of Applied Thermodynamics

Supervisor: Urszula Domańska-Zelazna

Project Description: Measurements of activity coefficients at infinite dilution for organic solutions and water in ionic liquids by GLC, LLE and LVE of binary systems (thiophene (or: pyridine, aromatic hydrocarbons, alcohols) + IL). LLE of ternary systems (thiophene+heptane+IL). A correlation of experimental LLE and VLE data by using an NRTL-model.

Perspective: Using ILs as a "green" solvent in industrial separation process for the extraction of sulfur- and nitrogen-containing compounds from fuels.

Anna Łatoszyńska

Project Title: Nonaqueous Proton Conducting Electrolytes and Their Application in Supercapacitors

Group: Polymer Ionic Research Group

Supervisor: Władysław Wieczorek

Co-supervisors: Paweł Kulesza and Patrice Simon

Project Description: The research concerns the use of polymer gels as electrolytes (GPE) in electrochemical capacitors with a double layer. The experiments focus mainly on the electrolyte synthesis and analysis, followed by its application in systems concerning activated carbon as the active electrodes material.

Perspective: The application of gel polymer electrolytes (GPE) in the field of supercapacitors solves the problems concerning liquid electrolytes (leakage, corrosion and high self-discharge). Additionally, organic solvents used in GPE allow for using capacitors in extreme temperature conditions (-40 to 80°C), which could be useful in hybrid electric vehicles (HEVs).





Project Title: Diagnostics of Electrode-Electrolyte Interfaces in the New Generation of Lithium Batteries

Group: Polymer Ionics Research Group

Supervisor: Marek Marcinek

Project Description: Obtaining a new generation of a PEO-based polymer blend solid-state electrolyte with lithium organic (imidazole-based) salts. Forming membranes-electrolytes by the tape casting method using organic solvent, molecular sieve and vacuum techniques. Diagnostics of electrode-electrolyte interactions by: CV, EIS, Raman, IR, DSC, EDS, SEM, PXRD.

Perspective: Applications of new-generation electrolyte materials allow for the improvement of battery parameters, such as: ionic conductivity, lithium ions mobility in apolymer matrix and electrolyte stability. In reality, these batteries may show higher efficiency and a greater number of full charge-discharge cycles than the ones used previously.



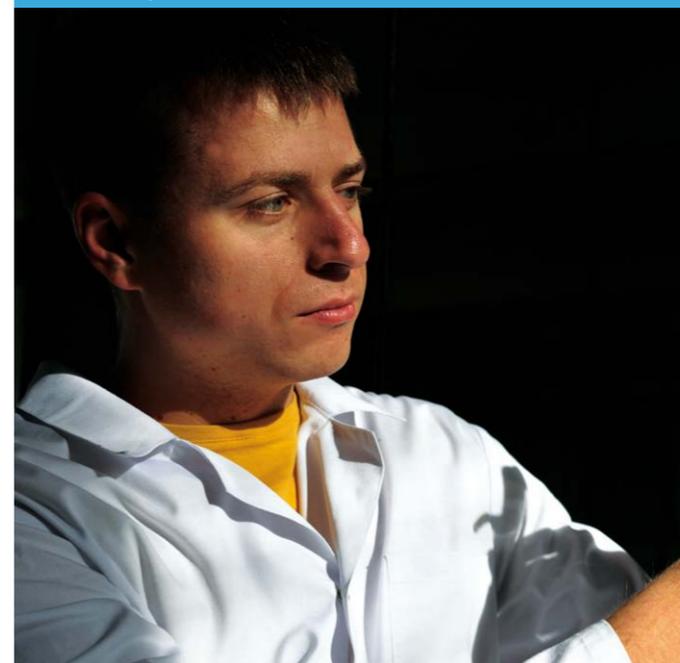
Project Title: Ion Microchromatography with a Contactless Conductivity Detector

Group: Laboratory of Miniaturized Chemical Systems

Supervisor: Artur Dybko

Project Description: The aim of the project is to implement and optimize a micro-ion chromatograph with conductivity detection. The project is consistent with the concept of lab-on-a-chip technology which aims to limit the use of solvents, in order to test a small volume of sample in a short time.

Perspective: Reducing the size of the analytical device will allow for the analysis of the place of sampling, e.g. a river. Low consumption of reagents will help to reduce the cost of a single analysis as well as it will have a positive impact on the environment.



Project Title: Sugars as Renewable Raw Materials for the Synthesis of Products with High Added Value

Group: Carbohydrate Research Group

Supervisor: Wojciech Sas

Project Description: Sugars as renewable raw materials are efficient and perspective substrates in the organic synthesis of biological active compounds. One is investigating the use of sugar derived nitrones to synthesize a number of iminosugars bearing a quaternary carbon atom on the α position to nitrogen, potent glucosidases inhibitors.

Perspective: Inhibition of novel iminosugars obtained in the project – piperidine, indolizidine and chinolizidine derivatives – will be tested in biological studies. The uncommon strategy in carbohydrate chemistry to use unprotected sugars in the synthesis of iminosugars will be developed.



Project Title: The Investigation of Metallocomplexes with Potential Anticancer Properties Transportation Under Simulated Physiological Conditions Using Multidimensional Analytical Methodology

Group: Laboratory of Separation Methods

Supervisor: Maciej Jarosz

Co-supervisor: Zbigniew Czarnocki

Project Description: The major research objective of this PhD thesis is the in vitro characterization of interactions of ruthenium(III) and gallium(III) complexes with serum transport proteins and pertinent cytoplasm components, e.g. cytosolic proteins, DNA.

Perspective: In the framework of the aforementioned project, novel analytical procedures and methodologies will be developed and tested in order to obtain specific knowledge about the modes of action of the potential anticancer metallocomplexes under simulated physiological conditions. The project is being carried out in cooperation with the Russian Academy of Sciences (Moscow).

Alicja Matuszewska



Project Title: Synthesis and Characterization of Ortho-Aminomethylphenylboronic Acids

Group: Laboratory of Synthesis and Structural Investigation of OrganoBoron Compounds (OBC)

Supervisor: Andrzej Sporzyński

Co-supervisor: Agnieszka Adamczyk-Woźniak

Project Description: The aim of the project is to synthesize new phenylboronic acids with an aminomethyl substituent at ortho position, which can be applied in organic synthesis catalysis, supramolecular chemistry, biology, medicine and industry.

Perspective: For decades, scientists have been searching for non-invasive glucose responsive systems. Phenylboronic acid (PBA) systems seem to be a perfect solution to detect carbohydrates and catecholamines. The o-aminomethylphenylboronic acids reveal a potential medical application owing to sugar sensing at the neutral pH.

Magdalena Mazurek



Project Title: Poly(ester-carbonate)s and Polyurethanes Based on Renewable Resources – Carbonic Acid Derivatives

Group: Laboratory of Biodegradable and Bioactive Polymers

Supervisor: Gabriel Rokicki

Project Description: The project focuses on the investigation of a new, alternative and susceptible of industrial applicability preparation methods of poly(ester-carbonate)s and poly(carbonate-urethane)s based on the derivatives of carbonic acid. The investigation also includes the physical, chemical and mechanical characterization as well as biostability and biodegradation of the prepared materials.

Perspective: The investigation of innovative and cheap technologies concerns the utilization of CO₂ and PET wastes as well as the synthesis of non-isocyanate polyurethanes, which contributes to pro-ecological industry development. The designed polymers (elastomers, thermoplastics) could be applied in the field of medical engineering and as well as in high-strength coatings.

Łukasz Mąkowski



Project Title: Investigation of the Role of pi-Interactions in the Reactivity of Oxygen Species

Group: Laboratory of Organometallic and Materials Chemistry – Lewiński Group

Supervisor: Janusz Lewiński

Project Description: The aim of this project is the investigation of the mechanisms by which O₂ molecules can be activated as well as the mechanisms of further transformation of reactive oxygen species. The project focuses on the role of the secondary sphere and non-covalent interactions, mainly by the introduction of pi-aromatic interactions into the model systems.

Perspective: Establishing and confirming the mechanisms by which an O₂ molecule can be activated and its further implementation into modern materials and organometallic chemistry.

Karol Molga



Project Title: Synthesis and Properties of Expanded Metallacycles

Group: Laboratory of Organometallic Chemistry and Homogeneous Catalysis

Supervisor: Piotr Buchalski

Project Description: The main goal of project is the synthesis of metallacycles with an expanded π -system as the molecule's core containing nickel, boron or silicon as bridging atoms. Their magnetic, electronic and optical properties will be investigated and evaluated for a potential use in organic electronics.

Perspective: Development of the methodology of organic synthesis for the preparation of large halogenated aromatic hydrocarbons. Elaboration of effective methods for the synthesis of novel metallacycles showing unique magnetic and optical properties for the use in organic electronics.

Project Title: Extraction of 2-Phenylethanol Using Ionic Liquids and Deep Eutectic Solvents

Group: Laboratory of Applied Thermodynamics

Supervisor: Urszula Domańska-Żelazna

Project Description: The project includes:

- measurements of phase equilibria in binary systems {2-phenylethanol + solvent: ionic liquid or deep eutectic solvent} and ternary systems {2-phenylethanol + water + solvent}
- conversion of L-phenylalanine to 2-phenylethanol by yeast with the in situ extraction of 2-phenylethanol
- determination of 2-phenylethanol by HPLC.

Perspective: Finding a "green" solvent for the in situ extraction of 2-phenylethanol from the fermentation broth.



Project Title: Solubility of Sugars in Ionic Liquids

Group: Laboratory of Applied Thermodynamics

Supervisor: Urszula Domańska-Żelazna

Project Description: The project includes:

- measurements of solid-liquid equilibrium phase diagrams in binary systems {sugar alcohol + ionic liquid} with a dynamic method up to the fusion temperature of sugar alcohol
- identification and discussing the impact of the chemical structure of both the ionic liquid and sugar alcohol on the results of measurements of phase equilibria.

Perspective: The obtained results will allow to ascertain the application of ionic liquids and carbohydrates in modern and ecological processes.



Project Title: Surface Activity of Saponins and Their Interactions with Other Biomolecules

Group: (BIO)Sensors, Sensor Arrays and Surface Chemistry

Supervisor: Kamil Wojciechowski

Project Description: The main goal of the project is to study interactions between saponins and lipids in the Langmuir monolayers mimicking different types of real biological cell membranes. In the experimental part of my PhD work, I will be mostly employing interfacial tension-based techniques as well as electrochemical, microscopic and reflectometric ones.

Perspective: The outcome of the project will help to understand what is happening at the interface between the cell and the extra-cellular surroundings during the encounter with the saponin molecules.



Project Title: Synthesis and Reactivity of Nickelacyclic Complexes

Group: Laboratory of Organometallic Chemistry and Homogeneous Catalysis

Supervisor: Piotr Buchalski

Project Description: Reactions of 9-nickelafluorenyllithium complexes with N-heterocyclic carbene precursors, isomerization of obtained salts and the study of their catalytic activity. Mechanism study of the mentioned reactions enhanced with DFT calculations.

Perspective: Synthesis of novel nickelacyclic salts and the elaboration of new synthetic pathways to NHC-nickel complexes.

Emilia Pawlikowska



Project Title: Ferroelectric Ceramic-Polymer Composites Prepared by Tape-Casting for Microwave Applications

Group: Advanced Ceramics Group

Supervisor: Mikotaj Szafran

Project Description: Microwave antennas are studied by many researchers in the world. The antennas allow to send more information in the signal unit. They can also serve as detectors or a component for signal transmitting systems. The study has developed flexible multilayer systems, tunable in high frequencies. As the ferroelectric material, one used Barium Strontium Titanate.

Perspective: The materials allow for the dissemination of modern communication systems formerly reserved for the military sector. The tunability of this system makes it possible to significantly extend the range of application of the developed solution.

Emilia Pietrzak



Project Title: New Low Toxic Additives in Colloidal Processing of Advanced Ceramic Materials

Group: Advanced Ceramics Group

Supervisor: Mikotaj Szafran

Project Description: The research on new functional, low toxic additives which should be able to improve the mechanical strength of ceramic samples in a "green state". More recently, the use of eco friendly acrylic monomers has provided new opportunities. They do not need cross-linking agents. Moreover, they have the ability to act as dispersing agents for selected nanopowders.

Perspective: Shaping methods based on colloidal processing allow to obtain the near-net-shape ceramic elements of high mechanical strength and a high degree of densification. Environmentally friendly additives may become an alternative group of compounds for those commonly used in shaping techniques, such as gelcasting.

Tomasz Pietrzak



Project Title: Reactivity of Selected Organometallic Compounds Towards Dioxygen and Nitrogen Monoxide

Group: Laboratory of Organometallic and Materials Chemistry – Lewiński Group

Supervisor: Janusz Lewiński

Project Description: The aim of my research is the investigation of the reactions of a new alkylzinc and alkylmagnesium complex supported by bifunctional N,N- and N,O- ligands with dioxygen and nitrogen monoxide. Catalytic activity of the resulting product in the selected organic reactions is also tested.

Perspective: The results may open new ways for the future investigation of the activation of small molecules and also contribute to a rational design of new, efficient catalysts for the epoxidation of enones and the polymerization of lactide.

Adriana Przerwa



Project Title: Sugars as Renewable Raw Materials in the Synthesis of Products with High Added Value

Group: Carbohydrate Research Group

Supervisor: Wojciech Sas

Project Description: Polyhydroxylated pyrrolidines, piperidines, pyrrolizidines natural and synthetic, owing to their similarity to natural sugars (named as iminosugars), are powerful glycosidase inhibitors and potential therapeutics. My work is focused on studying on the synthesis of a novel hybrid iminosugar-nucleobase with a 4,5-disubstituted-1,2,3-triazole linker.

Perspective: In the future, I would like to build a library of hybrid iminosugar-nucleobase with 1,2,3-triazole linker. Hybrids in their structures will own different nucleobase or iminosugar. Next, the synthesis of derivative will be analyzed for potential therapeutics.

Ewelina Reda



Project Title: Conversion of Volatile Organic Compounds in Gliding Discharge Reactor

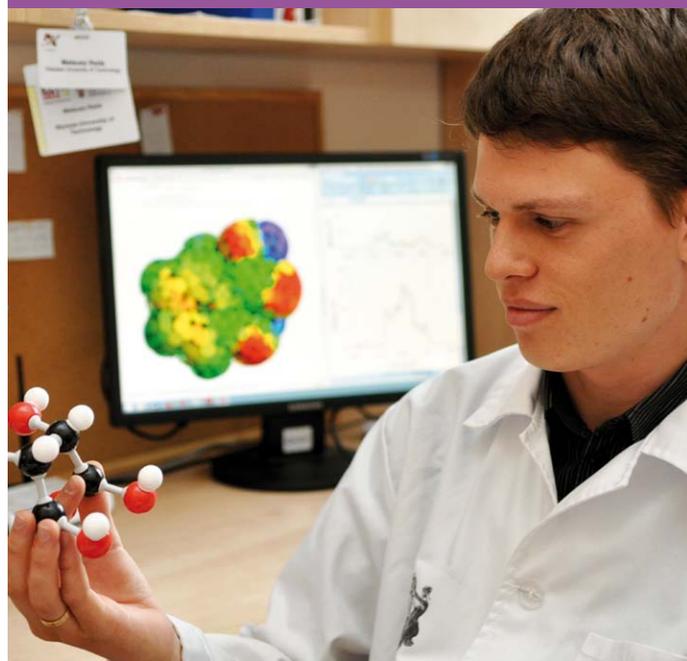
Group: Laboratory of Low Temperature Plasma Processes

Supervisor: Krzysztof Krawczyk

Project Description: The aim of the project is to develop an effective technology of air purification from VOCs. The studies are conducted in non-equilibrium plasma, in a gliding discharge reactor. This method is especially attractive owing to the high quantity of produced radicals and a possibility to conduct chemical processes at high gas flow rates.

Perspective: A disadvantage of plasma methods is often incomplete conversion, leading to even more toxic by-products. In order to solve this problem, the plasma-catalyst system is used. Currently, the main effort is finding a catalysts which will improve the conversion and selectivity of VOCs decomposition.

Mateusz Reda



Project Title: Modeling of Thermodynamic Properties of Pure Components and Mixtures

Group: Laboratory of Applied Thermodynamics

Supervisor: Tadeusz Hofman

Project Description: The aim of the project is to elaborate on a qualitative and simultaneous description of various thermodynamic properties by means of one physical model. The research is focused on the group of so-called molecular models which are being tested, modified and developed. The experimental part provides data for the testing purposes.

Perspective: The ultimate aim of thermodynamics of solutions is to find an approach enabling the prediction of different thermodynamic properties of all kinds of mixtures. Such a need is supported by the increasing cost of a direct experiment. As a result, MD, MC and quantum-mechanical methods are constantly developed. Our research is following this trend.

Katarzyna Rucińska



Project Title: Lactic Acid as a Reactant in the Polyester Resins

Group: Polymer Synthesis, Characterization and Processing Research Group

Supervisor: Zbigniew Florjańczyk

Project Description: Biopolymers based on renewable resources are the basis for the 21st century ecological plastic. Poly(lactic acid) has been widely investigated for biomedical applications because it is biodegradable and biocompatible. Lactic acid as a reactant of polyester resins could give new properties of polyester resins and make them more environment friendly.

Perspective: Nowadays, preservation of our ecological system has become a vital concern. To facilitate this process, conventional plastic should be replaced with degradable polymers. This is the reason for which biodegradable polymers, with their high potential of development, have gained popularity among several companies which are willing to invest in this branch of science.

Renata Rybakiewicz



Project Title: New Arylene Bisimides with Electron-Donating Substituents as Solution Processable Organic Semiconductors. Their Synthesis, Spectroscopic, Electrochemical, Structural and Electrical Transport Properties

Group: Laboratory of Electronically Active Organic Materials

Supervisor: Małgorzata Zagórska

Project Description: The main goal of this project is to synthesize and investigate the spectroscopic, electrochemical and electrical transport properties of a new class of organic semiconductors, namely arylene bisimides N- or core-functionalized with different electron-donating substituents, such as triarylamine, carbazole, etc.

Perspective: The development of new, solution-processable organic electroactive materials should allow for changing the technology of electronic components. They seem to be suitable materials for the fabrication of organic field effect transistors (OFETs) and organic light-emitting diodes (OLEDs).



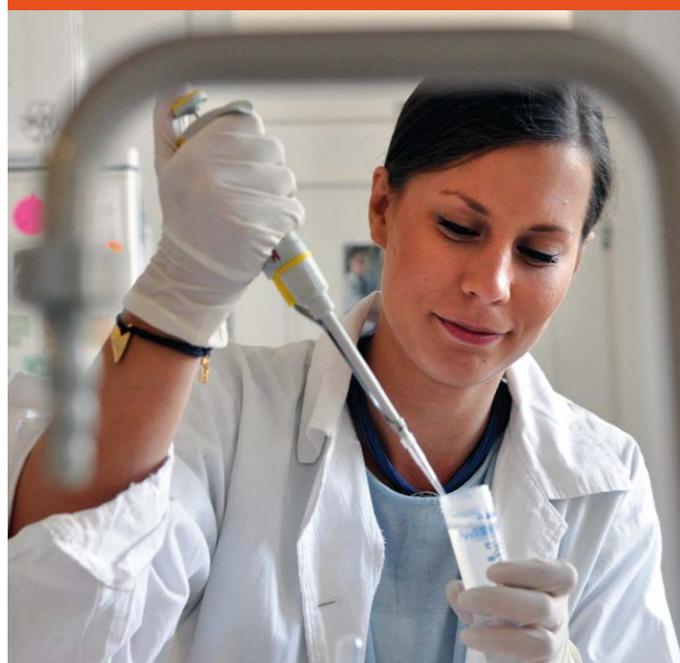
Project Title: Estimating the State of Health in Lead-Acid Batteries

Group: Laboratory of Application of Methods, Models and Materials in Electrochemistry

Supervisor: Władysław Wieczorek

Project Description: The scope of the project is designing and testing a battery degradation prediction model. The model is based on the research conducted on batteries in controlled conditions which are similar to the real-life exploitation. One can also devise an algorithm based on the research of tying the battery state of health to easily measurable properties, such as voltage or impedance.

Perspective: Battery management systems prove to be a useful resource for predicting battery failures of various systems – to maximize the life span of batteries and minimize unexpected failure rates in such systems. Complex programs based on prediction algorithms have to be developed and a demand for such is currently on the rise to optimize the battery use.



Project Title: Application of Quartz Crystal Microbalance for Studying Protein-Ligand Interactions

Group: Laboratory of Recombinant Proteins

Supervisor: Joanna Cieśla

Project Description: The scope of research of my PhD thesis covers the investigation of protein-protein interactions which are intrinsic to virtually every major biological function. In my studies, I mostly focus on investigating proteins significant for the anticancer and antitumor therapy, including protein kinase CK2 and enzymes involved in the thymidylate biosynthesis cycle.

Perspective: Investigating the mechanisms of protein-protein interactions is essential for gaining the insight into many significant physiological and pathological processes in cells. We believe that this study may significantly contribute to the anticancer and antitumor research and will help in designing new effective drugs.



Project Title: Investigation of Histidine Phosphorylation in Thymidylate Synthase (TS) and Searching for Causative Protein Kinase

Group: Laboratory of Recombinant Proteins

Supervisor: Joanna Cieśla

Project Description: Recently, we have discovered that TS, a molecular target in chemotherapy, undergoes phosphorylation. Our data point to the presence of acid-labile phosphohistidine. This modification changed catalytic and non-catalytic properties of TS. We want to discover which protein is responsible for the phosphorylation of histidine residue(s) on a TS molecule.

Perspective: Our input in the field of acid-labile phosphorylation may be beneficial for the development of new research methods dealing with this problem. The outcome of our research may be the discovery of a new protein with possible regulatory function or ascribing a new function to the already known protein.

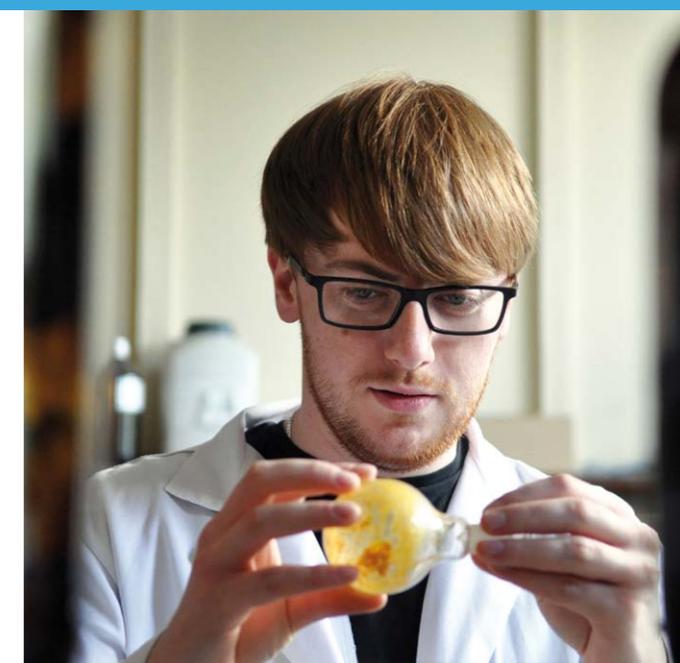
Project Title: Organic Molecules for Spintronics Applications

Group: Laboratory of Electronically Active Organic Materials

Supervisor: Irena Kulszewicz-Bajer

Project Description: The project is devoted to the phenomenon of ferromagnetic spin interactions in organic species. It consists of three major parts: theoretical (DFT), synthetic and physico-chemical (EPR and SQUID). All of these parts are equal and, when combined together, they constitute a powerful tool in the search of organic magnets.

Perspective: The goal of this study is to understand the nature of ferromagnetic coupling within organic materials. It is aimed at determining which structural factors are responsible for the coupling, both qualitatively and quantitatively. This fundamental study will be valuable for future applications and materials design.





Agnieszka Sobiecka



Project Title: Preparation of New Tartaric Acid Derivatives and Their Application in Cosmetics

Group: Laboratory of Technological Processes

Supervisor: Ludwik Synoradzki

Project Description: The main goal of the project is the preparation of new tartaric acid derivatives containing four different functional groups, including O-acyl and O-alkyl tartaric acids and their monoamides and monoesters. Optimizations have been carried out in order to obtain environment friendly technology for selected syntheses.

Perspective: New compounds will be used as analogs of ceramids occurring in epidermis, antioxidative agents or as antimicrobial agents, depending on the structure of tartaric acid derivatives. One needs to conduct the research of permeability, skin absorption, antioxidant activity or antimicrobial properties of tartaric acid analogs before the actual application.

Anna Sobiepanek

Project Title: The Diagnostics of Melanoma and Non-Melanoma Skin Cancer

Group: Laboratory of Biotechnology

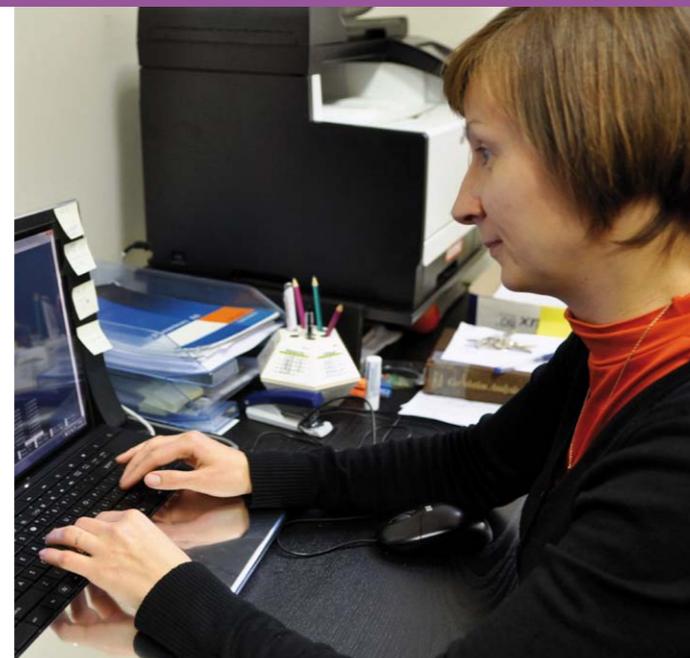
Supervisor: Maria Bretner

Co-Supervisor: Tomasz Kobiela

Project Description: We expect to design a biosensor that can improve the diagnostics of skin cancer. We are presenting a new approach that combines the use of atomic force microscopy and quartz crystal microbalance.

Perspective: Melanoma and non-melanoma skin cancers are considered to be the most dangerous types of diseases. The melanoma malignant tumor is believed to have limited therapeutic procedures for its treatment. Our research may significantly improve the health care of people suffering from these diseases.





Project Title: Effect of Intermolecular Interactions on the Π -Electron Structure and Tautomerism of Nucleobases

Group: Laboratory of Applied Thermodynamics

Supervisor: Halina Szatylowicz

Co-Supervisor: Tadeusz M. Krygowski

Project Description: This project focuses on the study of several most stable tautomers of DNA nucleobases (adenine, guanine, thymine and cytosine) and their intermolecular interactions via H-bonding and complexation with alkali metal cations. Its aim is the investigation of effects of these interactions on geometric and electronic structures of the studied systems.

Perspective: The obtained results allow for a better understanding of the effects observed in more complex biological systems which can be investigated by applying our methodology, e.g. the influence of metal cations on the characteristics of intermolecular interactions in nucleobase pairs or their stacked dimers.



Project Title: Research on the Synthesis of Biodegradable Polyesters and Copolyesters by the Solid State Polycondensation Method

Group: Laboratory of Biodegradable and Bioactive Polymers

Supervisor: Gabriel Rokicki

Project Description: An important group of biodegradable polymers are polyesters. In our study, most of the attention is paid to the PLA synthesis which is currently the most popular, biodegradable, aliphatic polyester obtained from renewable raw materials. Moreover, the subject of our interest is the synthesis of aliphatic-aromatic copolyesters for various applications.

Perspective: A wide range of potential applications of biodegradable materials (e.g. in medical and packaging industry) contributed to the intensive development of research in this field. The production and use of biodegradable polymers would reduce the amount of waste intended for the storage and development of new materials for medicine (e.g. drug delivery system).



Project Title: Organozinc Functional Materials

Group: Laboratory of Organometallic and Materials Chemistry – Lewiński Group

Supervisor: Janusz Lewiński

Project Description: The project focuses on the synthesis of novel photoluminescent materials based on 8-hydroxyquinoline, porphyrin systems and ZnO nanoparticles. These molecules are also used for small molecules activation, e.g. carbon and sulfur dioxides. Finally, the possibility of fluorescent zinc MOFs formation is being investigated.

Perspective: In perspective, gas sorption materials with optically tunable properties and light harvesting systems could be developed by using luminescent precursors. Fundamental research into the reactivity of organozinc compounds towards water, oxygen and organophosphates will also be included.



Project Title: Nanotechnology for Anticancer Therapy

Group: Laboratory of Miniaturized Chemical Systems

Supervisor: Michał Chudy

Project Description: Cell culture techniques that mimic in vivo conditions are very important in biochemical research. Microsystems have now become accepted tools used for fundamental biological studies. They provide a possibility of developing personalized therapy such as a photodynamic therapy which combines a photosensitizer with a specific type of light.

Perspective: Among a variety of reported nanocarriers, polymeric nanocapsules represent a relatively new trend in creating effective nanocarriers for PDT purposes. We aim to test new nanocapsules loaded with different photosensitizers and to evaluate their biocompatibility with the use of microsystems upon different human cell lines.

Project Title: Development of a Microfluidic Cardiac Cell Culture Model

Group: Laboratory of Miniaturized Chemical Systems

Supervisor: Michał Chudy

Project Description: The aim of the project is to design a microfluidic system for a cardiac cell culture. The studies are focused mainly on the hydrogel-based three-dimensional cardiac cell culture. For the research purposes, mouse embryonic cardiomyocytes are used. Moreover, the possibility of using stem cells for cardiovascular regeneration in microsystem is also examined.

Perspective: The developed microsystem could be a heart model for pharmacology studies. It could be a more representative experimental model of the in vivo environment than conventional culture dishes. In the future, this microsystem could be a promising tool for studying cardiac diseases.



Project Title: Determination of Mercury and Tin Species in Environmental and Biological Samples

Group: Laboratory of Separation Methods

Supervisor: Krzysztof Jankowski

Project Description: The goal of the project is to develop a method for the determination of trace amounts of inorganic and organic mercury as well as tin compounds in environmental and biological samples, after the preconcentration of their volatile derivatives by SPME followed by thermal desorption and OES detection.

Perspective: The research on the possibilities to use microtechnology for a selective separation of trace amounts of inorganic and organic mercury and tin compounds in environmental and biological samples. Implementation of enhancements to the method by e.g. applying the Savitzky-Golay algorithm for the correction of spectral interferences and reduction of noise.



Project Title: Synthesis and Characterization of New Lithium Salts for Applications in Electrolytes for Lithium-Ion Batteries

Group: Polymer Ionic Research Group

Supervisor: Marek Marcinek

Project Description: The aim of the project is to synthesize new lithium salts and check their properties in terms of the use in lithium-ion cells. In syntheses, I am focusing on the aromatic or conjugated structures of anions. The characterization includes: determination of ionic conductivity, transference number, thermal and electrochemical stability of electrolytes containing salts.

Perspective: Modern industry desires new technologies increasing the performance of modern batteries. My research can contribute to the improvement of almost all properties of Li-ion batteries, such as: capacity, power density, charging efficiency and toxicity. Battery development is crucial for increasing the use of energy from renewable sources.

Project Title: Design, Synthesis and Study of the Building Units Structures as the Precursors of Non-Covalent Porous Materials

Group: Laboratory of Organometallic and Materials Chemistry – Lewiński Group

Supervisor: Janusz Lewiński

Co-Supervisor: Robert Moszyński

Project Description: The goal of the proposed research is to design, prepare and characterize new non-covalent porous materials (NPMs) of a desired topology, unique guest-responsive framework and functionality based on the coordination-driven and non-covalent interaction-driven self-assembly.

Perspective: Synthesis of the organometallic porous materials, their precursors and modeling of molecular interactions between the pre-designed host and the certain guest.



Iwona Magdalena Ufnalska



Project Title: Electrochemical Studies of Coordination Properties of Synthetic Peptides and Their Analogs Having Biological Activity

Group: (BIO)Sensors, Sensor Arrays and Surface Chemistry

Supervisor: Wojciech Wróblewski

Project Description: The aim of this project is to investigate the coordination abilities of different biologically active peptides. The efficiency of metal ion binding by tailored peptide ligands is examined by voltammetric and spectroscopic techniques. The studies include a formation of mono- and also binuclear complexes, focusing particularly on copper(II) coordination.

Perspective: We hope that our research will be a further step towards a better understanding of the role of copper(II) ions being coordinated by various peptides in many important biochemical processes. In a broader sense, these studies may have a significant contribution in the field of molecular recognition and coordination chemistry as well.

Mateusz Urban



Project Title: Selected Boracyclic Compounds and Their Application in Synthesis and Materials Chemistry

Group: Laboratory of Fine Technologies

Supervisor: Sergiusz Luliński

Project Description: The subject of the project is the synthesis and characterization of novel boracyclic compounds. The main focus are borafluorenes, siloxaboroles, their heteroaromatic analogues and complexes of boracycles (boryl anions) with various metals.

Perspective: Boracyclic compounds are the compounds containing heterocycle with a covalently bonded boron atom as the heteroatom. They find numerous applications as intermediates in organic synthesis, catalysis (NHC ligand analogues, FLP) or in materials chemistry (frameworks - COFs, sensors).

Piotr M. Urbański



Project Title: Synthesis and Investigation of Nickel and Boron-Nickel Complexes as New Homogenous Catalysts

Group: Laboratory of Organometallic Chemistry and Homogeneous Catalysis

Supervisor: Włodzimierz Buchowicz

Project Description: The synthesis and characterization of nickel and boron-nickel complexes for a homogenous catalysis, aiming at the development of cheap and highly active alternatives of widely used palladium-based catalysts. The investigation of boron-nickel complexes as an insight into the Suzuki-Miyaura reaction and searching for nickel-boron complexes for catalytic applications.

Perspective: The use of the first-row transition metals in a homogenous catalysis is more appealing than the use of precious metals, owing to their reasonable price and abundance in the Earth's crust. Since a significant scientific interest has been focused on coupling reactions, nickel-based catalysts seem to be especially desirable substitutes of palladium complexes in the homogenous catalysis.

Edyta Wawrzyńska



Project Title: Advanced Polymeric Materials – From Calculation to Application

Group: Laboratory of Biodegradable and Bioactive Polymers

Supervisor: Paweł Parzuchowski

Project Description: The subject of the thesis concerns advanced polymeric materials: design and synthesis of multifunctional hyperbranched polymers soluble in supercritical carbon dioxide, Monte Carlo simulations of branched polymers and polymerization process.

Perspective: The thesis concentrates on researching a versatile strategy for a more effective drug delivery. The theoretical studies and the laboratory research on the synthesis of branched polymers soluble in supercritical carbon dioxide will play a significant role in the future development of new medical solutions for the treatment of human diseases.

Project Title: Electronic Tongue for the Assessment of Taste Properties of Pharmaceuticals

Group: (BIO)Sensors, Sensor Arrays and Surface Chemistry

Supervisor: Wojciech Wróblewski

Project Description: Electronic tongue allows for the identification and classification of liquid samples. The aim of this study is to investigate different chemical images formed with the use of sensor array during the measurements of various active pharmaceutical ingredients and excipients. The images will be evaluated to study taste masking effects in pharmaceuticals.

Perspective: We would like to build an electronic tongue system for the reliable and repeatable analysis of pharmaceuticals. Such a device may reduce taste studies performed by human taste panels, and allow for an objective assessment of taste.



Project Title: Compatibility of Microwave Plasma Chemical Vapor Deposition Manufactured Si/C Electrodes with New LiTDI Based Electrolytes

Group: Polymer Ionic Research Group

Supervisor: Marek Marcinek

Project Description: The main goal of this project is the synthesis of a new type of Si/C composite anodes for lithium-ion batteries. Thin layers of graphitic carbon decorated in 3D with Si nanoparticles were synthesized from liquid organic precursors by using one-step microwave plasma chemical vapor deposition (MPCVD). The electrodes are being investigated with a new generation of imidazole saltbased electrolytes.

Perspective: Further investigations of new electrolytes and their compatibility with the obtained anodes and an attempt of application of the results.



Project Title: Design, Synthesis and Spectro-Electrochemical Studies of Interactions of Synthetic Peptides with Selected (Bio)Analytes

Group: (BIO)Sensors, Sensor Arrays and Surface Chemistry

Supervisor: Wojciech Wróblewski

Project Description: The main goal of this work is to investigate the interactions between copper(II) ions and ATCUN peptides. The experiments with short tripeptides: β AlaAlaHis, Ala β AlaHis, AlaAlaHis are carried out to elucidate the nature and mechanisms of interactions between peptides and copper ions at different oxidation states.

Perspective: We are going to create sensors with peptides monolayers. Electrodes modified with oligopeptides molecules will be used as a new tool to clarify the nature of the interactions between the copper ions at different oxidation states and β -amyloid (A β) – an important peptide associated with the Alzheimer's disease.



Project Title: Investigation of Metallocomplexes with Potential Anticancer Properties Transportation Under Simulated Physiological Conditions Using Multidimensional Analytical Methodology

Group: Laboratory of Separation Methods

Supervisor: Maciej Jarosz

Project Description: The main aim of the study is to identify degradation products and to elaborate a method allowing to distinguish natural dyes based on their degradation products.

Perspective: The knowledge on the mechanism of degradation of natural dyes could be helpful to determine what a work of art looked like originally as well as to choose the best restoration procedure.



Michał Wlazło



Project Title: Ionic Liquids in the Breaking of Azeotrope Mixtures

Group: Laboratory of Applied Thermodynamics

Supervisor: Urszula Domańska-Żelazna

Project Description: The aim of the project is to investigate the possibility of ionic liquids (ILs) in azeotrope breaking. In this case, the activity coefficients at the infinite dilution in ionic liquid-organic solute systems and a ternary liquid-liquid equilibrium are determined to calculate the selectivity and capacity of different azeotrope mixtures separation using ILs.

Perspective: Ionic liquids have distinctive properties such as: high thermal and chemical stability, wide liquid temperature range and negligible vapour pressure. It allows to consider ILs as environment friendly entrainers in the azeotrope breaking, which can replace commonly used volatile organic solvents as well as it may also reduce the cost of industry processes.

Agata Włodarska



Project Title: The Synthesis of Nickel Compounds and Their Use as Components of Catalyst Systems for the Polymerization and Oligomerization of Carbenes and Olefins

Group: Laboratory of Organometallic Chemistry and Homogeneous Catalysis

Supervisor: Antoni Pietrzykowski

Project Description: The aim of this project is the synthesis and study of catalytic activity of organonickel compounds. The first stage of research is to provide a path to synthesis of novel nickel compounds. The resulting compounds will be used as components of catalytic systems in polymerization and oligomerization reactions as well as cross coupling reactions.

Perspective: Nickel catalysts have found application in a vast number of organic transformations, and they may replace more expensive palladium or ruthenium systems. They are used in carbene polymerization which is an attractive method for the preparation of new polymers that could not be obtained by conventional polymerization methods.

Bartłomiej Wnęk



Project Title: Plasma Chemical Reactor as an Integral Part of the Device to the Waste Disposal by Pyrolytic-Plasma Method

Group: Laboratory of Low Temperature Plasma Processes

Supervisor: Krzysztof Krawczyk

Co-Supervisor: Teresa Opalińska

Project Description: In the framework of the project, one has developed and built a device for utilization by the pyrolytic-plasma method. The waste must contain organic compounds. In the first step, the waste is pyrolysed in the atmosphere of argon. Then, the pyrolysis gases in the stream of argon are introduced into the plasma reactor and oxidized with oxygen. The research is done in ITR.

Perspective: The objective of the project is to develop innovative technologies for the disposal of hazardous waste. As a consequence, the amount of waste at landfills will be decreased and the recovery of materials will be improved.

Justyna Wojcieszek



Project Title: Speciation Analysis Of Selected Metals and Their Bioavailability Investigation from Functional Food to Human Organism

Group: Laboratory of Separation Methods

Supervisor: Maciej Jarosz

Project Description: The project is based on the fractionation of complexes of various elements in diet supplements and functional food to determine bioavailability of the extracted metal complexes by the human body. The in vitro simulation of gastrointestinal digestion allows for gathering information on the amount of element and its compounds which are absorbed by the human body.

Perspective: Novel analytical procedures of the extraction of elements complexes from functional food will be developed to obtain the knowledge about metal compounds with bioligands existing in diet supplements. The bioavailability of elements in natural and synthetic diet supplements will be compared.



Project Title: Synthesis, Functionalization and Characterization of ZnO Nanoparticles Derived from Organometallic Precursors Supported by Various Organic Ligands

Group: Laboratory of Organometallic and Materials Chemistry – Lewiński Group

Supervisor: Janusz Lewiński

Project Description: In my research, I am focused on the preparation of well-defined ZnO NPs coated by organic ligands, using a bottom-up approach from the organometallic self-supporting precursor. This method consists of the synthesis of an appropriate RZnL-type precursor, its transformation into nanoparticulate forms of ZnO and the full characterization of the obtained ZnO NPs.

Perspective: When adopted properly, ZnO NPs can be an innovative implement for bioapplications. The crucial advantage of nano-ZnO is its biocompatibility and non-toxicity towards biological tissues. My plans concern the synthesis and design of a ZnO NPs bioconjugate with selected biomolecules and its integration in a bioanalytical systems.



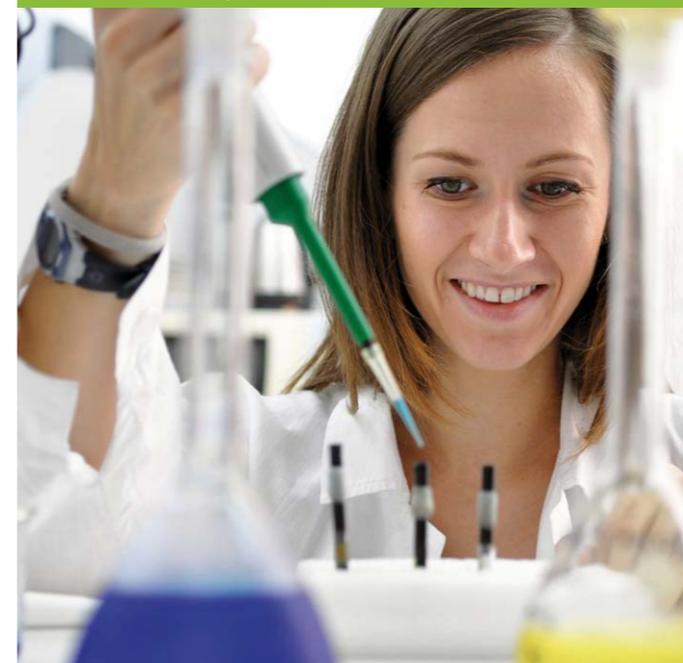
Project Title: Hydrogel Polymer Electrolyte Membrane for a Biofuel Cell

Group: Laboratory of Application of Methods, Models and Materials in Electrochemistry

Supervisor: Władysław Wieczorek

Project Description: A new type of hydrogel electrolyte was obtained by the free-radical polymerization process. The aim of the work is to obtain a biocompatible conductive polymer membrane. A bio-cell with this electrolyte showed increased stability, durability and higher conductivity. The samples were characterized by spectroscopic, thermal and electrochemical methods.

Perspective: The biofuel cell is a special type of electrochemical fuel cell in which, instead of noble-metal (e.g. Pt) type catalytic electrodes, biocatalysts in a form of microorganisms or enzymes are used. However, because of obtaining a low current density, the device can be used as a selective biosensor or the device for studying the mechanism of the enzymatic reaction.



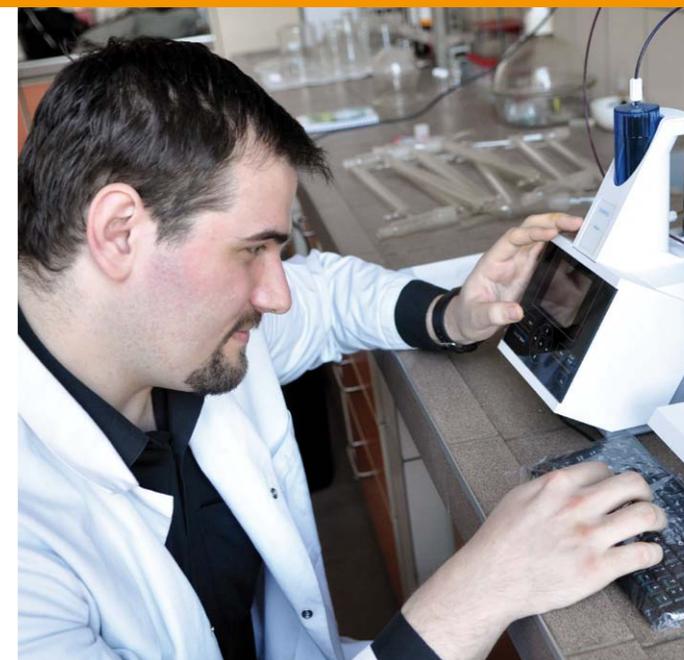
Project Title: Polymeric Biomaterials for Optical and Electrochemical Sensing Platforms

Group: Laboratory of Biosensors

Supervisor: Elżbieta Malinowska

Project Description: Polymeric materials have a long history in the context of sensors construction. They can be used to assemble both electrochemical and optical based sensors and biosensors. In fact, such devices are successfully used, especially in the field of biological and clinical analysis; however, there is still a demand for new (bio)sensors.

Perspective: The application of various polymeric materials (e.g. polyacrylates, modified poly(vinyl chloride)) in (bio)sensors construction is the main aim of this project. Developed electrochemical or optical (bio)sensors are applied for a detection of important (bio)analytes, with the major focus on the enzyme activity determination.



Project Title: Studies on the Compatibility of Solid Rocket Fuel Components Derived by Using α,ω -Dihydroxypolybutadiene (HTPB)

Group: Laboratory of High Energy Materials

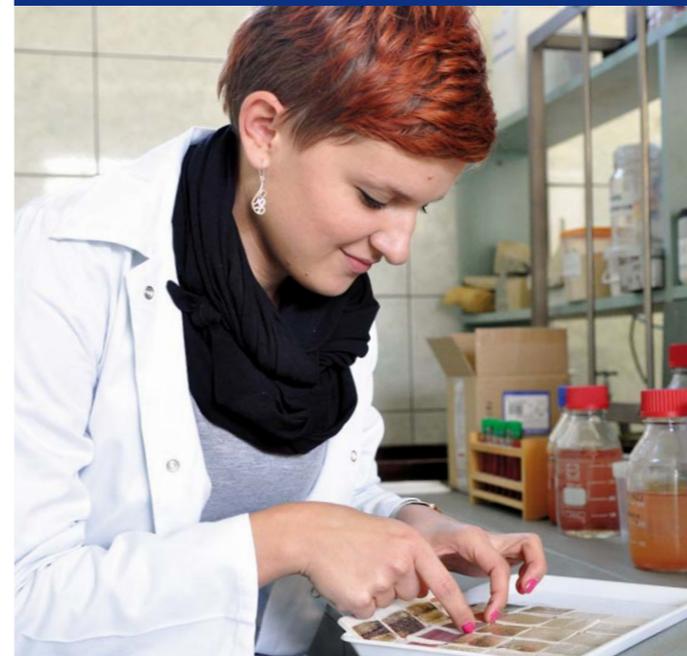
Supervisor: Wincenty Skupiński

Project Description: The goal of the project is to study interactions between different solid rocket fuel components, ranging from high explosive materials, oxidizers, plasticizers with HTPB. The main focus is to find a mixture that is both thermodynamically and chemically stable and can be used as a propellant in rockets. The studies feature the use of IR and DSC.

Perspective: This study can lead to the development of a solid rocket fuel that is cheaper and both more durable and efficient than the currently used ones.



Milena Zalewska



Project Title: Surface Modification of Polypropylene Nonwoven
Group: Advanced Ceramics Group
Supervisor: Mikotaj Szafran

Project Description: The small size of viruses causes huge problems with their removal from water. A good solution are filters which retain viruses on the basis of electrostatic adsorption. Viruses have a negative surface charge, thus the surface of the filter should have a positive charge. Therefore, the surfaces of materials are modified.

Perspective: The application of polymers nonwoven and ceramic powders for removing viruses from water is also beneficial because of great properties of polymers and ceramic powders. The main problem is the modification of polymers fibers with ceramic particles and with the homogeneous distribution of the particles on the surface of fibers.

Krzysztof Zawada

Project Title: Tartaric Acid Derivatives as Additives to Polymerization
Group: Laboratory of Technological Processes
Supervisor: Ludwik Synoradzki

Project Description: Tartaric acid is a commonly occurring chemical compound. Its optical activity and the presence of several functional groups in its molecule make it an attractive substrate for synthesis. Our attention was focused on monoalkyl tartaric acid derivatives. The main goal of the investigations was to obtain the O-benzyl-L-tartaric acid anhydride.

Perspective: Both the anhydride and mono-derivatives received, after they have been opened by using suitable reagents (e.g. ethanol or amine), can serve as completely new desymmetrization building blocks in organic synthesis. Owing to the natural origin of tartaric acid, based on such blocks, one is planning to obtain a biodegradable polymer.



Project Title: Preparation, Properties and Activity of the Promoted Cobalt Catalysts for Ammonia Synthesis
Group: Laboratory of Heterogeneous Catalysis
Supervisor: Krzysztof Krawczyk

Project Description: The aim of the research is a development of new, active catalysts for the ammonia synthesis in which the active phase is cobalt with the addition of selected promoters. The essential aspects are the determination of the influence of promoters on the properties and the activity of the catalysts and explanation of the mechanism of promoters operation.

Perspective: These studies correspond well with the current research on the optimization of the process of ammonia synthesis. Obtaining the catalyst, which is active under lower pressure and temperature, creates a possibility of improving the efficiency of the process, mainly lowering the energy consumption level (application potential).



Project Title: Rocket Propellant Based on Nitrocellulose
Group: Laboratory of High Energy Materials
Supervisor: Andrzej Książczak

Project Description: The aim of project is to develop a safe method of homogeneous rocket propellant preparation. The basic component of casting propellant is granules with a desired shape, size and density. In order to obtain a desired fraction of granules, it is necessary to specify the physico-chemical parameters.

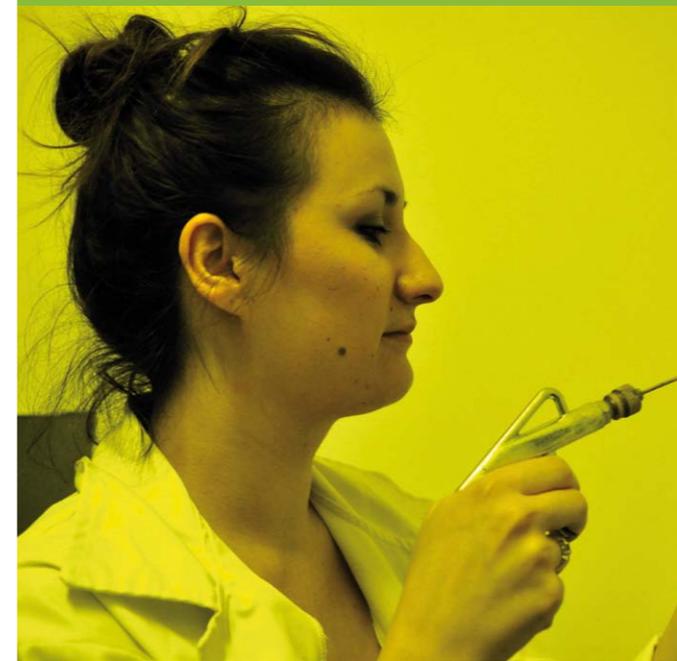
Perspective: This project is to develop a composite rocket propellant. A modifier will be added to basic components (nitrocellulose and nitroglycerin), which will allow to increase a specific impulse of propellant.



Project Title: Spatial Culture's Research
Group: Laboratory of Miniaturized Chemical Systems
Supervisor: Zbigniew Brzózka

Project Description: The main objective of the project is to develop a microsystem for direct monitoring of the behavior of spheroids composed of healthy and cancerous cells. The study is based on three main stages: designing and forming the system's geometry, growing a spatial culture of spheroids, investigating interactions between spheroids and various chemical compounds and selecting an analytical method to determine their viability/morphology.

Perspective: The microsystem developed in this project will be used to examine toxicity/cytotoxicity of therapeutic compounds, to determine the mechanism of tumor formation as well as to study the interactions of tumors with normal tissues.



Project Title: Synthesis and Study on Organo-Inorganic Hybrid Polymers
Group: Polymer Synthesis, Characterization and Processing Research Group
Supervisor: Zbigniew Florjańczyk

Project Description: In my work, I focus on the synthesis and application of zinc organophosphates which have a linear – polymeric structure. These compounds behave much like organic polymers and they also easily mix with them. Also, one can easily tune the properties of these compounds by simple modifications of side groups, which is another advantage.

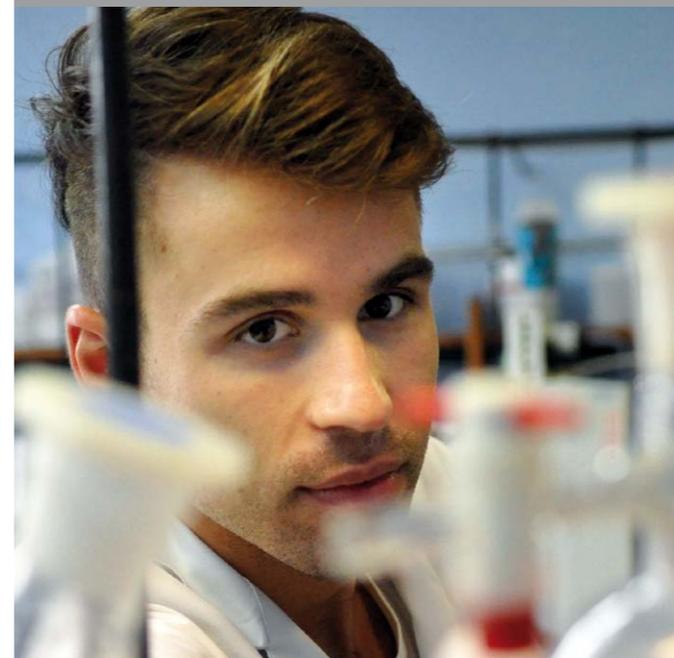
Perspective: The compounds synthesized in my work can be used as additives in plastics – new functional materials as catalysts and catalyst supports.



Other PhD Projects at the Faculty of Chemistry



Rafał Matczak



Project Title: π -Expanded 1,4-Dihydropyrrolo[3,2-b]pyrroles – Synthesis and Optical Properties
Supervisor: Daniel Gryko

Project Description: Heteropentalenes are a class of 10π -electron aromatic compounds and 1,4-dihydropyrrolo[3,2-b]pyrrole is the least studied member of this family. The superb optical properties, including intrinsically high fluorescence quantum yields, make these compounds the core unit of choice for the application in various areas of photonics.

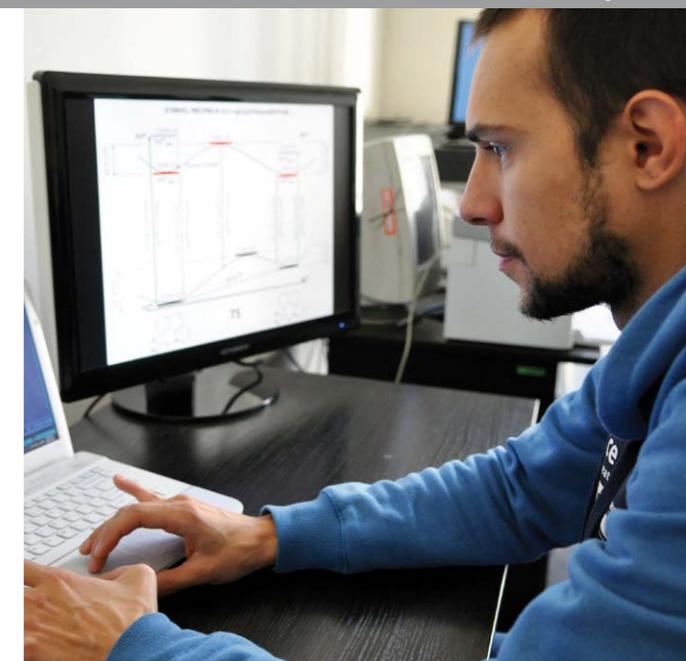
Perspective: The synthesis of novel chromophores bearing 1,4-dihydropyrrolo[3,2-b]pyrrole as a core possessing the quadrupolar structure (A-D-A, D-A-D) which can exhibit high 2PA cross-sections. Optical properties of new molecules will be measured.

Anton Stasyuk

Project Title: Effect of Intermolecular Interactions on the π -Electron Structure and Tautomerism of Nucleobases
Supervisor: Daniel T. Gryko
Co-Supervisor: Michał K. Cyrański

Project Description: This project focuses on the study of excited state intramolecular proton transfer in the most promising chromophore cores. This investigation includes not only the synthesis of such compounds but also the computational simulation (DFT) and advanced photo-physical study.

Perspective: These results are not only of theoretical significance but they may also open the door to practical applications. Moreover, newly received compounds can serve as an ideal platform to obtaining more complex systems.



Index of PhD students

| | | | | | |
|---------------------------|-----|------------------------|-----|----------------------------|-----|
| Anna Antosiewicz | 89 | Monika Karpińska | 109 | Katarzyna Skierka | 129 |
| Agnieszka Antosik | 89 | Anna Kasztankiewicz | 109 | Łukasz Skórka | 129 |
| Agnieszka Bala | 90 | Aleksandra Kezwoń | 110 | Agnieszka Sobiecka | 131 |
| Łukasz Banach | 90 | Aleksandra Kędzierska | 110 | Anna Sobiepanek | 131 |
| Dariusz Basiak | 91 | Szymon Komorski | 111 | Olga Stasyuk | 132 |
| Aneta Bernakiewicz | 91 | Kamila Konopińska | 111 | Izabela Steinborn-Rogulska | 132 |
| Anna Bitner-Michalska | 92 | Danuta Kończak | 112 | Adam Świerkosz | 133 |
| Krzysztof M. Borys | 92 | Jędrzej Konrad Korczak | 112 | Katarzyna Tokarska | 133 |
| Katarzyna Brama | 93 | Kamil Kotwica | 113 | Ewelina Tomecka | 134 |
| Krzysztof Budny-Godlewski | 93 | Aleksandra Kruk | 113 | Monika Truskolaska | 134 |
| Konrad Chojnacki | 94 | Anna Kundys | 114 | Tomasz Trzeciak | 135 |
| Karolina Chreptowicz | 94 | Monika Kupiec | 114 | Adam Tulewicz | 135 |
| Agnieszka Czajka | 95 | Paweł Leszczyński | 115 | Iwona Magdalena Ufnalska | 136 |
| Karolina Czerwińska | 95 | Rafał Letmanowski | 115 | Mateusz Urban | 136 |
| Sylwester Czmiel | 96 | Elena Lukoshko | 117 | Piotr M. Urbański | 137 |
| Paweł Ćwik | 96 | Anna Łatoszyńska | 117 | Edyta Wawrzyńska | 137 |
| Sameer Deshmukh | 97 | Paweł Łęzak | 118 | Małgorzata Wesoty | 138 |
| Marcin Drozd | 97 | Karolina Maciejewska | 118 | Piotr Wieczorek | 138 |
| Mohammad Fadaghi | 98 | Maciej Malinowski | 119 | Magdalena Wiloch | 139 |
| Anita Frydrych | 98 | Magdalena Matczuk | 119 | Katarzyna Witkoś | 139 |
| Emil Furmanek | 99 | Alicja Matuszewska | 120 | Michał Wlazło | 140 |
| Katarzyna Gańczyk | 99 | Magdalena Mazurek | 120 | Agata Włodarska | 140 |
| Grzegorz Gąbka | 100 | Łukasz Mąkowski | 121 | Bartłomiej Wnęk | 141 |
| Jacek Giersz | 100 | Karol Molga | 121 | Justyna Wojcieszek | 141 |
| Małgorzata Gtuszek | 101 | Patrycja Okuniewska | 122 | Małgorzata Wolska | 142 |
| Krzysztof Gontarczyk | 101 | Marcin Okuniewski | 122 | Dariusz Zabost | 142 |
| Agnieszka Górka | 103 | Marta Orczyk | 123 | Joanna Zajda | 143 |
| Piotr Aleksander Guńka | 103 | Roman Pacholski | 123 | Bartosz Janusz Zakościelny | 143 |
| Maja Haczyk | 104 | Emilia Pawlikowska | 124 | Milena Zalewska | 145 |
| Mohammed Halayqa | 104 | Emilia Pietrzak | 124 | Krzysztof Zawada | 145 |
| Wioletta Jakubczak | 105 | Tomasz Pietrzak | 125 | Magdalena Zybert | 146 |
| Piotr Jankowski | 105 | Adriana Przerwa | 125 | Angelika Zygmunt | 146 |
| Marta Jarczewska | 106 | Ewelina Reda | 126 | Agnieszka Żuchowska | 147 |
| Eliza Jaškowska | 106 | Mateusz Reda | 126 | Konrad Żurawski | 147 |
| Joanna Jureczko | 107 | Katarzyna Rucińska | 127 | Rafał Matczak | 149 |
| Jakub Jurkowski | 107 | Renata Rybakiewicz | 127 | Anton Stasyuk | 149 |
| Marcin Kaczorowski | 108 | Piotr Ryś | 128 | | |
| Ewelina Karpierz | 108 | Elżbieta Senkara | 128 | | |

Warsaw University of Technology
Faculty of Chemistry

Noakowskiego Street, 3
00-664 Warsaw, Poland

Phone: +48 22 234 75 07

Fax: +48 22 628 27 41

E-mail: dziekan@ch.pw.edu.pl

Web: www.ch.pw.edu.pl