FRANCE 2030

PROGRAMME DE RECHERCHE

RECYCLAGE

BEYONDWASTE2027.SCIENCESCONF.ORG

# BEYOND WASTE 2027

## *RECYCLING OF MATERIALS FROM ATOMS TO SYSTEMS*

*INTERNATIONAL SCIENTIFIC SYMPOSIUM*

***16, 17 & 18 MARCH - LILLE, FRANCE***

# CALL FOR PAPERS

RÉPUBLIQUE FRANÇAISE

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# Beyond Waste

## Recycling of materials from atoms to systems

Recycling is a multidisciplinary field of research mobilizing: chemistry, physics, engineering, informatics, but also law, economics and social sciences, etc. To contribute to this essential societal challenge and to propose relevant solutions, it is necessary to adopt holistic approaches, from matters to systems, from atoms to actions.

Beyond Waste 2027 is an international scientific symposium that will be held in Lille (France) from March 16 to 18, 2027. It will bring together experts from all around the World in order to meet and discuss research themes related to recycling, eco-design, and the circularity of materials. The event will feature parallel sessions dealing in detail with topics related to materials (plastics, composites, strategic metals, textiles, and papers-cardboards), as well as sectorial issues (WEEE, new energy technologies – photovoltaics, wind mills, hydrogen devices -, batteries, and household waste) and interdisciplinary matters, with the inputs of digital and social sciences. Plenary sessions will also cover common and broader topics, including political, economical, and environmental questions.

Supported by the National research program PEPR "Recycling, Recyclability, and Reuse of Materials" led by the National Centre for Scientific Research (CNRS) which brings together more than 300 scientists from nearly 100 laboratories across the country, Beyond Waste aims to unite an international research network on these issues. During the three days of the conference, the goal is to bring together the scientific community from around the world and showcase the diversity and richness of research on recycling and the circular economy of materials, which cannot be resolved through a single scientific discipline.

## Topics

- Plastics
- Strategic metals
- Composite materials
- Papers&Cardboards
- Textiles
- Batteries
- New Energy Technologies (NET)
- Waste Electrical and Electronic Equipment (WEEE)
- Household Waste
- Humanities and social sciences
- Digital sciences

**General keywords :** *Recycling, recyclability, reuse, valorization, upcycling, recovery, regeneration, sustainability, circular economy, end-of-life, Life-Cycle Analysis (LCA), mechanical recycling, chemical recycling, waste sorting, decontamination, environmental impact, material flow analysis, characterization*

## Submission guidelines

Submissions may concern either a written communication (scientific poster) or an oral presentation. Abstracts must not exceed 5000 characters (around 2 pages) and be written in English using the form on the "Submission" page of the event's Sciencesconf website at : beyondwaste2027.sciencesconf.org

**Suggested abstract structure:**

- Highlights (2 to 4 bullet points)
- Purpose
- Materials and methods
- Results and discussion
- Conclusions and perspectives

*Submission deadline: September 7, 2026*
*Notification of acceptance: December 15, 2026*

**If you have any questions, please send a message to contact@pepr-recyclage.fr**

*« Material » topic*

# Plastics

Beyond waste 2027 aims to bring together experts from academia, industry, and government to discuss cutting edge and recent advances, innovative technologies, and sustainable strategies for the recycling and valorization of plastic materials.

Contributions are invited on topics including, but not limited to:

- Mechanical recycling of mono-materials and multi-materials plastics,
- Chemical recycling, innovative processing technologies,
- Polymer reprocessing and stabilization,
- Circular economy approaches,
- Advanced sorting technologies,
- Recycled material performance,
- Life Cycle Assessment (LCA) analysis of recycling processes.

Authors are encouraged to submit original research, case studies, and technological developments that contribute to improving plastic recycling efficiency and sustainability. Selected abstracts will be invited for oral or poster presentations. Several keynote lectures will also be selected to address the innovative topics mentioned above.

**Key words:** *Plastic waste, recycled plastics, polymer recycling, closed-loop recycling, open-loop recycling, plastic sorting, plastic degradation, compatibilization, pollution removal, pyrolysis, solvolysis, enzymatic recycling, selective dissolution, Extended Producer Responsibility (EPR)*

## Session leader:

Khalid LAMNAWAR, Ingénierie des Matériaux Polymères (IMP), Institut National des Sciences Appliquées (INSA) of Lyon

*« Material » topic*

# Strategic metals

This symposium addresses both fundamental and applied research aimed at improving the valorization of strategic metal wastes while minimizing the environmental impacts of recycling. Strategic metals are present in a wide range of waste streams, including Waste from Electrical and Electronic Equipment (WEEE) such as printed circuit boards, hard drives, but also spent batteries, catalysts, purge solutions, structural alloys, and manufacturing scraps. Despite their high resource potential, these waste streams are currently characterized by low recycling rates.

Moreover, existing recycling processes suffer from significant limitations, including insufficient collection and sorting, dilution and losses of critical metals, limited capability to treat low-concentration waste streams, high energy consumption, extensive use of environmentally hazardous chemicals, and a lack of comprehensive data on environmental benefits (if any) and economic viability.

To overcome these challenges, the symposium will focus on the following topics:

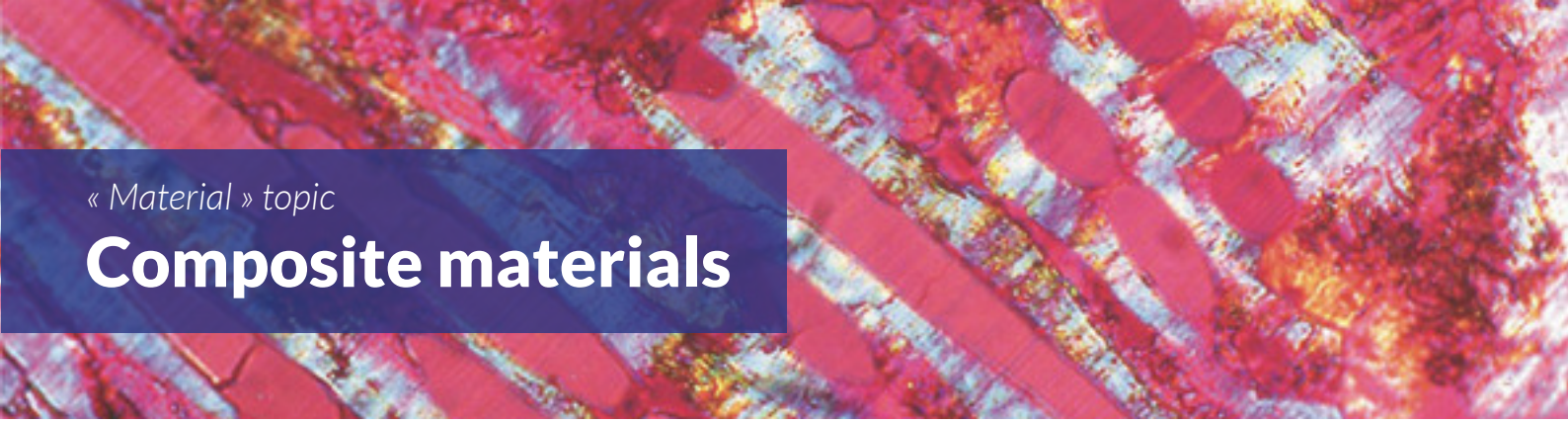
- Online and automated analytical techniques for waste sorting and pre-treatment
- Alternative and advanced hydro- and bio-metallurgical processes for metal recovery
- Pyrometallurgical and solid-state recycling approaches
- Socio-economic and environmental assessment of strategic metal recycling

Other topics aiming at improving the head, core or end of strategic metal recycling are also of interest.

**Key words:** *Hydrometallurgy, biometallurgy, solid-state recycling, short recycling loops, recycling of processing waste, reactants regeneration, minimization of metallurgical waste production (ionometallurgy, solvometallurgy, electrometallurgy)*

## Session leader:

Mathilde LAURENT BROCQ, Institut de Chimie et des Matériaux Paris Est (ICMPE), National Centre for Scientific Research (CNRS)



*« Material » topic*

# Composite materials

The Composite materials session invites contributions aimed at improving the recycling and recyclability of composite materials made of an organic matrix (OMC).

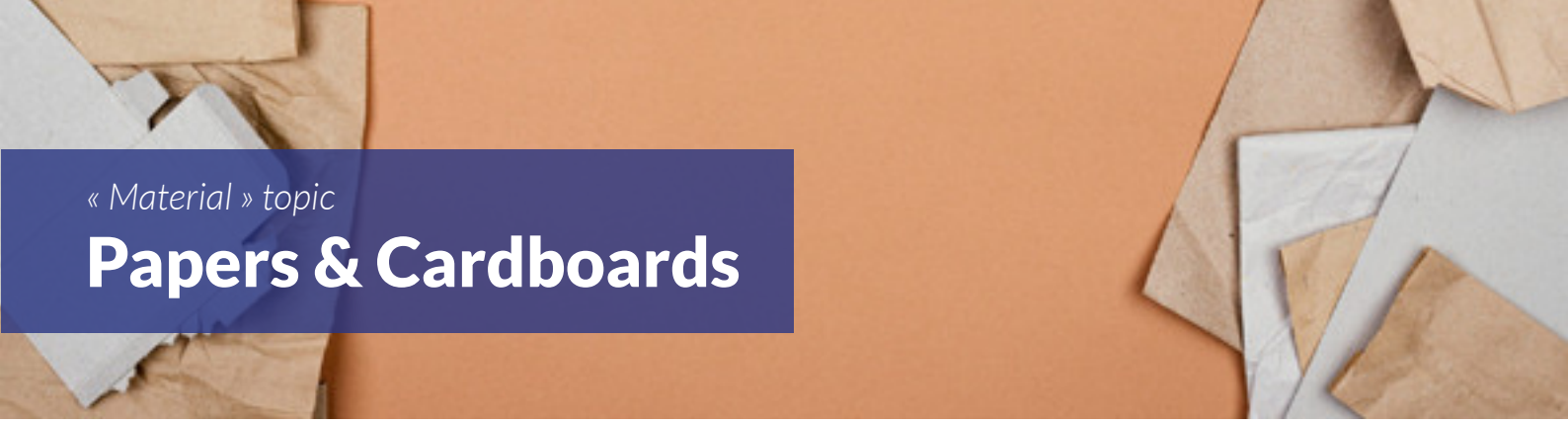
The design of new composite materials (extended to multi-materials) requires overcoming material challenges such as mastering assembly/disassembly, and ageing processes in service. All of these aspects must be integrated at the design stage (synthesis, formulation) to ensure that OMC can be recycled at the end of their life, and recovered as recycled raw materials.

Any communication addressing the end-of-life issue for composite materials reinforced with natural, mineral, and synthetic fibers, native or modified, from the sectors of wind power, automotive, recreational boats, construction, etc., will be welcome, regardless of the type of resin (i.e., biobased or not, and thermoplastic or thermoset). Work on the design of innovative composites that can be deconstructed, for example through interfacial modifications, will be also appreciated, as work dealing with the manufacture and characterization of a new generation of composites produced from recycled raw materials or life cycle analysis studies.

**Key words:** *Solvation/solvolysis, reverse engineering, fiber-reinforced composites, upcycling of thermoset and thermoplastic resins and composites*

## Session leader:

Philippe EVON, Laboratoire de Chimie Agro-industrielle (LCA) Toulouse, ENSIACET



*« Material » topic*

# Papers & Cardboards

While paper and cardboard recycling chains are now well established, many issues remain to improving the recycling rate of these materials, even though it is already very high. The challenges lie in the sorting and selective collection of paper and cardboard, in improving recycling processes to achieve higher yields and reduce waste, and in the reuse of recycled fibers in all paper and board grades. Another issue concerns the increasingly diverse recycling rejects, following the introduction of new cellulosic materials to the market as a substitute for plastic, for example single-use packaging (fast food packaging, disposable cups, etc.) made of fibers and polymers. Finally, the new European strategies and policies aimed at transforming Europe's economy, energy, transport, and industries for a more sustainable future also impact the entire paper recycling sector.

All paper and cardboard manufacturing sectors are concerned: packaging (flexible packaging and cardboard), graphic papers (writing and printing paper and newspapers), and hygienic paper. To overcome these challenges, the symposium will focus on the following themes:

- Improving conventional recycling processes and adapting them to new cellulosic materials introduced to the market
- The development of new sustainable processes to enhance or give specific properties to recycled fibers (optical, mechanical, barrier properties, etc.) and to decontaminate them in order to improve the reuse rate
- The valorization (1) of solid and liquid waste resulting from recycling, and (2) of composite cellulosic materials that are difficult to recycle, through chemical, physico-chemical, enzymatic, or thermal conversion processes, in order to give them a new life that currently poses environmental and cost-related disposal issues

Finally, regulations related to the marketing of cellulosic materials or the reuse of recycled fibers, as well as the environmental and socio-economic aspects of the paper and cardboard sector in relation to recycling, may also be the subject of submission.

**Key words:** *Paper and cardboard based composite materials, recycled cellulosic fibers, physico-chemical separation, chemical processes, enzymatic processes, thermo-conversion, best available technology, business model, regulation*

## Session leader:

Fabienne ESPITALIER, Centre RAPSODEE, IMT Mines Albi - Papers-cardboards Axis

*« Material » topic*

# Textiles

This conference track focuses on the current state and the challenges, at all scales (polymers, fibers/filaments, fabrics, and composites), related to the valorization of end-of-life textiles, the extension of their service life, the industrial engineering of their transformation, the value chains of their recycling, and their eco-design.

The value chains of textile recycling are complex and dynamic systems in which each stakeholder or process constitutes a system with its own objectives and constraints. The textile material, across its different scales, also presents its own set of constraints.

Regulation, volumes involved, interactions between stakeholders, costs, sovereignty, competition between recycling pathways, risks, environmental and societal impacts, and quality—combined with consumer expectations—make textile recycling a major global challenge.

Textile recycling is a multidisciplinary field that brings together polymer science, process engineering, management sciences, digital sciences, and legal studies.

**Key words:** *Lifespan, Decision Support System (DSS), classification, clustering, design, material by desing, eco-design, polymer carry out, textile process engineering, automation*

## Session leader:

Ludovic KOEHL, Gemtex, École Nationale Supérieure des Arts et Industries Textiles (ENSAIT)

*« Systemic » topic*

# Batteries

Li-ion batteries (LIBs) production has witnessed galloping development during the last two decades, particularly in response to the needs of electric mobility. However, LIBs are heavily dependent on so-called critical metals (Co, Ni, Li …), found in particular in the NMC/NCA positive electrodes.

While the supplies of raw materials seem to be fairly varied (China, Africa, South America, etc.), their conversion into active materials and then into LIBs is dominated by Asia (China, South Korea) making the entire supply chain vulnerable. In response, numerous initiatives have been launched recently. To cite an example, within the U.E., the European Batteries Directive has very recently evolved into the Batteries Regulation, setting ambitious targets for batteries placed on the European market. In terms of EoL management, collection and recycling targets (for Co, Cu, Ni and Li) have been set. Moreover, future batteries placed on the E.U. market will have a mandatory target content of materials derived from recycling. To reach these targets important progress must still be achieved in many aspects of LIBs recycling.

This symposium proposes to address both fundamental and applied research related to the broad field of LIBs recycling. Papers addressing the current challenges related to LIBs recycling are welcome. Different aspects of this recycling should be covered including:

- LIBs pre-treament (collection, discharge, shredding and grinding and sorting)
- Hydrometallurgical operations such as leaching, separation, purification and selective recovery
- Pyrometallurgical operations
- Closed-loop recovery and regeneration of cathode and anode active materials and their electrochemical performance
- Supply chain aspects related to LIBs and their recycling
- Environmental assessment of LIBs recycling

**Key words:** *Li-ion batteries, hydrometallurgy, pyrometallurgy, active materials, graphite, NMC, LFP, electrochemical properties, physical pre-treatment, leaching, separation, purification, elective precipitation, graphite regeneration, electrodialysis, critical raw material*

## Session leader:

Lenka SVECOVA, Laboratoire Électrochimie et Physicochimie des Matériaux et des Interfaces (LEPMI), Grenoble INP-UGA

*« Systemic » topic*

# New Energy Technologies (NET)

This conference session invites contributions aimed at improving the recycling and recyclability of components from new energy technologies. This covers production technologies (PV, wind turbines) and conversion technologies (fuel cells and electrolysers).

The specific focus is on multi-material components of different types, which may contain multiple critical and/or toxic (PFAS) substances. Any communication addressing issues of repair, second life, remanufacturing and recycling is welcome, including the upstream phases of dismantling. In particular, approaches to direct recycling via short (closed or open) routes using virtuous technologies (green chemistry) are expected. LCA approaches are of course included.

**Key words:** *Short loop recycling, re-manufacturing, close loop recycling, ionometallurgy, metal recovery, polymer recovery, deep eutectic solvant (DES), ionic liquids, direct recycling, permanent magnet recycling, HT/LT fuel cell/electrolyzer recycling, PV cells recycling*

## Session leader:

Etienne BOUYER, Commissariat à l'énergie atomique et aux énergies alternatives (CEA)

*« Systemic » topic*

# Waste Electrical and Electronic Equipment (WEEE)

This axis focuses on the integration of circularity principles across the lifecycle of electronic systems, combining advances in design, materials, manufacturing, diagnostics, and recycling. The objective is to enable the transition from linear waste management approaches to circular, value-retaining systems.

More specifically, the axis will address the following themes:

- Integration of circularity principles into early design through decision-support frameworks combining creativity tools, circularity indicators, and scenario-based models to guide lifecycle-oriented strategies for WEEE systems.
- Development of eco-designed materials and reversible assembly solutions to improve disassembly, repairability, and recyclability of electronic components.
- Implementation of advanced manufacturing strategies compatible with circular economy principles, including additive manufacturing and resource-efficient processes.
- Development of diagnostic tools and predictive models (SoH, RUL) to enable the reuse and second-life application of electronic components.
- Optimization of recycling and recovery processes, including depolymerization, selective separation, and high-value material recovery from complex assemblies.
- Integration of lifecycle assessment (LCA) and sustainability evaluation methods to assess the environmental and economic performance of circular strategies.
- Exploration of new value creation mechanisms and business models (to support the deployment and scalability of circular solutions

Finally, this axis promotes a systemic and multidisciplinary approach, ensuring coherence between technological innovations and design practices, and contributing to the transformation of WEEE value chains toward sustainable, resilient, and closed-loop systems.

**Key words:** *Innovative materials, diagnostics and Remaining Useful Life (RUL), self-immolative polymers, vitrimers, printed circuit board recycling, additive manufacturing, early design creativity tools*

## Session leader:

José-Armando HIDALGO-CRESPO, Laboratoire Conception de Produits et Innovation (LCPI), Arts et Métiers

*« Systemic » topic*

# Household Waste

This axis of the conference invites contributions aimed at improving household waste recycling across the entire value chain. It seeks to gather research and case studies that contribute to a better understanding and improved performance of waste management systems, from collection to treatment and recycling, as well as the recovery and/or disposal of final residues.

The topics outlined below are intended as illustrative examples of the types of work that may be submitted, rather than as an exhaustive or restrictive list.

Contributions may, for instance, address the combination of technological solutions and analyses of social behavior to improve source separation and sorting of household waste materials, as well as the detection of undesirable materials along waste streams. Submissions focusing on innovative processes and technologies for the decontamination of recycled materials are also welcome, particularly when they aim to enhance material quality and reuse potential.

More broadly, contributions may explore waste value chains through the analysis of material and energy flows, logistics, and environmental impacts, offering systemic and integrated perspectives. Research addressing human behavior, organizational dynamics, governance arrangements, and interactions between stakeholders within a given territory is equally encouraged, especially when proposing pathways to improve the structure and coordination of waste management value chains.

Finally, studies examining the role of regulation, public policy, and standardization in waste sorting and recycling systems may be submitted, with attention to their influence on practices, technologies, and markets.

**Key words:** *Advanced methods for waste sorting, individual behaviour towards waste sorting, household waste management, waste reduction, consumer behaviour, incentive and regulation levers*

## Session leaders:

Lesly CASSIN, Bureau d'Economie Théorique et Appliquée (BETA), Université de Lorraine
Adrien STOLIDI, Commissariat à l'énergie atomique et aux énergies alternatives (CEA)

*Transversal topic*

# Digital sciences

The transition to an efficient and sustainable circular economy does not rely solely on improving recycling processes. It also requires new approaches to understanding, modeling, and managing complex systems involving multiple actors, infrastructures, and material flows. In this context, digital sciences are an essential lever for designing, analyzing, and optimizing recycling and material circularity value chains.

As part of Beyond Waste 2027, this theme invites scientific contributions exploring the role of digital technology in transforming recycling systems. Work may focus on modeling and simulating complex recycling-related systems, designing and coordinating circular value chains, or developing decision-making tools to improve material flow management and cooperation between stakeholders. Contributions may also address the use of artificial intelligence, signal and image processing to improve waste sorting and characterization, the development of digital twins and cyber-physical systems applied to recycling sectors, as well as issues related to data management and exploitation (interoperability, data platforms, big data).

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As part of Beyond Waste 2027, this theme invites scientific contributions exploring the role of digital technology in transforming recycling systems. Work may focus on modeling and simulating complex systems related to recycling. Work on robotics and process automation, or on multi-scale and multi-actor modeling of recycling systems, is also welcome. More broadly, this session aims to bring together contributions showing how digital sciences can support the design, coordination, and evaluation of more efficient and sustainable recycling systems, in interaction with the industrial, territorial, and societal dimensions of the circular economy.

**Key words:** *Recycling value chain orchestration, Decision Support System (DSS), digital twin, multi-agent systems, data interoperability and analyse, model-based systems engineering*

## Session leader:

Pascale MARANGÉ, Centre de Recherche en Automatique de Nancy (CRAN), Université de Lorraine

*Transversal topic*

# Humanities and social sciences

This conference axis calls for contributions that address the issues of discard and waste studies in the broadest sense. It aims to analyze the place of waste in contemporary societies, with a particular focus on practices, public policies, citizen participation in waste governance, territories and channels for recovery, reuse, and recycling, but also to analyze consumption behaviors, production systems, and lifestyles that contribute to waste generation.

Covering a variety of fields (political ecology, territorial ecology, behaviors, regulation, practices, and representations), it seeks to offer a critical view of contemporary transformations in waste management and economics, to rethink our relationship with waste, and to promote more sustainable resource management. This approach involves questioning consumption and production systems from a systemic perspective.

We encourage papers focusing on the social, territorial, economic, cultural, and political issues surrounding waste that fit into this critical perspective and provide insights into: extraction, transformation, cleaning, waste circulation, socioeconomic, industrial, and behavioral dynamics, public policy,  as well as forms of civic engagement aimed at reducing waste, recycling practices and representations in the Anthropocene.

**Key words:** *Material cultures, practices, waste management, metabolism, discard studies, glassroots environmental action, waste economics, waste governance*

## Session leader:

Pierre DESVAUX, Espaces et Sociétés (ESO), National Centre for Scientific Research (CNRS)

# Beyond Waste 2027

## Chairs

- Sophie DUQUESNE, Unité Matériaux et Transformations (UMET), Centrale Lille
- Jannick DUCHET-RUMEAU, Ingénierie des Matériaux Polymères (IMP), Institut National des Sciences Appliquées (INSA) de Lyon, co-director of PEPR Recycling
- Cyril AYMONIER, Institut de Chimie de la Matière Condensée de Bordeaux (ICMCB), National Centre for Scientific Research (CNRS), co-director of PEPR Recycling

## International committee

- Kim RAGAERT, Professor, Université de Maastricht (NL)
- Christian EKBERG, Professor, Division Manager, Professor, Chemistry and Chemical Engineering, Industrial Materials Recycling and Nuclear Chemistry Chalmers (S)
- Markus REUTER, Doctor, MS Director, Honorary Prof. TU Bergakademie, Freiberg (D), Adjunct Prof. Curtin University (AUS)
- Patrice MANGIN, Professor Emeritus, Renewable Energies, Université du Québec à Trois-Rivières (CAN)
- Laetitia FORST, Doctor, Circular Textile Design Researcher, University of Arts London (UK)
- Enrico BENETTO, Doctor, Luxembourg Institute of Science and Technology LIST (L)
- Martin CHARTER, Professor, Centre for Sustainable Design, University of Creative Arts Farnham (UK)
- Anthony RYAN OBE, Professor, Université de Sheffield (UK)

## Organisation committee

- Marie COLMONT, Unité de Catalyse et de Chimie du Solide (UCCS), Centrale Lille
- Manon ROLLAND, Unité Matériaux et Transformations (UMET), Université de Lille
- Jérémie SOULESTIN, IMT Nord-Europe
- Ludovic KHOEL, Gemtex, École Nationale Supérieure des Arts et Industries Textiles (ENSAIT)
- Jean-François GERARD, professor emeritus at the Institut National des Sciences Appliquées (INSA) de Lyon, former-director of PEPR Recycling
- Elisa DESPRETZ, scientific mediation officer at the Institut Chevreul
- Amélie MARTIN, project manager of PEPR Recycling
- Etienne MORISSEAU, communication officer of PEPR Recycling