

BUTTERFLIES Project Accelerates Toward Sustainable Bio-intelligent Manufacturing

The Horizon Europe-funded BUTTERFLIES project has successfully completed its initial definition phase, marking a significant leap forward in the transition toward sustainable, bio-based additive manufacturing. Now in its ninth month, the consortium has finalised the specifications for its novel binder jetting systems and successfully synthesised chitin-based nanomaterials, laying the groundwork for a greener manufacturing ecosystem.

Blueprint for bio-polymer binder jet development established

An important achievement is the completion of the Process & Machine Requirements Specification. This milestone freezes the design parameters for both the lab-scale and industrial demonstrator machines, ensuring they can handle the unique properties of bio-based feedstocks.

The newly defined specifications include:

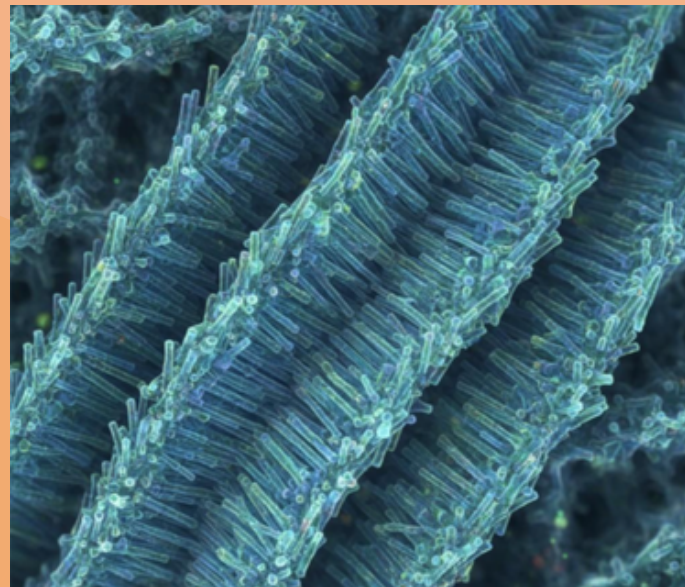
- **Precision Engineering:** A dual-system architecture featuring a flexible lab-scale test rig for material development and a robust industrial demonstrator for larger-scale validation.
- **Operational Windows:** Strict environmental controls of temperature and relative humidity to prevent moisture uptake by hygroscopic chitin powders.
- **Binder Dynamics:** A target viscosity and surface tension have been established to ensure stable jetting through industrial piezo printheads.

Material Breakthroughs: Chitin Nanocrystals & Films

In parallel, the material development team has reported successful synthesis of the project's core biomaterials.

The consortium has achieved:

- **Nanocrystal Production:** Successful production of Chitin Nanocrystals (ChNC) using hydrolysis methods, achieving particles with sizes ranging in the hundreds of nanometers.
- **Film Formation:** The production of uniform chitosan films with a good average strength, demonstrating the material's potential for structural integrity in printed parts.
- **Bio-Crosslinking:** Promising experiments created fully bio-based crosslinkers, eliminating the need for synthetic hardeners.



Nanocrystals representation. AI generated

Building the Digital Biosphere

To support these physical innovations, the Digital Biosphere Platform has been initiated. This AI-driven module is now ingesting preliminary data to optimise the complex interactions between the bio-binders and printing processes. The team has defined a modular optimisation approach that separates binder material, print behaviour, and powder interaction into distinct data streams for machine learning analysis.



Representation of digital biosphere platform. AI generated

Sustainability at the Core

Ensuring the environmental viability of these new technologies, BUTTERFLIES has established the Life Cycle Assessment (LCA) framework. It compares the BUTTERFLIES processes against conventional scenarios, such as standard 2-Photon Polymerization using PETA resins, to quantify reductions in carbon footprint and waste generation.

Next Steps

With specifications frozen and materials synthesized, the project now moves into the execution phase. Over the next quarter, partners will commence the physical build of the lab-scale binder jetting rig and begin extensive printability testing of the new chitin formulations.



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About BUTTERFLIES

BUTTERFLIES is a 36-month project funded by Horizon Europe (Grant Agreement No. 101178321). It brings together a consortium of 14 partners from across Europe and the UK to develop bio-intelligent manufacturing processes that utilize biological systems to create sustainable, smart bioproducts.

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