VITAL

Innovative processing technologies for bio-based foamed thermoplastics

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Manufacturing Partnership Days

21 October 2025

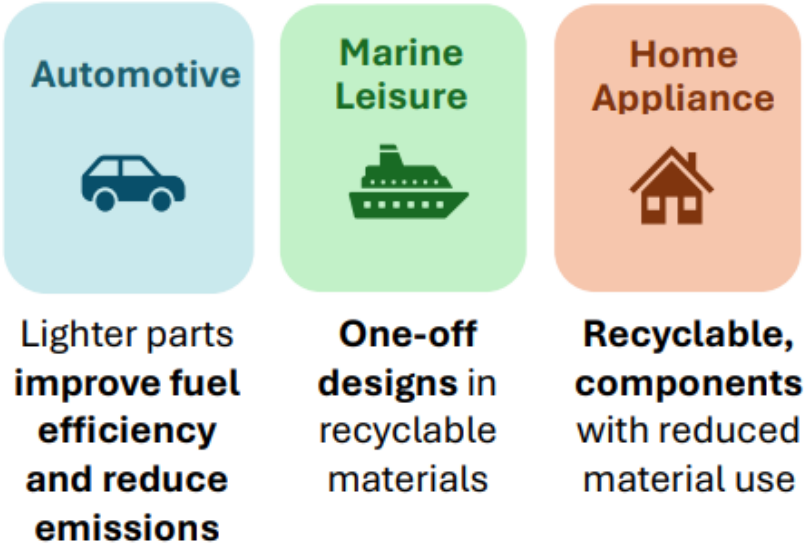
Brussels

Funded by the European Union

Innovative processing technologies for bio-based foamed thermoplastics (VITAL)

The transition from fossil-based to **biobased and recyclable materials** is no longer optional—it is a strategic necessity.

The **VITAL project** is driving this transition by developing breakthrough manufacturing solutions that make **lightweight, durable, and recyclable foamed bioplastics** viable for mainstream industrial use within a circular economy framework.



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Innovative processing technologies for bio-based foamed thermoplastics (VITAL)

3 Value chains

- Novel 3D foam printing
- Bead foaming
- Foam Injection Moulding, FIM

Materials development

Recycling

Smart FIM Control System

Cruise Ship Interiors – lightweight walls, seats, and tables via large-scale 3D printing

Fridge Parts – durable, recyclable components made at scale

Automotive Seat Cushions – flame-retardant, soft, and long-lasting

Automotive Body Panels – lightweight structures reducing vehicle mass and emissions

Value Chain 1: Globally unique 3D foam printing for mould-free rapid prototyping and bespoke production

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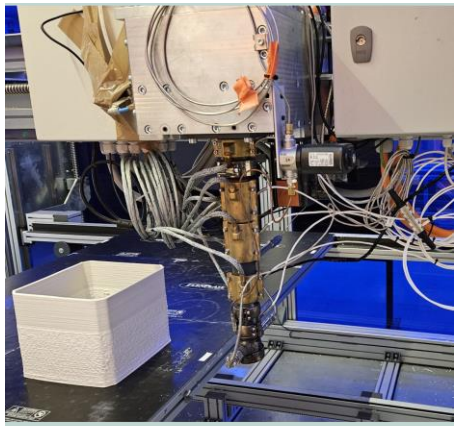
The technology for manufacturing of lightweight and customised components

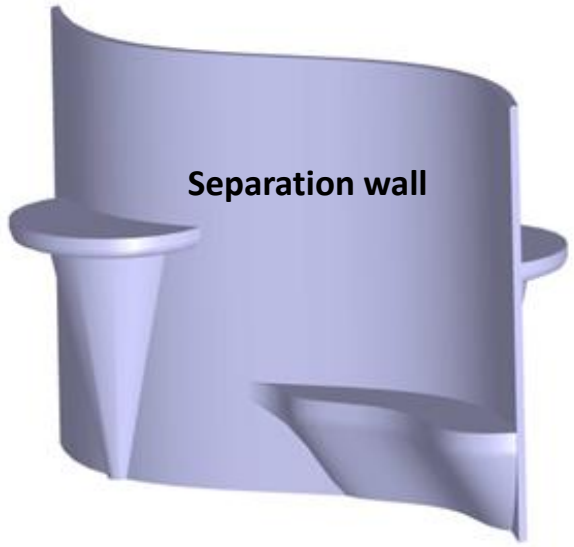
A 3D printer and foam printing head combination **was developed for 3D foam printing**.

- Feeding in granulate form
- Adjustable foam filament layer by layer

• Testing shows up to 66% weight reduction
• Simulation software
• Piloting with new biomaterial formulations



Demonstration in one-off designed separation wall for cruise ships with recyclable fireproofed PLA



VTT AM TECHNOLOGIES BY BRINTER Floreon AVIENT MEYER WERFT MEYER TURKU

Value Chain 2: Bead foaming of bio-based thermoplastics combined with radio-frequency (steam-free) heating

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Development of a steam-free manufacturing and moulding process **for biobased TPU** bead foams

- **Substitution for standard polyurethane foams with suitable density range (100 – 150 kg/m³)**
- Around 60% biobased content (compared to 0% for existing materials).

Development and modification of bio-based bead foams

PLA deveoped by Floreon

Bio-based TPU

Caramid developed by Fraunhofer

Additives from Avient

Demonstration in automotive seat part

Reduction in the use of non-recyclable, fossil-based polymer materials.

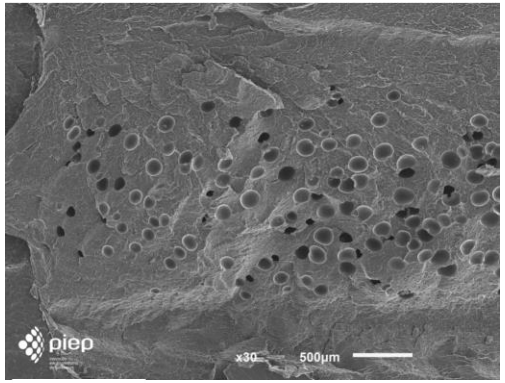
A bead foaming process with radio-frequency heating using up to 90% less energy than steam moulding and reducing the risk of hydrolysis.

Floreon Fraunhofer STELLANTIS CRF AVIENT

Value Chain 3: Foam Injection Moulding (FIM) processing approach for bio-based thermoplastics based on a Digital Twin with virtual AI control

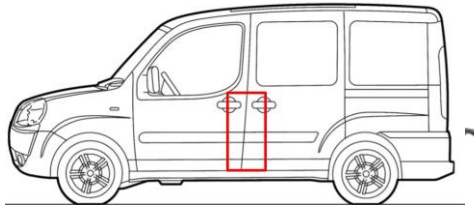
Funded by the European Union

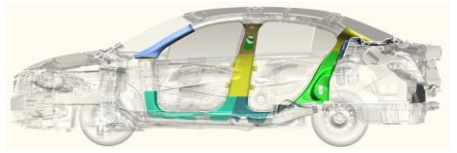
Optimization of Foam Injection Moulding (FIM) with bio-based PLA and blowing agent, validated by simulations and some prototype parts.

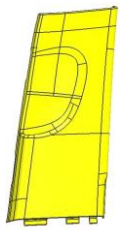


PIEP has published the data of the **durable, flame retardant PLA** from Floreon on the **MatWeb.com** platform. The data includes the mechanical and thermal properties of the material, as well as details on mould shrinkage and melt flow

Substitute ABS, HIPS and PP with developed Floreon's PLA in car interior trim parts and fridge parts







Interior trim parts

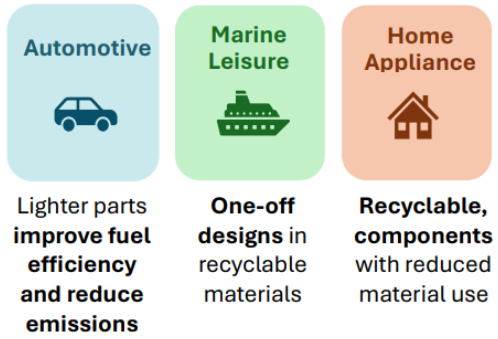
Vegetable tray
Evaporation cover

piep idener.ai Floreon AVIENT arçelik TOFAŞ farplas

PLA development for durable applications

Polylactic acid (PLA) is biobased and has an excellent eco-profile, but its performance is not sufficient for durable applications unless modified

Through compounding with reinforcing fillers, elastomers and compatibilizers the durability of PLA was increased enough to **meet the use case requirements**!



The **PLA** blend was found to **match or even exceed the performance** of ABS and HIPS plastics.

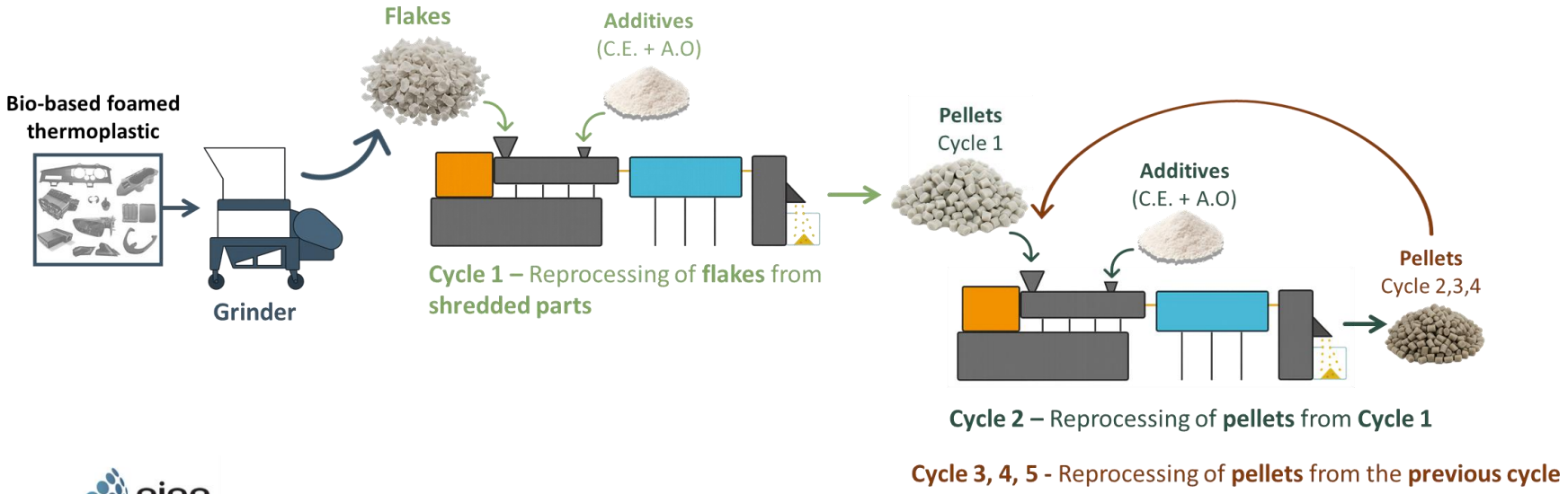
The blend also **met fire resistance requirements** and was easy to process.

Material or Use Case	**Impact Izod (kJ/m²) ISO 180/A**
Required for Fridge EVA Cover	>15
Required for 'B Pillar Lower'	40
Virgin (unmodified) PLA	3.6
VITAL Developed PLA Compound	44

Impact strength required for use cases vs impact strength of unmodified PLA including developed compound.

Optimized bioplastic mechanical recycling

- The extruder screw configuration was optimized with the support of intelligent control systems / digital twins, reducing shear and thermal load during processing.
- A stabilization system combining a chain extender (C.E.) and an antioxidant (A.O.) was introduced.
  - **significantly reduced degradation of PLA, enabling stable properties across successive reprocessing cycles**



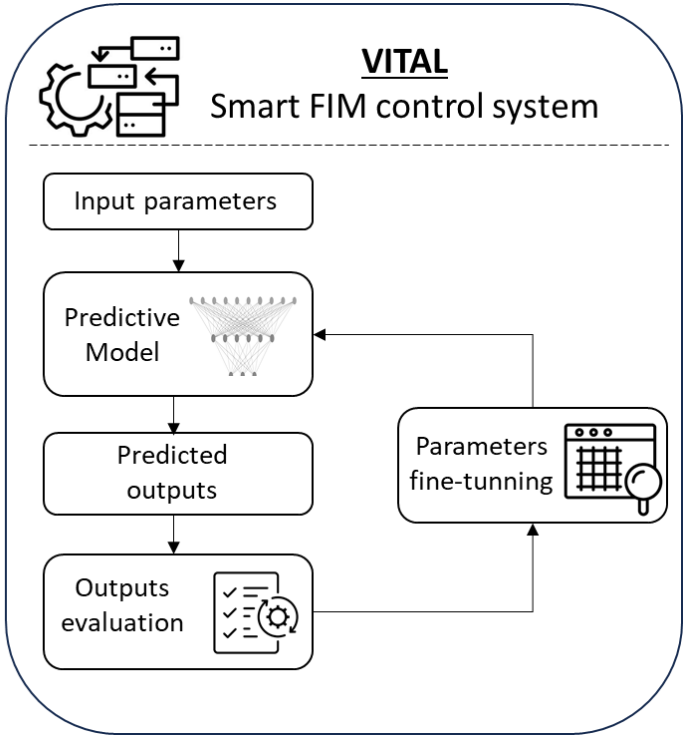
Smart FIM Control System

Digital Twin with virtual AI control to predict the FIM process behaviour, cellular distribution and average cell size proceeds with PIEP and IDENER

Key parameters analysed:

- Density distribution
- Temperature profiles
- Material mechanical behavior
- Dimensional accuracy and mold shrinkage

A control system with communications established via **MQTT** was developed, hosted on Idener servers and validated at PIEP facilities, where an **HMI** was also implemented to support the FIM operator.



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GA number: 101058328
Duration: 42 months
1.6. 2022 – 30.11. 2025
Call: HORIZON-CL4-2021-TWIN-TRANSITION-01
Topic: HORIZON-CL4-2021-TWIN-TRANSITION-01-05 - Manufacturing technologies for bio-based materials (Made in Europe Partnership) (RIA)
Requested EU Contribution: €5,623,016.00
EC contact: PA Ioannis Tsoumpas

Welcome to visit VITAL booth!

VITAL project supports the transition from fossil-based to **biobased and recyclable materials.**

Foamed, lightweight and durable bioplastics are on their way to industrial use within a circular economy framework

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