In a nutshell

VIBES introduces and showcases an innovative, eco-friendly, cost-effective, and non-toxic recycling technology, designed to reduce the disposal and environmental release of non-biodegradable polymers by at least 40%. After optimising and scaling the technology to a semi-industrial pilot level, the resulting products from this advanced recycling process will be reintroduced into the market. They will be valorised as new feedstocks for various chemicals or building blocks that can be upcycled into new industrial products.

Key Exploitable Results

- **Biobased, recyclable epoxy resins** incorporating specific **biobased bonding materials (BBMs)**, designed for use in **thermoset composites** with built-in **recycling capabilities**.
- **Advanced technology** for scaling up **lignin-TPU biobased** carbon fibre, intended for integration into **thermoset composites** with inherent **recycling properties**.
- **Environmentally friendly chemical recycling process** for **thermoset composites**, applicable at the end of their life cycle.

Identity

Project title: Improving recyclability of thermoset composite materials through a greener recycling technology, based on reversible biobased bonding materials.
Grant Agreement No: 101023190
Start: 1 June 2021
Duration: 48 months
BBI-JU contribution: € 4,224,039.25

Find Out More

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Project partners

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This project has received funding from the Biobased Industries Joint Undertaking (JU) under grant agreement N° 101023190. The JU receives support from the European Union's Horizon 2020 research and innovation programme and the Bio-based Industries Consortium.

VIBES

Green Chemistry Recycling Solution

An eco-friendly chemical recycling solution for the end-of-life management of thermoset composites

www.vibesproject.eu

Context and Rationale

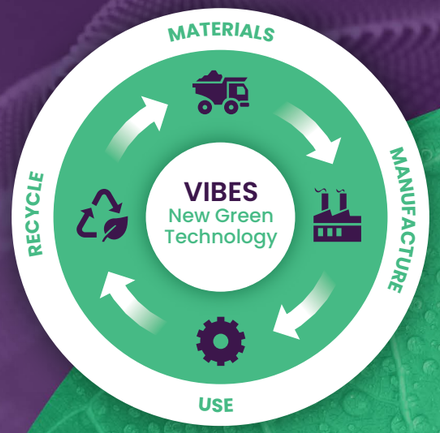
Thermoset composites have emerged as key components across various industries—thanks to their high strength, durability, chemical resistance, and light weight, alongside excellent corrosion resistance. Their appeal spans sectors like aeronautics, automotive, construction, naval, energy, and more.

However, thermoset composites present a significant challenge at the end of their lifecycle. Due to their complexity, they are difficult to recycle, with most waste being either incinerated (42.6%) or sent to landfills (24.9%). As industrial demand for high-performance materials continues to rise, establishing a circular ecosystem for these composites is becoming crucial. This will be essential to aligning with the EU's 2050 climate-neutral strategy.

Aim

The VIBES project presents an innovative solution to improve the recyclability of thermoset composite materials through an innovative, eco-friendly, cost-effective, and non-toxic recycling technology.

At the core of VIBES lies the mission to transform the thermoset composite materials industry, strategically incorporating these materials into a circular economy framework.



Our Goal
At least
40%
less waste

Project Phases

- Design & development of biobased materials
- Synthesis & validation of recyclable thermosets
- Optimisation & scale-up of recycling technology
- Return of recovered fractions to the market

Communication, Dissemination, Training and Exploitation of project results

Project Achievements

Innovative breakthroughs in R&D

- **Bisphenol-free epoxy** resins developed using **biobased materials**, also incorporating in certain cases **Biobased Bonding Materials (BBM)** that facilitate the reuse and revalorisation of the composites.
- **Lignin-derived carbon fibres** and fabrics developed for **sustainable reinforcement alternatives**.
- Introduced a **green recycling technology** for thermoset epoxy-based composites, revolutionising the way thermoset composite materials are being revalorised.

Real-world demonstrations of advanced solutions

- **Thermoset composite panels** produced and tested, using the newly developed bisphenol-free epoxy resins: three vitrimer-based (BBM) reinforced with glass, carbon and flax fibres for the **naval industry**, two others reinforced with glass and carbon fibres for the **construction industry**.
- A recyclable flax-reinforced composite produced and tested for non-structural components in the **aeronautics industry**.
- **Pilot plant** established for **recycling thermoset composites**, based on eco-friendly processes, with the potential to separate and revalorise composites from the construction, naval and aeronautics industries.
- **Recovered resins and fibres** valorised, demonstrating the potential of the green recycling technology to revalorise both reinforcement and matrix.

Successful stakeholder engagement and outreach

- 2 stakeholder roundtables, fostering collaboration with the industry and enlarging the **industrial impact** of the project.
- 2 summer courses for students, also adapted in e-learning format, and 4 training workshops for researchers and industry professionals, empowering the workforce.
- 9 scientific publications, 3 articles in industry magazines, and presentations at multiple conferences and workshops.

Stakeholders

The VIBES project addresses the entire composites value chain, incorporating not only consortium partners but also the VIBES Stakeholders Board and collaboration with other projects of Biobased Industries through communication and dissemination efforts. It ensures comprehensive engagement with a wide range of relevant stakeholders, including:

- Thermoset composite developers
- Industrial end-users across sectors such as aeronautics, naval, and construction
- Industrial waste management, logistics, and transport professionals
- Technology and innovation experts, including academics, researchers, and consultants
- Impact multipliers such as policymakers and media

This broad engagement strategy aims to maximise impact and drive innovation throughout the industry ecosystem.

Benefits

- Enhanced thermoset composite materials and recycling technology, reducing environmental impact while boosting cost-effectiveness and profitability.
- Lower reliance on primary materials and minimised landfill usage.
- Unrestricted industrial use of thermoset composites without environmental concerns.
- Fresh insights into the circular economy for thermoset composites within the European industry.
- Advanced skills and knowledge for European students in material science, engineering, and chemistry, meeting the rising demand for technical expertise.
- Job creation and economic growth through new connections in the "Intrinsic Recyclable Thermoset Composites Value Chain":

  → Linking waste management with biotechnology.

  → Connecting thermoset composites with biotechnology.