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In partnership with

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IPC: lowering the environmental impact of composites using ecodesign

Centre Technique Industriel (CTI) de la Plasturgie et des Composites (IPC)'s simplified life cycle analysis tool for composites can be used to compare the environmental impact of different designs.

'Design for sustainability' refers to a design approach which integrates requirements regarding the environmental and social impacts of the system being designed, in addition to technical and economic performances. This can be assessed using a life cycle analysis (LCA), following the ISO 14040 standard, as a multi-criteria assessment method, including all stages of the life cycle of the product (cradle to cradle), including end of life (EoL).

IPC and environmental consultancy EVEA have co-developed a simplified LCA tool dedicated to composite applications, named C3R Impacts. It was released in 2023. It is intended to be ergonomic, modular and customisable while ensuring robust assessments using the Environmental Footprint EF 3.0 method recommended by the European Commission. The tool was designed for non-LCA experts to increase the uptake of simplified LCA in the plastics and composites industries.

C3R Impacts can be used to evaluate eco-design and compare different technical solutions. In line with the chosen scope of study, this tool highlights the component(s) of the life cycle with the greatest contribution to environmental impact, and then, ultimately, aims to reduce the product footprint.

Robust dataset for LCA

A benchmark carried out by IPC, and discussions with IPC members, revealed a need to create and update composites life cycle inventory (LCI) to support robust LCA analysis.

In collaboration with ADEME (the French Agency for Ecological Transition), IPC led a project to produce and publish nine LCI[1]. LCI data covers the most popular thermoset and thermoplastic composite processes such as hand layup, spray moulding, infusion, pultrusion, filament winding, stamping, SMC, RTM, hot pressing. Several variants for the stamping and hot processing processes are also covered.

This work has successfully passed the critical review stage.

The main outcomes of this work are:

- Collection and publication of measurements at manufacturers' premises to develop inventories as close as possible to reality. For the nine selected processes, an inventory of raw materials, waste generated, consumables, energy and solvent consumption was performed and published.
- Creation of datasets by compiling the collected inventories while following a rigorous methodology to provide the best possible representativeness and transparency. The nine LCI datasets are already available in the C3R Impacts software.

The REWIND kick-off meeting was held in May 2024 in Valencia.

Outlook – towards eco-design of composites

So as to go beyond the state of the art of LCA of composite projects, IPC has joined REWIND.

The Horizon Europe project REWIND (Efficient Decommissioning, Repurposing and Recycling to increase the Circularity of end-of-life Wind Energy Systems), kicked off in May 2024 and aims at developing critical technologies for dismantling of EoL wind turbine blades. The following stages are covered: evaluation, cutting, etc. and implementation of new methodologies for composites repurposing and recycling (catalytic pyrolysis and solvolysis) to increase the circularity of wind turbine blades, increasing the industrial applications of the EoL composites.

In the frame of REWIND, IPC is involved in the development of a predictive tool to quantify the residual mechanical performances of wind turbine blades at EoL, and a methodology and a tool to model the eco-score of various technical solutions proposed in REWIND by aggregating indicators. Ultimately, this work will support decision makers in selecting the most suitable EoL management solution from a range of reuse and recycling options.

The consortium, coordinated by AIMPLAS Instituto Tecnológico del Plástico, includes 14 partners from seven different countries: Tekniker, IPC, Miljøskærm, Hochschule Pforzheim - Gestaltung, Technik, Wirtschaft und Recht, Deutsche Institute für Textil- und Faserforschung Denkendorf (DITF), Alke Electric Vehicles, Suez Group, bCircular, Composite Patch, CiaoTech - Gruppo PNO, TPI Composites, Inc., R-Nano, and AEMAC (Asociación Española de Materiales Compuestos). The project is funded by the European Union's Horizon Europe Framework Programme under grant agreement no. 101147226.

Further information

↘ IPC: www.ct-ipc.com

IPC plays a key role in promoting innovation in plastics and composite materials and processes. With its expertise and network of experts, IPC actively supports industrial companies in a wide range of fields, from study to feasibility and technology transfer.

References

1. ADEME, T. Harvey, Y. Cheikh and J. Leclercq, Inventaire du cycle de vie des procedes de mise en forme des composites, 2024.

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