



Strategic and targeted support  
to incentivise talented newcomers  
to NMP projects under Horizon Europe

## **HIGH-PERFORMANCE and SUSTAINABLE COMPOSITES INNOVATION WORKSHOP TU DRESDEN 13-14.10.2022**

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 958255

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ŁUKASIEWICZ RESEARCH NETWORK -  
INSTITUTE FOR SUSTAINABLE TECHNOLOGIES

SURFACE ENGINEERING CENTRE

TRIBOLOGY CENTRE

PROTOTYPING  
CENTRE

BIOECONOMY AND ECOINNOVATION  
CENTRE

CENTRE FOR VOCATIONAL EDUCATION RESEARCH  
AND INNOVATION MANAGEMENT



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Designing dedicated PVD coating materials solutions and technologies for their development for specific areas of application



**End-to-end process:**  
design – development – commercial services

**New technologies:**

- Surface treatment technologies
- Design of functional materials in the form of coatings and layers
- Innovative PVD coating materials solutions

**Technological services:**

- Deposition of PVD coatings on technological objects to extend their service life
- Thermochemical processing

**Research services:**

- Coating and layer materials tests and analyses



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Analysis of friction, wear  
and lubrication of machine parts  
and tool components, with particular focus on research  
methods and devices.



#### New research methods

- Methods for improving tribological characteristics of machine parts, particularly those operating in extreme conditions

#### New systems

- Systems for assessment of tribological properties of structural materials and greases

#### Research services:

- Analysis of friction and wear processes
- Surface analysis: surface imaging, elemental, phase, stereometric, physical and mechanical analyses

#### Product offer:

- Development or research and test instruments for tribological analyses



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New devices increasing durability of technological objects and  
expanding their service life

Prototype structures and  
architectures

Optomechatronic systems

Control systems

Prototype manufacturing



#### Prototypes:

- Research and test instruments
- Production lines
- Quality control systems
- Unique technical devices
- Diagnostic systems

#### Technological services:

- Precision machining
- Precise geometry measurement

#### Research services:

- Analysis of resistance to environmental factors
- Analysis of electromagnetic compatibility



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New methods and research instruments aimed to increase  
durability through new materials  
and industrial waste bioconversion



#### New materials

- Environmentally friendly energy carriers
- Polymer composites

#### New systems and technologies:

- Systems aimed to reduce the environmental impact of technological processes
- Waste-to-energy systems
- Membrane technologies for wastewater purification and water circuit closure
- Surface functionalisation of membrane and filtration materials

#### Research services:

- Analysis of physical and chemical properties of operating fluids



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- ✓ Research in the area of work pedagogy
- ✓ Development of job competence profiles
- ✓ Research, development, implementation and dissemination activities for vocational education, andragogy, as well as educational and career counselling
- ✓ Analysing trends, technical and technological opportunities arising from the latest scientific discoveries;



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# HORIZON-CL4-2024-RESILIENCE-01-24: DEVELOPMENT OF SAFE AND SUSTAINABLE BY DESIGN ALTERNATIVES (IA)

**PROJECT TITLE:** The new type of polymer filters modified by hybrid technology of surface engineering.

**KEY WORDS:** polymer filters, functional coating, antipathogen coatings, surface technologies, PVD, molecular plasma technology, water filtration process, biofouling, functionalization.

**PROJECT AIM:** The main objective of this project is to develop a model technology for the production of multifunctional layers dedicated to improving the filtration properties of polymer filters, especially in eliminating or reducing the problem of biofouling and organic fouling.

The finding solution in this area is dictated by the use of plastic materials for filter production, which despite very favorable general chemical properties are also characterized by a number of disadvantages, including susceptibility to organic fouling and biofouling. The global filtration industry is currently moving toward the use of filtration modules not only as a physical barrier but also as showing certain additional functional properties (bactericidal, catalytic ). Reducing the susceptibility of filter tools to organic fouling (including biofouling) is also in line with the global trend for efficient, economical and stable over time, and environmentally friendly solutions.

The analysis of the state-of-the-art in the area of surface engineering methods was carried out, which indicated that the most effective in limiting the intensity of the biofouling process of polymer filters is shaping the properties of the surface layer. A special role in this area is hybrid technologies, which are currently the dominant research and development direction in surface engineering. The hybrid technologies allow for a combination of several different surface treatment methods into a multi-stage technological process. The suitable selection of the individual stages of the hybrid technological process ensures not only the required chemical composition and microstructure of the coating but also ensures its synergistic interaction with the polymer substrate. As a result, it is possible to shape the properties of the surface layer of elements, which cannot be obtained by using standard surface treatment methods.

The result of the project will be the package of material and technological solutions in the area of surface engineering which will ensure the effective improvement of the filtration properties of polymer filters. These solutions play a great financial role (reduce costs by improving filter life)for enterprises using filtration processes.



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# HORIZON-CL4-2024-RESILIENCE-01-24: DEVELOPMENT OF SAFE AND SUSTAINABLE BY DESIGN ALTERNATIVES (IA)

Project LIDER VII (2017 – 2020)

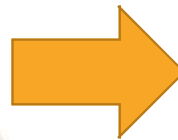
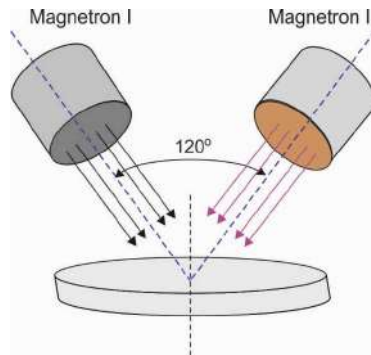
Multifunctional polymer membranes modified using hybrid technology of surface engineering

Project COMPOFILTR (2021 – 2023)

Long-life composite filter media for water cleaning and high efficiency separation of gas-liquid and liquid-liquid dispersions



Magnetron Sputtering



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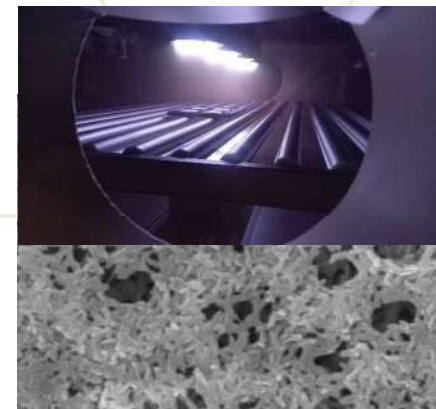
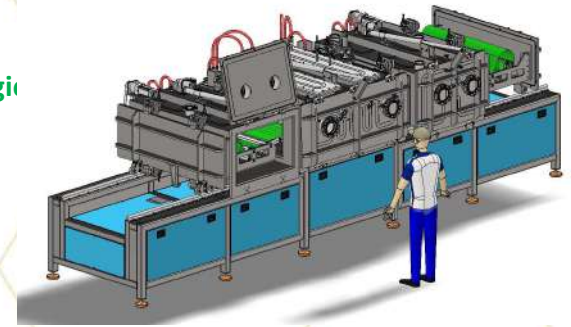
# HORIZON-CL4-2024-RESILIENCE-01-24: DEVELOPMENT OF SAFE AND SUSTAINABLE BY DESIGN ALTERNATIVES (IA)

## Project FLEXline (2020 – 2022)

Design and construction of a prototype device for the implementation of plasma surface treatment technology in the system roll-to-roll

### Possibilities:

- Modification of surface properties of polymeric materials in the form of webs (membranes, fibrous materials);
- Deposition of coatings or nanoparticles on the surfaces of web materials (membranes, fibrous materials, textiles, films, etc.)



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# HORIZON-CL4-2024-RESILIENCE-01-24 RELEVANT EQUIPMENT AND FACILITIES

## SURFACE ENGINEERING CENTRE

Development and implementation of modern technologies in the field of surface engineering, including requirements of industry. The activities of the Center focus on designing both PVD coating material solutions and technology of their production, strictly dedicated for specific application areas. The implementation of works in cooperation with the industry is carried out in a system of complex solutions: design - development – commercial application.



Plasma arc source



Positioning system



Magnetron source

Technological device „PLATIT”



Device with magnetron source



Technological device „XXL”



„Flexline” device



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# HORIZON-CL4-2023-TWIN-TRANSITION-01-31: ENERGY EFFICIENCY BREAKTHROUGHS IN THE PROCESS INDUSTRIES (PROCESSES4PLANET PARTNERSHIP) (RIA)

**PROJECT TITLE:** A prototype system for continuous recovery of waste heat from the industrial installations

**KEY WORDS:** waste heat, industrial installations, energy efficiency, waste heat recovery system, heat exchanger, thermoelectric generators

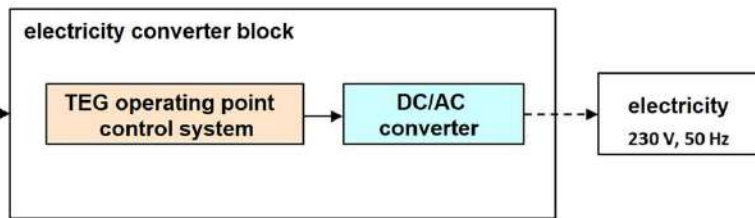
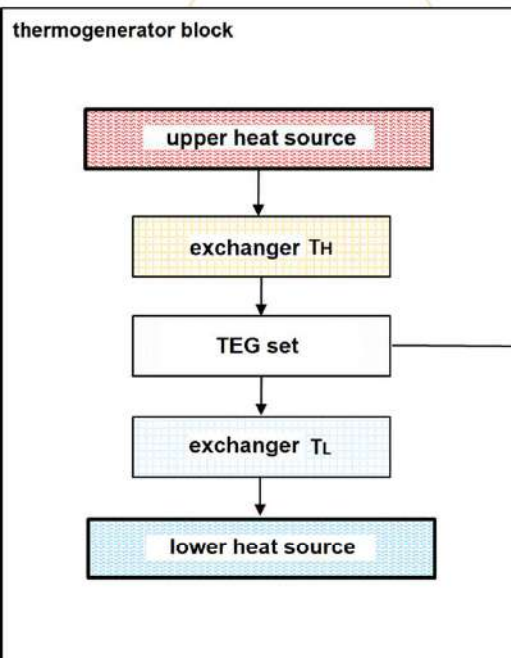
**PROJECT AIM:** In order to management of waste heat from industrial installations and lost irretrievably by discharging to the environment the exchange the thermal energy of waste heat into useful electric energy with the use of thermoelectric generators is proposed.

## **Description of the project:**

- 1) Obtaining the maximum value of the electric current power from the heat flux under the conditions of energy balance in the system.
- 2) Providing high-temperature heat energy to the hot side of the thermogenerator, taking into account the compensation of uneven temperature distribution on the surface of the waste heat source and maintaining the nominal operating temperature of the thermogenerator.
- 3) Conversion of DC output waveforms of thermogenerators into power grid parameters with the possibility of working in on-grid and off-grid systems and ensuring that the operating point is maintained at the maximum power of the thermoelectric generators.
- 4) Effective heat collection from the cold side of thermogenerators ensuring minimum energy consumption.
- 5) Integration of system elements in the form of a control system that monitors the condition and parameters of the system and enables cooperation with external systems.



# HORIZON-CL4-2023-TWIN-TRANSITION-01-31: RELEVANT EQUIPMENT AND FACILITIES



## ADVANTAGES

- No moving parts
- Work in any position
- Long service life
- Maintenance-free operation (without spare parts and maintenance)
- The refrigerant is water

## PROTOTYPING CENTRE



An experimental waste heat recovery system developed in the Institute

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Surface Engineering Center

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