PRESS RELEASE

Fraunhofer IFAM – Tolerance-conform adhesive bonding of fiber composite components and certifying training at JEC WORLD

With automation, digitalization and robotics as well as specially trained personnel into the efficient, high-rate and versatile production of the future

Honored with the JEC Composites Innovation Award 2026 in the Aerospace – Process category: the Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM was awarded together with the partners of the "SAUBER 4.0" project. The trade fair presentation at JEC WORLD 2026 will focus on innovative automation solutions for adhesive bonding, assembly and processing of large lightweight structures on a 1:1 scale for the aerospace, wind energy systems, commercial vehicles, rail vehicles and agricultural sectors as well as advanced training in the context of adhesive bonding and fiber composite technology. March 10-12, Paris, joint stand Composites United e.V. l Hall 6 l Booth Q 24.

Adhesive bonding technology is the predestined joining method for high-rate production of fiber composite components in order to meet current and upcoming industrial requirements for targeted lightweight construction. Consistent and adaptive automation of these adhesive bonding processes will become increasingly important in the future due to the growing shortage of skilled workers. At the same time, the special training of qualified personnel in both adhesive bonding technology and fiber composite technology is essential.

Here, composite materials have high requirements for adhesive bonding processes. Exact knowledge of the joining situation and the right choice between paste adhesives and adhesive films are crucial. Specially developed R&D solutions from Fraunhofer IFAM – such as digital gap measurement, adaptive gap filling and automated application processes for paste adhesives and adhesive films – enable high-precision, resilient and cost-efficient adhesive bonding processes for the most demanding composite structures and increase productivity at the same time.

Adhesive bonding technology as enabler of lightweight construction

Adhesives and sealants enable the efficient combination of fiber-reinforced plastics (FRP) with metals and other lightweight materials. In addition to force transmission, they perform tasks such as gap compensation, sealing and edge sealing. With increasing quality and documentation requirements, manual processes are reaching their limits; automated solutions, by contrast, reduce error rates and costs while enhancing quality.

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Automated vacuum suction blasting – the robotic, abrasive FRP surface pre-treatment

Vacuum suction blasting is an automated and clean process developed by Fraunhofer IFAM for removing and roughening of surfaces to create adhesion before bonding. The direct suction of the blasting particles creates a cleaned, residue-free surface. The process enables simultaneous pre-treatment and activation of surfaces and can also be used as a removal method of individual FRP layers for scarfing for repairs.

www.ifam.fraunhofer.de/en/technologies/abrasive-pre-treatment-vacuum-suction-blasting.html

Gap determination as basis for low-stress joining

Composite structures often have considerable shape and position tolerances. Standardized, mostly manual, compensation methods frequently fail to address this. A 3D surface measurement of the components generates point clouds from which the local joining gap geometry can be determined by means of coordinate transformation and virtual joining. The resulting gap map serves as basis for planning specific filling strategies, minimizing stresses and optimizing the material quantity – even for very large and complex assemblies.

www.ifam.fraunhofer.de/en/technologies/adaptive-gap-measurement.html

Automated application of paste adhesives

Pasty one- and two-component adhesives are suitable for individual gap compensation. Specifically developed, robot-assisted dispensing systems enable precise volume application along complex component geometries. Agile applications can be realized depending on viscosity, ambient conditions and component characteristics. In combination with gap measurement, adhesive beads can be varied locally to achieve defined layer thicknesses and low-stress joining.

www.ifam.fraunhofer.de/en/technologies/application-adhesives-sealants.html

Precise application of adhesive films

Post-curing adhesive films offer predefined layer thicknesses and highly reproducible mechanical properties. Robot-guided deposition heads developed in Stade take care of cutting, liner removal, application pressure and, if necessary, thermal activation. For varying gap dimensions, adhesive films can be applied in multiple layers or in a patch process, whereby the previously determined gap geometry specifies the number and position of the sections. In this way, even curved fiber composite structures can be joined over a large area in a material-saving and high-quality manner.

www.ifam.fraunhofer.de/en/technologies/automated-application-adhesive-tapes

Certifying training courses for adhesive bonding and fiber composite technology

In line with its internationally recognized advanced training courses in adhesive bonding technology, which have been established for more than 30 years, Fraunhofer IFAM also offers advanced training courses in the field of fiber reinforced plastic (FRP) materials, demonstrating how to design, handle and repair FRP. The training programs ensure qualification for technology transfer and are tailored to all company levels.

The offered courses comply with the requirements of the new DIN 35255 published in November 2025. It was developed to define requirements for the quality-oriented manufacture and repair of fiber reinforced components and to supplement the existing quality management system in accordance with ISO 9001. It closes the gap that composite products cannot be fully verified by subsequent tests, which often results in inadequate safety standards. This standard promotes error prevention and ensures both product and process safety throughout the entire life cycle of FRP components.

www.weiterbildung.ifam.fraunhofer.de/de/blog/din-35255-qualitaetsanforderungen-composite-prozesse.html

Fraunhofer IFAM honored – JEC Composites Innovation Award 2026 in the category Aerospace – Process

Together with CTC and Airbus and many other partners of the research project "Smart & Sustainable RTM 4.0 – SAUBER 4.0" (funded by Niedersächsisches Ministerium für Wirtschaft, Verkehr und Bauen as well as NBank – Investitions- und Förderbank Niedersachsen), Fraunhofer IFAM was awarded the prize in Paris on January 12, 2026.

The new induction heating simulation model developed by Fraunhofer IFAM, which enables the use of resin transfer molding (RTM) tools made of Invar in the production of fiber composite components instead of expensive autoclaves for curing, increases the production efficiency of the components and reduces costs.

Predictive modeling is used to optimize the positioning of the heating devices for homogenic temperature distribution during the curing of the components and is supported by advanced simulation of the fiber composite components and fast-curing technologies from Fraunhofer IFAM. This enables higher efficiency for high-rate production, cost reduction through RTM instead of autoclave, accelerated planning through predictive modeling and process simulation as well as enhanced quality assurance through real-time sensor data and analytics.

In addition, Electrical Capacitance Tomography (ECT) was used for the first time as a comprehensive inline method for analyzing the mixing quality of resins relevant to aerospace production. This advanced sensor technology enables real-time insights into complex mixing processes, significantly improving process transparency and setting a new benchmark for data-driven quality assurance in manufacturing. The vision is to integrate ECT directly into production, demonstrating how innovation, digitalization and smart analytics can shape the future of advanced materials processing.

These processes are not only of interest for the production of aircraft fuselages, but also for wind turbine rotor blades, cryogenic hydrogen tanks as well as terrestrial and maritime vehicles, for example.

www.jec-world.events/program/innovation-awards
https://journals.sagepub.com/doi/10.1177/14644207241270761

Further Information

- **Website**
  www.ifam.fraunhofer.de/en/stade
  www.weiterbildung.ifam.fraunhofer.de/en/overview/training-centers-ifam.html
- **Flyer**
  https://s.fhg.de/7wp
- **Trade fair**
  Find out more – visit us at JEC WORLD 2026 in Paris from March 10 to 12, Hall 6, Booth Q 24 (joint booth of Composites United e.V.).

Photos

www.ifam.fraunhofer.de/en/Press_Releases/Downloads.html

Figure 1 l Caption
Automated adhesive gap measurement and volumetric dosing with sensor-based real-time control on aircraft window frames using lightweight robots (© Fraunhofer IFAM).

Figure 2 l Caption
Automated dosing process for the gap-precise application of a paste adhesive material to a rudder hinge for tolerance compensation (© Fraunhofer IFAM).

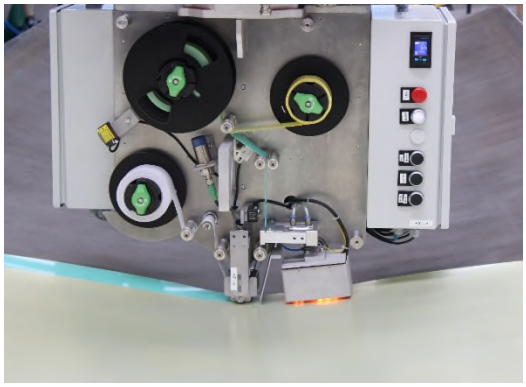

Figure 3 l Caption
Automated adhesive film application in an aircraft skin (© Fraunhofer IFAM).