BUTTERFLIES Project Bio-Polymers & Additive Manufacturing

NEWSLETTER #2

Advancements in Chitin-Based Biopolymers for BJT and 2PP Technologies

As part of the BUTTERFLIES project, we are advancing the optimization of chitin-based derivatives to redefine the sustainability of additive manufacturing.

The primary goal is to develop high-performance, bio-intelligent binders for two distinct 3D printing technologies: Binder Jetting (BJT) and Two-Photon Polymerisation (2PP). By replacing synthetic chemicals with renewable biopolymers, the aim is to enhance material strength and biocompatibility while significantly reducing the environmental footprint of the manufacturing process.

Core Materials: The Versatility of Chitin and Chitosan

The research focuses on two renewable biopolymers: chitin and chitosan.
Chitin is an abundant, biodegradable, and antimicrobial polymer known for its excellent structural reinforcement due to its high crystallinity and strong hydrogen-bonding network. However, its natural insolubility requires advanced processing methods to be effectively used in manufacturing applications.

Chitosan, a derivative of chitin, offers greater polarity and solubility in acidic environments, making it easier to process. Its superior biocompatibility and ability to be chemically modified make it especially suitable for biomedical and advanced 3D printing applications.

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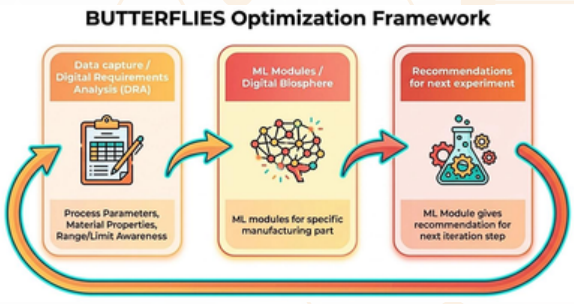
The ML-Models in the Loop

How **BUTTERFLIES** tries to automatically turn early experimental data into actionable **"try this next"** recommendations

In BUTTERFLIES, process development spans multiple manufacturing and formulation tracks.

Across them, the bottleneck is the same: finding the right parameter combinations efficiently is a multi-parameter optimisation problem.



Small changes in material composition, process settings, or environment can flip outcomes from robust parts to failed runs—and brute-force trial-and-error is slow and expensive.

VAL is building the AI/ML optimisation layer and early prototypes that connect structured data capture to predictive models and, ultimately, to recommendations for the next best experiments.

The goal is to accelerate learning across the project while reducing wasted material, time, and energy.

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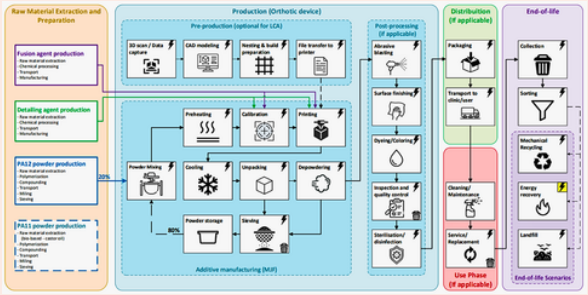
Towards sustainable additive manufacturing processes: a LCA approach

The growing environmental pressure imposed by conventional manufacturing models has significantly accelerated the development of more sustainable production processes. In this context, the synergetic use of additive manufacturing (AM) and bio-based polymers can represent a frontier of particular interest for circular and low-emission manufacturing.



Within the BUTTERFLIES project, which aims at optimizing AM processes (e.g. Binder jet printing) with chitin/chitosan-based binder for biomedical and pharmaceutical applications, LCA and LCC models are under development to quantify the environmental and economic impacts of these innovative solutions, when compared to commercially viable alternatives (e.g. Powder Bed Fusion approach with polyamide-based binder).

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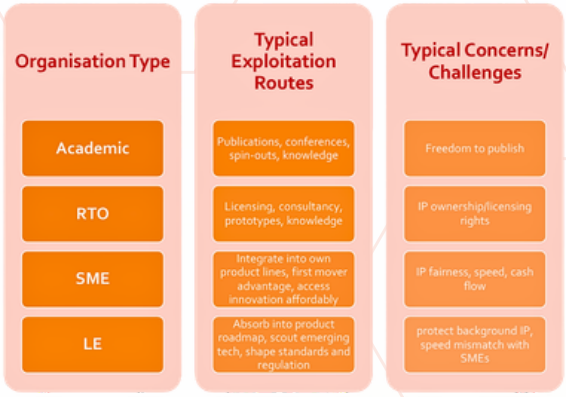
Building impact together: exploitation planning in the BUTTERFLIES project

EU-funded innovation projects are, by design, ambitious. They bring together diverse partners, tackle complex challenges, and aim to produce tools and technologies that change how people work. But there is a question that sits underneath all that activity, which doesn't always get the attention it deserves until quite late on: what happens after the project ends?



This is the sphere of exploitation planning. The work of ensuring that the output of a project doesn't quietly gather dust once it finishes, but instead finds its way into the hands of people who need it. For BUTTERFLIES, these ultimately could be people with medical needs, so there is real pressure to get it right.

The platform structure of a project like BUTTERFLIES, where multiple partners work together in a pre-built value chain, brings both a strategic advantage in terms of that value chain, but also a particular kind of complexity to exploitation planning.

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