

ASPIRE
PROCESSES4PLANET RESEARCH ASSOCIATION

 **PROCESSES4PLANET**



Łukasiewicz
Institute of Heavy
Organic Synthesis
BLACHOWNIA





ABOUT US

Łukasiewicz Research Network - Institute of Heavy Organic Synthesis "Błachownia" (PIC: 892054778) is a Polish R&D institute working within the sector of organic chemistry. We are a reliable business partner for domestic and foreign partners in the areas of development and improvement of chemical technologies. We belong to one of the largest research networks in Europe – Łukasiewicz Research Network. Operating in line with the Science is Business model, we network with business owners and offer solutions designed to help them to enhance business operations and build game-changing technologies.

Our competence is proven by numerous publications, patents and commercial implementations. We are experienced in creating valuable proposals, applying for R&D grants and perform research tasks within projects funded by European Commission.

Our researchers are operating within six research groups focusing on the fields of Analytics, Bioeconomy, High Pressure Processes, Catalytic Processes, Specialty Chemistry and Advanced Materials. The Analytics Research Group performs analyses according to Good Laboratory Practice (GLP) standards.

Since 2024, Łukasiewicz-ICSO "Błachownia" has been a Research Member of A.SPIRE. Our activity profile focuses on innovation, research, and development in various sectors related to organic chemistry. We strongly prioritize environmental challenges, reducing carbon emissions, and advancing economic growth through the development of biobased technologies in a sustainable manner. We are actively involved in international partnership projects, knowledge exchange platforms, and supporting the implementation of innovative technologies and practices to create a more sustainable planet. We encourage other A.SPIRE partners to collaborate with us to collectively pursue our shared goals of sustainable development.

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Research Groups

Advanced Materials Research Group

Analytics Research Group

Bioeconomy Research Group

Catalytic Processes Research Group

High Pressure Processes Research Group

Specialty Chemistry Research Group





ADVANCED MATERIALS

RESEARCH GROUP

WHO ARE WE?

The Advanced Materials Research Group specializes in two areas. The first one involves the development of technologies for producing and modifying synthetic resins (epoxy, phenolic) and polyurethanes. The second area of expertise focuses on the modification and processing of materials based on thermoplastic polymers, such as polyolefins or PVC, as well as biobased plastics like PLA or TPS. The Group also conducts research on plastic recycling.

Our team is highly skilled in designing, synthesizing, and characterizing polymeric materials with tailored properties, including mechanical strength, thermal stability, and chemical resistance. Our expertise lies in analyzing complex links between the structure and properties of various polymeric materials and extensive experimental work.

We possess well-equipped laboratories and advanced technological facilities with processing and testing machines. We are currently seeking partners interested in collaborating on innovative materials, particularly composite materials based on bioplastics and bio-based materials in the context of Circular Economy. We are also open to other proposals that align with our knowledge and experience.

WHAT WE SPECIALIZE IN?


- synthesis of phenolic resins using petrochemical and renewable raw materials (such as lignin) for various applications like gelcoats reinforced with natural fibers, fiberboards, water-resistant plywood, wood wool boards, and foams;
- technologies for producing bio- and fossil-based basic epoxy resins and glycidyl ethers, and their chemical modification for different applications, like biobased composites and prepregs, coatings, and glues. We are a partner in the HE ESTELLA Project, which is developing epoxy composites with inherent recyclability (<https://estellaproject.eu/>);
- synthesis of fully-biobased non-isocyanate polyurethanes (NIPU). We were partners in the H2020 BIOMOTIVE Project, which focused on the application of NIPU in the automotive industry (<https://biomotive.info/>);
- development of synthesis and processing of novel biopolyesters (PEF, PPF);
- plasticization of starch and chitosan;
- grafting and cross-linking of polymers;
- development of polyolefin vitrimers – recyclable crosslinked plastics;
- bio-based materials (sodium alginate, starch, cellulose, chitosan, etc.) for coating applications, including PFAS-free, antibacterial and water/oil resistant coatings;
- development of new biopolymer materials (composites, films, foams, packaging materials, etc.), including polysaccharides and polyesters, using fully biodegradable bio-modifiers, bio-fillers and bio-flame retardants;
- development of new types of fiber-reinforced, multi-material, and high-filled composites;
- determination of the mechanical and rheological properties of polymer materials;
- material recycling solutions (mainly recycling of polymeric waste from petroleum-based polymers, but also from biopolymers) with reduced environmental impact in line with the EU's circular economy and zero pollution action plans.

A.SPIRE Expertise Selected Keywords

new circular value chains, eco-design of materials, sustainable & safe by design, circular value chains, waste to resources, recycling, chemical plastics recycling

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The background features a close-up of several glass test tubes or flasks containing a vibrant pink liquid. The focus is sharp on the central tube, with others blurred in the foreground and background. Overlaid on the bottom half of the image is a large, stylized geometric logo. It consists of a white hexagonal shape with rounded corners, set against a black background. This white shape is further defined by a thick, light pink border. The text 'ANALYTICS RESEARCH GROUP' is centered within the white hexagon, with a thin black horizontal line positioned directly below the words 'RESEARCH GROUP'.

ANALYTICS
RESEARCH GROUP

WHO ARE WE?

Analytics Research Group offers comprehensive analytical services in R&D works on chemical production technologies, processing and recycling. We specialize both in the main components and trace level impurities analysis including detection of harmful substances, environmental analysis and ecotoxicological research. We develop and validate new analytical methods, both classical and advanced ones. We perform identification and determination of main products as well as impurities, residues and by-products. We classify substances as polymers and perform analytical studies of polymers and biopolymers (aging studies).

We offer:

- analytical research, customized method development, testing products and formulations, complex research analysis and expertise,
- a multiparameter screening method used for effective detection of SVHC (Substances of Very High Concern) which are subjected to authorization under the REACH regulation and which detection in recyclates is an important element of the Circular Economy and chemical safety of products.

We perform physical-chemical testing, studies on behavior in water, soil and air, bioaccumulation, residue studies (analytical phase) and chemical analysis according to Good Laboratory Practice.

Our highly specialized professionals work with modern analytical equipment HPLC-MS/MS; PDA; ELSD; Corona; RI; GPC; GC-MS/MS; TCD; FID; XRF; DCS; TG-DTA; UV/VIS spectrometers; FTIR; TOC; CNSCI; MALDI. We develop analytical solutions in compliance with e.g. EN ISO, OECD, SANCO, SANTE, IKW guidelines.


WHAT WE SPECIALIZE IN?


- determination of bioactive substances, environmental pollutants, pesticide residues using chromatographic techniques coupled with high sensitivity and selective tandem mass spectrometers;
- providing an extensive support to food, feed and agrochemical industries, enabling them to provide the product safety required by the market;
- testing in accordance with the REACH regulation. Physicochemical and spectral studies to determine the composition of mixtures and confirm the identity of substances with possible impurity profiles, enabling to create safety data sheets;
- biodegradation studies according to OECD guidelines, aerobic biodegradation analysis services (DOC die away, modified OECD screening, Zahn-Wallens) and pre-compostability studies;
- physicochemical studies on detergents and quality assessment of household chemical products.


A.SPIRE Expertise Selected Keywords

eco-design of materials, sustainable & safe by design, circular value chains

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BIOECONOMY
RESEARCH GROUP

WHO ARE WE?

Bioeconomy Research Group promotes Circular Economy through the development of disruptive processing technologies of renewable raw-materials.

Our experienced staff uses state-of-the-art equipment which enables production and analysis of liquid bio-fuels, lubricating oils, low-scale chemicals and ecological products from sustainable resources.

We are willing to participate in proposals and collaborate in projects concerning chemical processing of renewable materials into valuable bio-derived products including lubricants, bio-heating oils, coating materials, bio-fuels, polymer additives etc.

WHAT WE SPECIALIZE IN?


- development of new bio-based additives (plasticizers, compatibilizers, stabilizers, lubricating agents) for polymers/bio-polymers, such as starch, lignin, chitosan, PHA, PVC;
- compounds and building blocks from fats/fat derivatives via reactions of ester groups and unsaturated bonds, e.g. bio-based polyols for PU;
- processing of renewable raw-materials into products and half-products of industrial chemistry,
- production technologies of bio-fuels from bio-based raw-materials of various origin;
- management of by-products from bio-fuel production and products of oleochemical industry;
- use of fats derived from less-common oilseed plants for the production of coating materials;
- development and optimisation of purification methods for fatty raw materials adapted to their field of application;
- valorization of lignin towards useful bio-components for polymers, bio-sorbents, fertilizers, hydrogels and bitumen;
- production and application of new generation heterogeneous catalysts (ionic liquids, organic-inorganic catalysts) for processing of vegetable oils and carbohydrates to various products;
- other technologies based on sustainable materials, e.g. modification of natural fibers;
- consultancy and expertise.

A.SPIRE Expertise Selected Keywords

eco-design of materials, sustainable & safe by design, circular value chains, waste to resources, waste to energy, recycling, chemical plastics recycling

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The background features a high-speed photograph of a water splash, creating a crown-like shape with numerous droplets and ripples. The entire image is tinted with a teal color. In the lower half, there is a large, dark teal geometric shape that resembles a stylized house or a shield. Inside this shape is a white, rounded hexagonal area containing the text.

CATALYTIC PROCESSES

RESEARCH GROUP

WHO ARE WE?

Catalytic Processes Research Group has extent experience in light and heavy organic synthesis. Our efforts are scoped on scientific research and results implementation in the field of production technologies including testing of catalytic systems or separation processes. Through decades of cooperation with industry we have acquired know-how of bisphenols, alkylphenols, plasticizers, surfactants, fuel additives, recycling processes and purification operations. Our specialists are able to perform high quality tests throughout industrial problems providing the best solutions in concept of Circular Economy.

We are eager to join interdisciplinary partners and project coordinators to provide wide R&D support concerning current and future chemical challenges.


WHAT WE SPECIALIZE IN?


- development of chemical recycling of polymer materials;
- development of processes based on ion-exchange resin as catalysts and adsorbents (e.g. catalytic syntheses, wastewater treatment);
- research on surfactants, emulsifiers and other functional additives for cosmetics and household products;
- fire retardants in wide range of applications;
- complex technologies of polycarbonate purity bisphenols (A, TMC and F) in range of research and industrial application;
- production processes of plasticizers, alkylphenols, polyalcohols, glycols and amino acids;
- bio-based acetals as fuel additives;
- research on more sustainable modified resol resins;
- liquid mixtures separation processes;
- other organic syntheses and catalytic processes;
- post-productional waste-water treatments - removing organic pollution

A.SPIRE Expertise Selected Keywords

flexible, robust processes, reactor design, separation technology, catalyst use and development, recycling, chemical plastics recycling, water technologies, water-waste nexus

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HIGH PRESSURE
PROCESSES
RESEARCH GROUP

WHO ARE WE?

We offer a wide range of hydrogenation processes as well as various types of hydrogenation reactors. We possess know-how and infrastructure to carry out high-pressure synthesis using other gasses as CO, CO₂, NH₄, CH₄, propylene oxide, ethylene oxide and other gasses after consultation. We are looking for potential projects coordinators and partners for successful proposals. The main area of focus is circular environment and use of hydrogen and bio-based feedstocks for synthesis of bio-fuels and specialty chemicals, including polymers, coatings for agriculture, plasticizers and cosmetics additives. We also specialize in simulation of various processes in laboratory scale continuous fixed bed reactor units, working up to 300 bar, ranging from screening test scale up to quarter-technical hydrogenation unit able to produce demonstrative batches. Another area of interest is the synthesis of catalysts for various processes. We are equipped with lab scale twin-screw extruder as well as physics- and chemisorption apparatus for evaluation of catalysts properties.

We are open to collaborate in projects concerning chemical processing of renewable materials into valuable bio-derived products e.g. biofuels, bioplasticizers.


WHAT WE SPECIALIZE IN?


- hydrogenation processes especially in the field of bio-based fuels for aviation and diesel engines;
- oxyalkylation processes using propylene oxide and/or ethylene oxide, including synthesis of specialty chemicals from natural and waste products;
- Circular Economy related chemical syntheses, including specialty chemicals using bio-based feedstock;
- chemical syntheses with the use of a wide range of process gases, in stainless steel fixed bed continuous or batch reactors;
- testing the activity and lifetime of catalysts operating in a catalytic bed or in a suspension;
- catalysts for the alkoxylation processes of alcohols, esters and amines;
- simulation of high-pressure processes (including hydrogen) in laboratory and quarter-technical scale;
- purification of hydrocarbon fractions, including petro- and carbochemical, origin feedstocks;
- synthesis and evaluation of catalysts for hydrogenation and oxyalkylation processes;
- synthesis and evaluation of non-ionic surfactants for cosmetics, food and pharma industries;
- synthesis of ionic liquids;
- biobased coatings for slow release fertilizers
- catalyst and adsorbents characterization using chemi- and physisorption.

A.SPIRE Expertise Selected Keywords

hydrogen use in processes, hydrogen storage, renewable energy, energy vectors (including hydrogen, ammonia, ect.), process intensification, reactor design, catalyst use and development, CCU for fuels/chemicals, chemical plastic recycling, skills, social demand for technology, social acceptability of technologies, social value of materials, technologies

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The background features a close-up of a person's face, partially obscured by vibrant green ink splatters and swirls. A large, dark teal geometric shape, resembling a stylized house or a shield, is overlaid on the lower half of the image. Inside this shape is a white hexagonal area containing the text.

SPECIALTY CHEMISTRY
RESEARCH GROUP

WHO ARE WE?

The Specialty Chemistry Research Group has expertise in the field of organic synthesis and colloidal chemistry. Team members develop liquid auxiliaries for industrial branches such as: machining industry, automotive, aviation, packaging technologies or manufacturing sector. Researchers use different types of homogenization (i.e. pressure homogenization, batch homogenization etc.) for composition of multiphase systems containing surface active agents to obtain products ready to implement, of the specific properties and high stability.

Our activity profile involves biodegradable barrier dispersion coatings for paper packaging, microemulsions with anticorrosion properties, lubricants composed with nanomaterials, auxiliaries for wood industry, formaldehyde-free resins, new full-fledged products based on raw materials derived from recycled plastics etc. Together with industrial and research partners, Specialty Chemistry Research Group develops and implements innovative products and solutions, which are in line with the principles of sustainable development and the Circular Economy approach. Furthermore, the Research Group performs research for scale-up, i.e. the screening of thermochemistry and safety studies for chemical processes with the use of the RC1E calorimeter and uses light scattering methods for the particle size measurements and stability assessment of colloids.

We are looking for partners who are open to collaborate in projects in the field of chemical technology and specialty chemicals for various industries. We are open to join interdisciplinary consortia in the role of research partner.


WHAT WE SPECIALIZE IN?


- manufacturing technologies of paraffin, polyethylene and natural waxes based water emulsions;
- synthesis of formaldehyde-free resins;
- synthesis of cross-linking agents for amine and epoxy resins;
- synthesis of elastomer additives, including antidegradants and adhesion promoters;
- development of emulsifying oils used as fire-resistant hydraulic fluids and metalworking fluids;
- selection of additives and corrosion inhibitors for technological liquids;
- evaluation of the properties of technological fluids;
- synthesis and research on anti-corrosive and anti-sediment agents for water-steam circulations of cooling and heating water;
- synthesis of adhesive and anti-lumping agents;
- manufacturing technologies of thickening and softening agents;
- manufacturing technologies of anti-freezing and surface hydrophobization liquids- research on other specialty chemicals;
- consultancy and expertise.

A.SPIRE Expertise Selected Keywords

H4Circularity, circular use of resources models, waste to resources, new circular value chains, eco-design of materials, sustainable & safe by design, circular value chains, recycling, chemical plastics recycling

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