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Fact sheet

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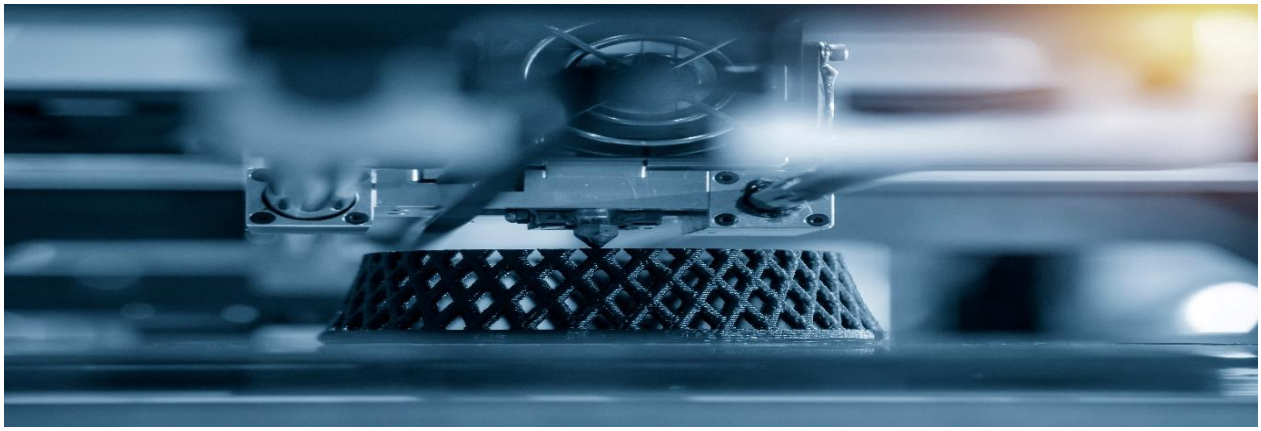
Incubation Forum for Circular Economy in European Defence (IF CEED)

Project idea

Circular and energy efficient polymer Additive Manufacturing



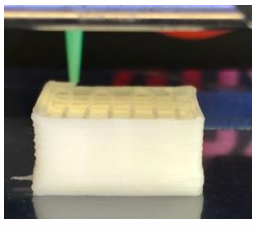
Context

Via optimised design and consumption of materials, additive manufacturing can reduce the footprint associated to the production of parts. Still, use of innovative materials can lead to drastic energy savings and further circularity.

Previous developments of room temperature bio-composite paste (RTBP) printing in labs have shown that it can cut print energy by up to 75%, raw material costs by 50%, be dissolved and re-printed for local closed-loop circular manufacturing, also reducing material toxicity hazards.

This presents an opportunity both for economic savings and strong reduction of CO_2 emissions, if rolled out at large scale across the EU.

However, current RTBP have to be improved to meet military requirements, e.g. in terms of mechanical strength or print quality features (e.g., dimensional accuracy or surface smoothness).



A solution for mechanical strength is also to combine bio-based polymers with fibres. There, improvements on energy efficiency and circularity are needed.

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Objectives

The different approaches need specific developments to obtain required performances while maintaining low energy consumption and enhanced circularity vs more conventional materials.

The objective of the project idea is to develop bio-based solutions for additive manufacturing at room temperature, suitable for military applications.

The specific objectives are to:

- Redesign RTBP materials for improved mechanical properties & waterproofness.
- Test the effectiveness & scalability of local closed-loop RTBP manufacturing.
- Develop biopolymer/fibre composite materials and their printing for energy efficiency.
- Develop biopolymer/fibre composite recycling and/or reuse systems for energy-efficiency.
- Perform LCA, LCC & toxicity assessment for each solution.

This project proposal is in line with the wider objectives of the Incubation Forum for Circular Economy in European Defence (IF CEED).

Methodology

	Eco-Risk	Eco-Reward	Function Risk	Function Reward
Room temperature bio-composite paste printing (RTBP)	🟢	🟢	🔴	🟡
Biopolymer + fiber composite print energy optimization (BFCO)	🔴	🟡	🟢	🟢
Biopolymer + fiber composite material recovery (BFCR)	🔴	🔴	🟢	🟢

Stakeholders

- Entities engaged in the IF CEED Project Circle “Circular Additive Manufacturing”.
- Research-and-Technology-Organisations, industry.

Timeline & Milestones

The foreseen project duration is 48 months.

Expected Outcome

- Report on the sustainability improvements, cost, and functional properties of the materials, print processes, and closed-loop recovery processes developed, including recommended applications.
- Materials and printing technologies for low-energy additive manufacturing.

Operational benefits

- Reduction of energy consumption linked to the production process.
- Improving Additive Manufacturing processes on deployed missions in challenging climate conditions.
- Easier on-mission manufacturing.
  (e.g. no risk linked to high temperature)

Budget & funding

Type of project: collaborative project

Budget: EUR 2 000 000 – 5 000 000
(Depending on final TRL.)