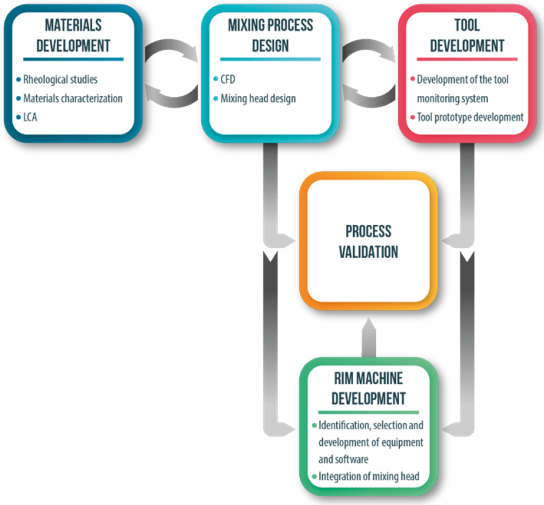
InnovPolymer - Process technologies for the novel advanced material based on in situ polymerization

Abstract:

InnovPolymer unites biobased materials (bioPU) with Reaction Injection Moulding (RIM). The consortium spans the plastic value chain to create flexible, innovative RIM technology (resins/process/machine) for low-weight, low-carbon parts across markets. Today, RIM is dominated by few players using standard formulations, with little interest in new products. InnovPolymer intends to develop new RIM technology by adapting an open patented mixing process to new equipment, tested with patented bioPU, ensuring a versatile, validated RIM method. The project also generates tools and best practices for RIM-based design and production of parts.



Countries involved

Application sectors
Aerospace, Automotive, Railway, Industrial components

Research and innovation domains
Advanced manufacturing processes, Sustainable manufacturing, Customer-based manufacturing

Total cost in M€ (millions)
1.585 M€

Starting date
01/11/2024

Duration (in months)
36 months

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RATIONALE OF THE PROJECT

Reactive polymers, processed through Reaction Injection Moulding (RIM), play a crucial role in producing composites and medium-scale parts. Materials such as bio-polyurethanes (bioPU) enable reduced dependence on fossil resources, aligning with Industry 5.0 goals. However, RIM remains a niche technology, limited by long cycle times, complex process control, and lack of adaptable equipment tailored to new formulations—barriers particularly critical for SMEs. Formulators developing recyclable and bio-based materials face additional challenges, as current RIM systems are not optimized for their properties. Furthermore, the scarce know-how on tooling for RIM and limited design flexibility hinder the technology's industrial uptake. The InnovPolymer project addresses these gaps by developing a new generation of RIM technology with adaptable mixing devices, advanced control systems, and low-cost tooling. Simultaneously, it will validate bioPU processing, establishing the basis for sustainable, efficient, and customizable polymer manufacturing aligned with future industrial needs.

TECHNOLOGICAL INNOVATION, ACHIEVEMENTS AND RESULTS

RIM technology is currently optimized through trial-and-error, limiting its use to niche applications such as large parts and small-to-medium production series, where tooling costs make thermoplastics unfeasible. This narrow focus has concentrated expertise among a few specialists. InnovPolymer brings together these experts to introduce new concepts that enable a scientific approach to RIM equipment and tooling design. The project builds on decades of research to establish a universal design equation for RIM mixing devices and will innovate in tooling by developing low-cost computational tools and design guidelines. The technological innovation of InnovPolymer lies in the development and commercialization of a breakthrough RIM technology (resins, process, and machine) that enables the production of lightweight, low-carbon parts using novel bio-based polyurethane (bioPU). Key advances include using rheological measurements during polymerization and modeling mold filling as a dynamic two-phase flow.

MARKET POTENTIAL

One of the largest industries that will benefit from the technologies researched and developed in InnovPolymer is the Manufacturing industry. This industry is one of the European Union's most important industries generating nearly 30 million jobs throughout its 27 members. By focusing on bio plastics, InnovPolymer is directly contributing to the continuity of the global position of EU's Manufacturing industry, as well as its long-term sustainability. The materials and technology developed in InnovPolymer possess a large cross-fertilization potential, i.e., could be employed for several high-tech markets. Industries such as the Automotive, Aerospace, Medical Devices, Chemical and Railway have long looked at composite materials as a means of reducing operational costs and environmental impact.

IMPACT POTENTIAL

The project will introduce an innovative RIM machine and a novel bio-based polymer (bioPU), offering a sustainable alternative to oil-based PU. This breakthrough supports circular economy goals by enabling lightweight, recyclable materials that reduce carbon footprint, particularly in the automotive sector. By developing technology and materials fully in Europe, the project strengthens EU leadership in polymers and manufacturing, creates new market opportunities, and addresses the demand for efficient, high-quality, and cost-effective processes.