

TOSCA 101191394
Manufacturing Processes and Digital **To**ols for more **S**ustainable **C**omposite **A**erostructures

Deliverable D4.1: "Lay-up process implementation – Summary"

Due date of deliverable: 2026-04-30
Actual submission date: 2026-04-28

Start date of project: 1st January 2025 Duration: 36 months

Coordinator:
Christian Eitzinger, Profactor

Lead Beneficiary: Addcomposites Oy
Contributions by: FIDAMC, Profactor, CIDETEC

Dissemination Level		
PU	Public	
SEN	Sensitive information	X

TOSCA Project is entirely funded by the European Union, under the topic HORIZON-CL5-2024-D5-01-08 of the Horizon Europe Framework Programme (HORIZON). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

Funded by the European Union

SUMMARY

1.1 Objective

Deliverable D4.1 reports the development and implementation of the AFP lay-up process in TOSCA. It covers the prototype lay-up process developed for the project's new structural parts, the features of those parts and the novel material that affect lay-up, and the adaptations made to the AFP equipment to enable integrated quality control.

TOSCA uses a new recyclable vitrimer prepreg developed by CIDETEC. Vitrimers sit between thermosets and thermoplastics; they cure into a cross-linked network but can be reprocessed, repaired and recycled. Their handling and tack behaviour differ from conventional prepregs, so a dedicated AFP process had to be established before structural laminates could be produced.

The work ran on two parallel tracks. The first built a single-tow AFP prototype head, installed it on a robotic cell at FIDAMC and used it for the first process trials and panel production with the vitrimer tape. The second, at the Addcomposites facility in Finland, builds a multi-tow AFP system to demonstrate the project's deposition-rate target, with integrated in-process quality sensing from Profactor.

1.2 Approach

Material behaviour relevant to lay-up was characterised together with CIDETEC and FIDAMC: how the tape's tack changes with storage time, how flexible it is, how its edges hold up after slitting, and how its release film is configured. Practical issues found in early trials were fed back to material production and resolved in later batches.

The agreed process route uses AFP for fast, controlled tape placement with heat-assisted tack, followed by out-of-autoclave oven curing. Separating placement from consolidation keeps the AFP process robust and supports the project's autoclave-free manufacturing objective. Parameters are developed on flat panels before moving to the use-case geometries, and tool paths are planned in Addcomposites' AddPath software with geometry rules suited to the material.

For quality control, the AFP equipment was adapted to work with Profactor's optical inspection sensor, which scans the deposited surface between lay-up passes, and to stream process data (robot position, speed, compaction, heating and machine state) in real time towards the consortium's shared manufacturing database for the digital twin.

1.3 Conclusions

- The properties of the TOSCA vitrimer prepreg that matter for AFP have been identified, and a workable lay-up processing window and handling practice have been established.
- A dedicated single-tow AFP prototype head with closed-loop temperature control was designed, built, installed and commissioned on the robotic cell at FIDAMC.
- Flat laminate panels were successfully laid up with the vitrimer prepreg and cured out of autoclave, supplying test material to the downstream work on characterisation, repair, structural health monitoring, joining, inspection and recycling.
- Real-time process data streaming from the AFP system is in place and designed for integration with the project's manufacturing database.
- The concept for integrating the optical quality sensor on the AFP head has been defined, and its communication with the AFP data system has been verified.
- A multi-tow AFP system that uses the lessons from the prototype trials is being built to demonstrate the throughput target of the Grant Agreement, with integrated quality inspection.
- The remaining work in WP4 covers completing sensor integration on the multi-tow system, demonstrating throughput, validating the end-to-end digital-twin data chain and continuing panel production for the project demonstrators.