Bio-based fire-retardant thermoplastic composites reinforced with natural fibers

THERMOFIRE (GA101112370)

Yolanda Núñez - CTME

The project is supported by the Circular Bio-based Europe Joint Undertaking and its members.

THERMOFIRE: Bio-based fire-retardant thermoplastic composites reinforced with natural fibres

The general objective of the THERMOFIRE project is to develop novel bio-based and recyclable composites with enhanced mechanical properties and fire resistance by using natural fiber reinforcements and bio-based halogen-free flame retardants.

Consortium of 12 partners led by Avanzare Innovacion Tecnologica SL

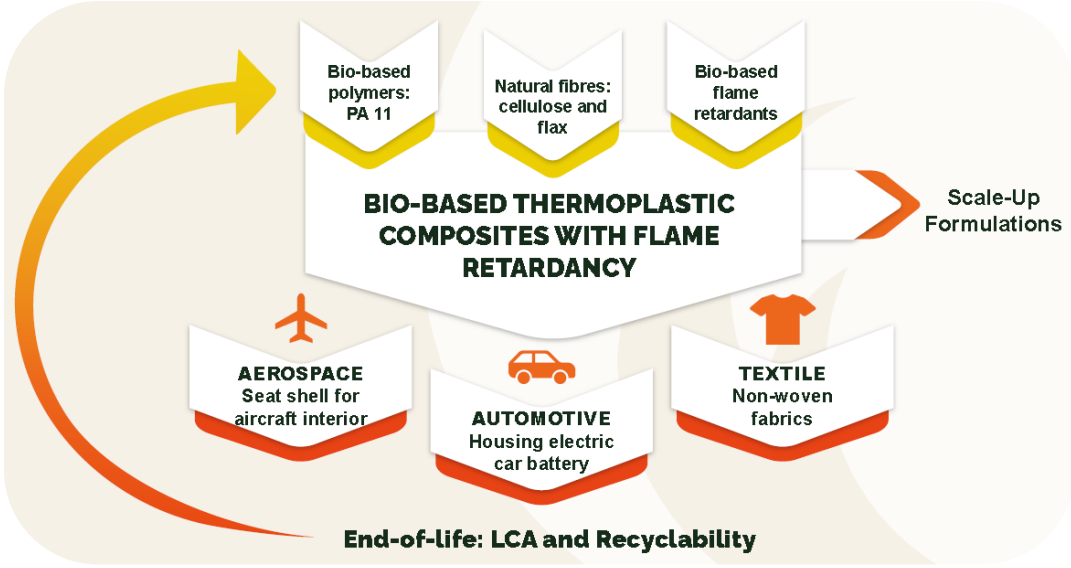
Use of bio-based materials as a feedstock

100% bio-based PA11, bio-based flame retardant and biobased fibres.

3 prototypes (TRL5) in automotive (housing for electrical batteries), aerospace (aircraft interior seat shell) and textile (non-woven fabrics).

Remove the EU's dependence on fossil-based polymers and increases the sustainability of the composites, addressing new methods for bio-polymer preparation with low environmental impact.

Comparative LCA: traditional petroleum-based products vs. THERMOFIRE's bio-based alternatives.



CBE JU contribution: € 4.47 million

Duration: June 2023 – May 2027

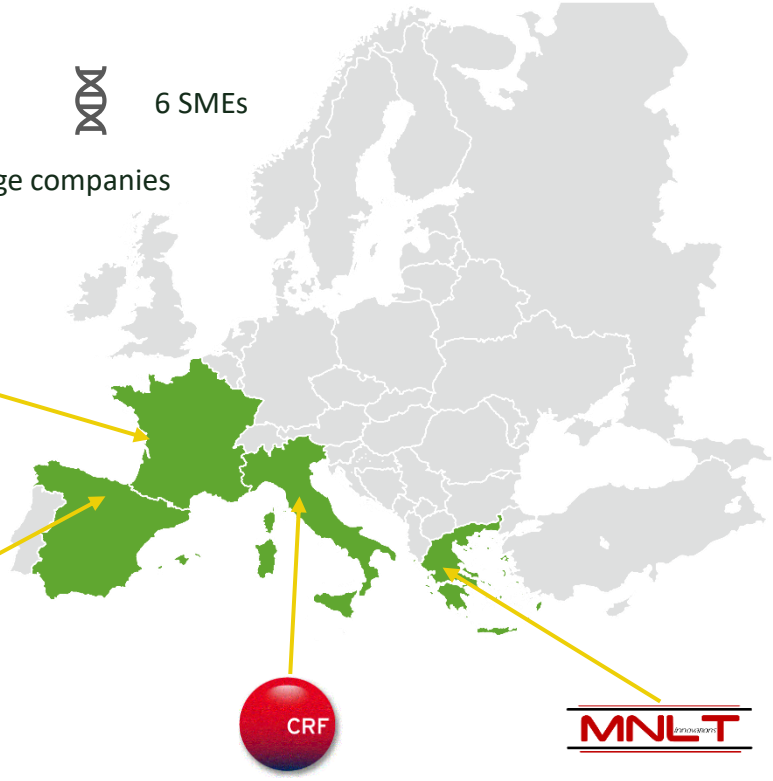
THERMOFIRE: Consortium

Project lead: Avanzare Innovacion Tecnologica SL (Spain)

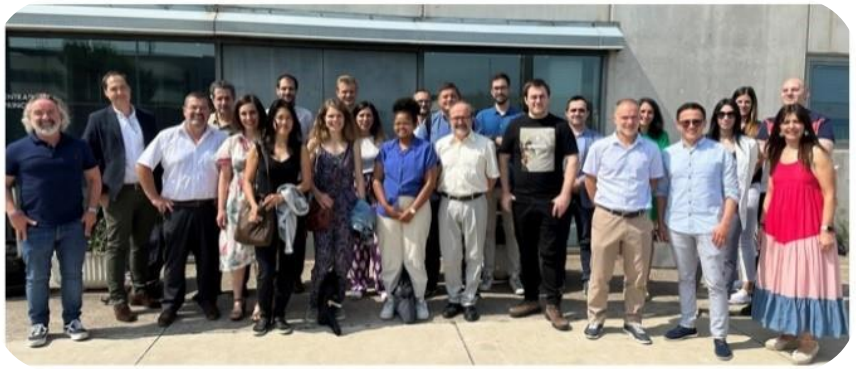
2 RTOs

6 SMEs

4 Large companies



DEMONSTRATORS



THERMOFIRE: Comparative Life Cycle Assessment

Goal definition

- The intended application of the study is to compare the environmental behaviour of traditional petroleum-based products and bio-based THERMOFIRE alternative solutions.
- The study outcomes help the partners to lessen the environmental impacts of the THERMOFIRE solutions by guiding the decision-making process

Scope definition

- It is considered appropriate to analyse separately the environmental profile of each raw material, transformation processes, prototype and their EoL.
- 3 types of raw materials:
  - Bio-based polymer: PA 11,…
  - Natural fibres (cellulose, flax,…)
  - Bio-based flame retardant

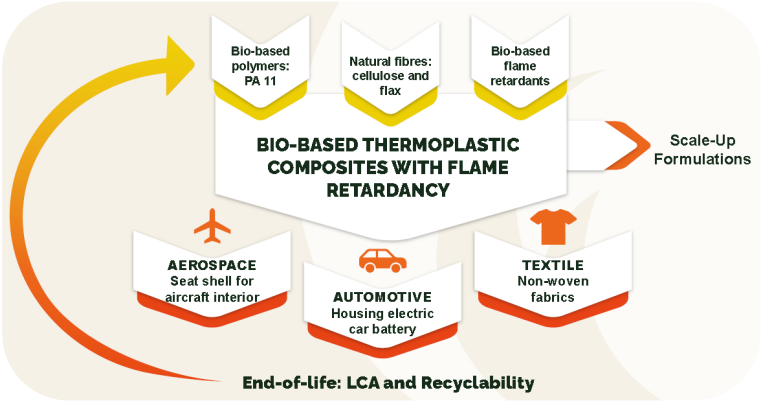
  Functional unit: 1 kg (composition, properties…)
- 3 TP composites: transformation process (extrusion, injection, thermocompression, air laid method…)

  Functional unit: 1 test piece (dimensions, properties….)
- 3 prototypes

  Functional unit: 1 unit (dimensions, quality, lifetime…)
- 2 End of life processes (mechanical and chemical recycling)

  Functional unit: 1 kg of recycled product (composition, properties…)
- Identify 3 current fossil-based alternatives and quantify their associated impact.

  Functional unit: 1 unit (dimensions, quality, lifetime…)



14 product systems to assess

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- 3 prototypes
- 2 End of life processes (mechanical and chemical recycling)
- 3 Identify current fossil-based alternatives and quantify their associated impact.
- LCIA methodology and types of impact: European Commission – Product Environmental Footprint Guide
- Data requirement
  - Time-related coverage
  - Geographical coverage
  - Technology coverage
  - Precision, completeness and representativeness of the data
  - Consistency and reproducibility of the methods used in the study
  - Sources of the data
  - Uncertainty of the information and data gaps

Circular Bio-based Europe Joint Undertaking
Bio-based Industries Consortium
Co-funded by the European Union
THERMOFIRE Project – GA no. 101112370

THERMOFIRE: Comparative Life Cycle Assessment

Next steps

Bio-based Thermofire composites

- Develop flow diagrams for each process under evaluation.
- Identify all inputs and outputs (mass and energy flows) for each unit process in the flow diagrams.
- Quantify the identified inputs and outputs to ensure accurate assessment.

Fossil-based alternatives

- Identification of current fossil-based alternatives
- Develop flow diagrams for each process under evaluation.
- Identify all inputs and outputs (mass and energy flows) for each unit process in the flow diagrams.
- Quantify the identified inputs and outputs to ensure accurate assessment.

THERMOFIRE: Comparative Life Cycle Assessment

Key challenges

Life Cycle Assessment

- Data Availability: limited or incomplete data.
- Influence of geographic variability in the environmental assessment of bio-based products, considering difference in feedstock availability, soil, climate conditions, agricultural practices, supply chain…
- Land Use, Land Use Change and Biodiversity: accounting for indirect impacts of bio-based feedstocks
- End-of-Life Scenarios: modelling accurate and comparable end-of-life options
- Low TRL: difficulties in predicting environmental impacts for industrial-scale production based on lab-scale or pilot-scale data (process performance, material yields, resource efficiency...)

Comparative LCA

- System boundaries: Defining consistent and comparable system boundaries for bio-based and fossil-based products.
- Functional equivalence: Ensuring both alternatives provide the same functionality and performance for a fair comparison.
- Variations in data quality: between bio-based and fossil-based products.

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https://www.thermofire-project.eu/
https://www.linkedin.com/company/thermofire-cbe-ju/

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Bio-based Industries Consortium

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