Cluster 4

Digital Industry and Space

The overarching vision behind the proposed investments under Cluster 4 is that of Europe shaping competitive and trusted technologies for a European industry with global leadership in key areas, enabling production and consumption to respect the boundaries of our planet, and maximising the benefits for all parts of society in the variety of social, economic and territorial contexts in Europe.

This will build a competitive, digital, low-carbon and circular industry, ensure sustainable supply of raw materials, develop advanced materials and provide the basis for advances and innovation in global challen-ges to society.

AREAS OF INTERVENTION

- manufacturing technologies
- key digital technologies including quantum technologies
- emerging enabling technologies
- advanced materials
- artificial intelligence and robotics
- next generation internet
- advanced computing and Big Data
- circular industries
- low carbon and clean industries
- space including earth observation

Source: Cluster 4

PhD
Adam Zapała
DIGITAL INFRASTRUCTURE FOR HUMANITIES

INSTITUTE OF HISTORY, PAS
DIVISION I - HUMANITIES AND SOCIAL SCIENCES
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EXPERTISE

The expertise of the interdepartmental DARIAH.Lab team at the Institute of History lies in preparing digital tools for the humanities & arts. Our work focuses on providing reliable reference databases for people & places in the past, preparing scholarly digital editions.

SEEKING FOR COLLABORATION WITHIN

editors/holders of historical materials, authority files creators, creators of digital repositories

RELEVANT PROJECTS

DARIAH

PhD, DSc
Artur Różański
PHYSICAL PROPERTIES OF CRYSTALLIZING POLYMERS GROUP

CENTRE OF MOLECULAR AND MACROMOLECULAR STUDIES, PAS
DIVISION III - MATHS, PHYSICS, CHEMISTRY, EARTH SCIENCES
ARTUR.ROZANSKI@CBMM.LODZ.PL
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EXPERTISE

My research team has extensive experience in designing new materials from semicrystalline polymers and their micro- and nanocomposites. By modifying their nanostructure, we create materials with unique barrier, mechanical, and thermomechanical properties. Additionally, we have significant expertise in analysing the relationship between the nanostructure of both disordered and ordered components of semicrystalline polymers and their physical properties.

SEEKING FOR COLLABORATION WITHIN

nano-structured semicrystalline polymers, nanocomposites, structure-barrier/mechanical properties

RELEVANT PROJECTS

NCN/SONATA2
NCN/SONATABIS8
NCN/OPUS25

PhD, DSc
Iurii Vozniak
GROUP OF LIGHT AND STRONG POLYMER MATERIALS

INSTITUTE OF BIOCHEMISTRY AND BIOPHYSICS, PAS
DIVISION II - BIOLOGICAL AND AGRICULTURAL SCIENCES
IURII.VOZNIAK@CBMM.LODZ.PL
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EXPERTISE

Our team specializes in lightweight polymer research with a special focus on green polymers and their use as matrices for the production of smart or functional nanomaterials. We fabricate and study polymer-polymer nanocomposites, polymer nanoblends, polymer foams. Our specific areas of expertise include: shape memory polymers, polymer-polymer nanocomposites, polymer foams, 3D/4D printing, polymer recycling, mechanical properties of solid polymers, polymer crystallization.

SEEKING FOR COLLABORATION WITHIN

biopolymers, shape memory polymers, foams, lattice material, green nanocomposites, recycling, FDM

RELEVANT PROJECTS

Formation of biocomposites
Development of an innovative technology
Multiple-shape memory polymers formation
Foaming of polymer nanocomposites

Professor
Ewa Schab-Balcerzak
LABORATORY OF ENGINEERING FUNCTIONAL MATERIALS

CENTRE OF POLYMER AND CARBON MATERIALS, PAS

DIVISION III - MATHS, PHYSICS, CHEMISTRY, EARTH SCIENCES

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EXPERTISE

Our team focuses on the synthesis and characterization of novel light-sensitive materials, with a particular emphasis on highly thermally stable azopolyimides. The comprehensive characterization of azomaterials includes the generation of photoinduced birefringence, diffraction and surface relief gratings (SRGs), and the study of photomechanical effects. The potential applications have been evaluated in various areas, including the construction of LC cells, 3D diffraction gratings, and optical Vortex.

SEEKING FOR COLLABORATION WITHIN

application of light-sensitive materials, optoelectronics, new technologies

RELEVANT PROJECTS

NCN/SONATA15

NCN/PRELUDIUM11

Professor
Mieczysław Kłopotek
ARTIFICIAL INTELLIGENCE FUNDAMENTAL RESEARCH LABORATORY

INSTITUTE OF COMPUTER SCIENCE, PAS

DIVISION IV - ENGINEERING SCIENCES

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EXPERTISE

Our laboratory is focused on Artificial Intelligence, including Web, Text and Data Mining, Reasoning and Machine Learning. In particular, we are interested in spectral and related cluster analysis methods, both in the area of clustering and classification. We work on uncertainty representation, including probabilistic, Dempster-Shafer, metasets, and other approaches. We are interested in explainable artificial intelligence as well as the theoretical foundations of clustering methods.

SEEKING FOR COLLABORATION WITHIN

spectral cluster analysis, explainable artificial intelligence, metasets

RELEVANT PROJECTS

NEKST

INSTATCENY

Professor
Szymon Jaroszewicz
STATISTICAL ANALYSIS AND MODELING GROUP

INSTITUTE OF COMPUTER SCIENCE, PAS

DIVISION IV - ENGINEERING SCIENCES

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EXPERTISE

Our group is focused on statistical and machine learning methods, being particularly interested in causal discovery, from experimental and observational data, especially uplift modeling, heterogeneous treatment effect estimation, multi-label classification and positive-and-unlabeled data. We have also significant expertise in analysis of high-dimensional data, especially using information theoretical methods. We are also skilled in practical applications of machine learning and statistical methods.

SEEKING FOR COLLABORATION WITHIN

causal discovery, high dimensional data, positive-and--unlabeled classification, variable selection

RELEVANT PROJECTS

SAI

Uplift modeling in marketing and biomedical research.

Professor

Wojciech Jamroga

THEORY OF DISTRIBUTED AND COMPUTING SYSTEMS GROUP

INSTITUTE OF COMPUTER SCIENCE, PAS

DIVISION IV - ENGINEERING SCIENCES

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EXPERTISE

Wojciech Jamroga works on formal specification and verification of interaction between intelligent agents. He is particularly interested in formalizations of confidentiality, coercion-resistance, and voter-verifiability in e-voting procedures. Prof. Jamroga has coauthored around 150 refereed publications, and has been a PC member of most important conferences in AI and multi-agent systems. His research track includes Best Paper Award at the main conference on electronic voting and Best Demo Award at the main multi-agent systems conference.

SEEKING FOR COLLABORATION WITHIN

formal verification, logical methods in AI, secure electronic voting, models of socio-technical systems

RELEVANT PROJECTS

SpaceVote

SAI

STV

VoteVerif

PhD, DSc

Michał J. Dąbrowski

COMPUTATIONAL BIOLOGY GROUP

INSTITUTE OF COMPUTER SCIENCE, PAS

DIVISION IV - ENGINEERING SCIENCES

M.DABROWSKI@IPIPAN.WAW.PL

EXPERTISE

Dr. Dąbrowski specializes in bioinformatics, focusing on the epigenetics, especially DNA methylation in NGS data. His team discovers non-coding DNA regions contributing to i.e. gene expression regulation, 3-D chromatin structure composition, whose disorders result in pathological states and due to that are further tested in laboratory. They created a tool for Feature Selection in multidimensional data (MCFS-ID), returning ranking of features to be further used in classification as well as CytoMeth for comprehensive DNA methylation analysis.

SEEKING FOR COLLABORATION WITHIN

machine learning, feature selection, epigenetics, glioma tumor, single cell, population genetics

RELEVANT PROJECTS

Unveiling the role of VPS10P domain receptors

Monte Carlo Feature Selection

PhD, DSc

Maciej Ogrodniczuk

DEPARTMENT OF LANGUAGE MODELING

INSTITUTE OF COMPUTER SCIENCE, PAS

DIVISION IV - ENGINEERING SCIENCES

M.OGRODNICZUK@IPIPAN.WAW.PL

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EXPERTISE

Maciej Ogrodniczuk specializes in language modelling, both linguistic and computational, development of language resources and processing natural language at all levels of complexity, from morphology to discourse. His team creates large datasets of language data, implements innovative methods to analyze them, trains large language models (LLMs) and develops AI-based solutions with linguistic components.

SEEKING FOR COLLABORATION WITHIN

natural language processing (NLP), artificial intelligence (AI), linguistics, information technology,

RELEVANT PROJECTS

CLARIN

CURLICAT

DARIAH

HOMADOS

PLLuM

Full Professor

Dariusz Kardaś

CENTRE OF FLOW AND COMBUSTION / RENEWABLE ENERGY DEPARTMENT

INSTITUTE OF FLUID-FLOW MACHINERY, PAS

DIVISION IV - ENGINEERING SCIENCES

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EXPERTISE

Our team specializes in studying combustion and gasification phenomena and designing heat and power cogeneration systems. We conduct theoretical analyses and model flow processes involving phase transformations and chemical reactions, utilizing CFD and DEM calculations. Our work includes thermo-chemical measurements of pyrolysis, combustion, and heat transfer phenomena. We design and analyse burners, synthetic fuel reactors, heat exchangers, and power systems for rocket engines.

SEEKING FOR COLLABORATION WITHIN

particulate matter separation, syngas to liquids catalysis, surface reactions, combustion

RELEVANT PROJECTS

ResMe2E

Associate Professor

Paweł Flaszyński

CENTRE OF FLOW AND COMBUSTION / AERODYNAMICS DEPARTMENT

INSTITUTE OF FLUID-FLOW MACHINERY, PAS

DIVISION IV - ENGINEERING SCIENCES

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EXPERTISE

Our Aerodynamics Department has participated in many EU projects in aviation (turbomachinery and drag reduction), UAV propulsion and wind energy (turbine blades, wake steering and wind farm interactions). The research is focused on flow structure, heat transfer, boundary layer transition and separation, shock wave boundary layer interaction, flow control and noise reduction. Flaszyński has coordinated the EU FP7 TFAST project and H2020-MSCA-ITN TEAMAero.

SEEKING FOR COLLABORATION WITHIN

gas turbine, compressor, wind turbine, wind farm, flow control, heat transfer, aeroacoustics

RELEVANT PROJECTS

H2020-MSCA-ITN TEAMAero

HORIZON-EIC-2023-PATHFINDEROPEN-01 BEALIVE

H2020-MG-2016-2017 SMS

H2020-MSCA-ITN zEPHYR

PhD, DSc, Eng.

Adam Dębski

LABORATORY OF METALLURGICAL PROCESSES

INSTITUTE OF METALLURGY AND MATERIALS SCIENCE, PAS

DIVISION IV - ENGINEERING SCIENCES

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EXPERTISE

Our team's scientific interests focus on the thermodynamic and physicochemical properties of materials for energy and hydrogen storage. We are especially interested in the thermodynamic properties of magnesium alloys and their ability to interact with hydrogen. We conduct calorimetric studies of the formation enthalpy of intermetallic phases and the mixing enthalpy change of liquid, which we use to calculate phase diagrams.

SEEKING FOR COLLABORATION WITHIN

metals and alloys, thermodynamic properties, materials for hydrogen storage in the solid phase

RELEVANT PROJECTS

Achievements

PhD, DSc
Magdalena Bieda-Niemiec
LABORATORY OF SCANNING ELECTRON MICROSCOPY

INSTITUTE OF METALLURGY AND MATERIALS SCIENCE, PAS
DIVISION IV - ENGINEERING SCIENCES
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EXPERTISE

The laboratory specializes in materials characterization using scanning electron microscopy. We focus on qualitative and quantitative analysis of orientation topography of crystalline materials (EBSD), 3D analysis of chemical composition and crystallographic orientation, in-situ investigations using heating stage. Our expertise includes investigation of mechanisms of plastic deformation and recrystallization of materials for biomedical applications such as titanium, magnesium and zinc alloys.

SEEKING FOR COLLABORATION WITHIN

biodegradable metals, severe plastic deformation methods, local microstructure characterization

RELEVANT PROJECTS

Bioabsmat

NCN Preludium Bis

NCBR LIDER

Professor
Natalia Sobczak
LABORATORY OF METALLURGICAL PROCESSES

INSTITUTE OF METALLURGY AND MATERIALS SCIENCE, PAS
DIVISION IV - ENGINEERING SCIENCES
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EXPERTISE

Our work is focused on scientific, methodological and practical aspects of liquid metal engineering in the synthesis and characterization of advanced materials for use in energy storage, medicine and space applications, as well as materials recycling. Particularly important in our studies are the high temperature phenomena that occur during processes joining together dissimilar materials.

SEEKING FOR COLLABORATION WITHIN

high temperature liquid-assisted processes of metallic alloys in contact with refractory materials

RELEVANT PROJECTS

AEROGELS

AMADEUS

Pb-FREE

DIOPOMAL

PhD, DSc
Joanna Wojewoda-Budka
DEPARTMENT OF MULTILAYER MATERIALS

INSTITUTE OF METALLURGY AND MATERIALS SCIENCE, PAS
DIVISION IV - ENGINEERING SCIENCES
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EXPERTISE

Our team has long-standing experience in the development, testing, and characterization of coatings, including electrodeposited and electroless copper- and nickel-based coatings. Our research also focuses on diffusion phenomena in electronic interconnections, joining technologies such as diffusion soldering and explosive welding, as well as high-temperature wetting tests.

SEEKING FOR COLLABORATION WITHIN

coatings, soldering, materials microstructure characterization

RELEVANT PROJECTS

Pb-free

AntiPathCoat

PhD, DSc
Krzysztof Grochla
INTERNET OF THINGS GROUP

INSTITUTE OF THEORETICAL AND APPLIED INFORMATICS, PAS
DIVISION IV - ENGINEERING SCIENCES
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EXPERTISE

Internet of Things (IoT) research, with emphasis on wireless communication and network protocols. We design and analyze the performance of network protocols, address issues related to interoperability, and the semantic description of data and operation of IoT systems. We investigate auto-configuration, energy consumption minimization, and localization in embedded devices, especially in LP WAN and indoor localization using UWB and BLE AoA.

SEEKING FOR COLLABORATION WITHIN

practical application of IoT, long-range low-power wireless communication and indoor positioning

RELEVANT PROJECTS

Infrastructure Recovery
DOSS
Methodology

PhD, DSc
Joanna Domańska
SECURITY, MODELLING AND PERFORMANCE EVALUATION GROUP

INSTITUTE OF THEORETICAL AND APPLIED INFORMATICS, PAS
DIVISION IV - ENGINEERING SCIENCES
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EXPERTISE

My team is working on issues related to: anomaly detection and energy performance in Internet of Things (IoT) networks; semantic spatial orientation as a foundation for autonomous navigation systems that understand natural language context; software vulnerability prediction, particularly focusing on static code analysis using artificial intelligence algorithms; explainability of deep neural networks.

SEEKING FOR COLLABORATION WITHIN

attack detection, autonomous driving, vulnerability prediction, energy performance, explainable AI

RELEVANT PROJECTS

SerIoT
SDK4ED
IoTAC
DOSS

PhD, DSc
Przemysław Głomb
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EXPERTISE

Machine Learning, Computer Vision, hyperspectral imaging, water delivery networks, water leak detection, satellite imaging, drone imaging, industrial process monitoring, Large Language Models, Deep Reinfocement Learning

SEEKING FOR COLLABORATION WITHIN

intelligent systems for earth observation, industrial process monitoring, water delivery networks

RELEVANT PROJECTS

WaterPrime

Professor
Zbigniew Puchała
QUANTUM SYSTEMS OF INFORMATICS GROUP

INSTITUTE OF THEORETICAL AND APPLIED INFORMATICS, PAS

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EXPERTISE

The Group is focusing on developing quantum algorithms, error correction methods, and practical applications of quantum devices. It actively participates in various R&D projects, including the Team Net project, addressing challenges in quantum technologies. Additionally, the Group has developed software for simulating quantum annealers on classical computers, facilitating research into modern quantum architectures and optimization, along with tools for visualizing and analyzing the results.

SEEKING FOR COLLABORATION WITHIN

quantum computing, quantum error correction, machine learning, and optimization

RELEVANT PROJECTS

Near-term Quantum Computers Challenges

Professor
Arkadiusz Derkowski
CLAY MINERALS RESEARCH GROUP

INSTITUTE OF GEOLOGICAL SCIENCES, PAS

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EXPERTISE

The ClayLab is one of few in the world and the only one in Poland laboratory fully equipped with all tools used to study clay minerals and other layered aluminosilicates. Experimental and analytical facilities are employed in pursuing questions in paleogeography, thermal transformations of clay minerals, and clean energy transition, including nuclear waste disposal, CO2 sequestration, natural H2 exploration. The team develops its own methodology to analyze qualitative and quantitative composition of sedimentary rocks and soils, and the properties of clay materials.

SEEKING FOR COLLABORATION WITHIN

nuclear waste disposal, CO2 sequestration, natural H2 exploration, clay minerals, analysis of sedimentary rocks

RELEVANT PROJECTS

NCN no. 2019/35/D/ST10/02814
NCN no. 2025/57/B/ST10/01022
NCN no. 2020/37/B/ST10/01697
NCN no. 2021/41/B/ST10/01951

Professor
Michał Basista
DIVISION OF ADVANCED COMPOSITE MATERIALS, DEPARTMENT OF MECHANICS OF MATERIALS

INSTITUTE OF FUNDAMENTAL TECHNOLOGICAL RESEARCH, PAS

DIVISION IV - ENGINEERING SCIENCES
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EXPERTISE

The team is focused on processing of advanced metal, ceramic and polymer materials, as well as their characterization and modeling for applications in transport, energy and biomedicine. We fabricate materials using powder metallurgy, chemical synthesis and electrophoretic deposition. We analyze material microstructure via electron microscopy and X-ray tomography and measure mechanical properties using in-situ tests. We develop micro-CT based numerical models of deformation, fracture, thermal properties and residual stresses.

SEEKING FOR COLLABORATION WITHIN

metal-ceramic composites, intermetallics, high entropy alloys, activated carbon materials, nanowires

RELEVANT PROJECTS

KMM-NoE
MATRANS
INNVIN
KomCerMet