

**TOSCA 101191394**

Manufacturing Processes and Digital Tools for more Sustainable Composite Aerostructures

Deliverable D4.2: “Lay-up monitoring sensor – Summary”

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Coordinator:

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Contributions by: AddComposites

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SUMMARY

The deliverable D4.2 presents the development and implementation of a sensor-based quality control solution for Automated Fibre Placement (AFP) lay-up processes. It provides an overview of the sensor concept, experimental evaluation, and integration into an AFP manufacturing system. The deliverable demonstrates the application of in-process sensing for the monitoring and assessment of lay-up quality.

The working principle of the sensor is described, including the fundamental measurement approach and the main components required for the sensing process. The deliverable further details the hardware realisation of the sensor, with a focus on its mechanical and optical design and the arrangement of the relevant components. These aspects provide the basis for understanding the sensor architecture and its suitability for integration into an AFP lay-up system.

A range of typical defects occurring during AFP lay-up is presented and described. The deliverable discusses the characteristics of relevant defect types and evaluates their detectability using the developed sensor. This is complemented by results from an initial scanning campaign performed on an example defect panel. The measurements provide a first assessment of the sensor's ability to identify relevant surface and lay-up deviations and demonstrate its application under representative conditions.

The deliverable also describes the integration of the sensor into the AFP system. This includes the mechanical integration and positioning of the sensor as well as the electrical and technical interfaces required for its operation. Particular attention is given to the interface between the robot and the sensor, including the exchange and handling of positional and measurement-related information required during scanning. The calibration procedures used to establish the relationship between the sensor and the manufacturing system are also described.

Finally, initial scanning tests have been performed with the integrated system to verify the overall functionality of the sensor and its interaction with the AFP equipment. These tests provide a first validation of the integrated sensing approach and establish the basis for further development and optimisation of the sensor system and its application to in-process quality monitoring of AFP lay-up.