An innovative laser decoating for hybrid components

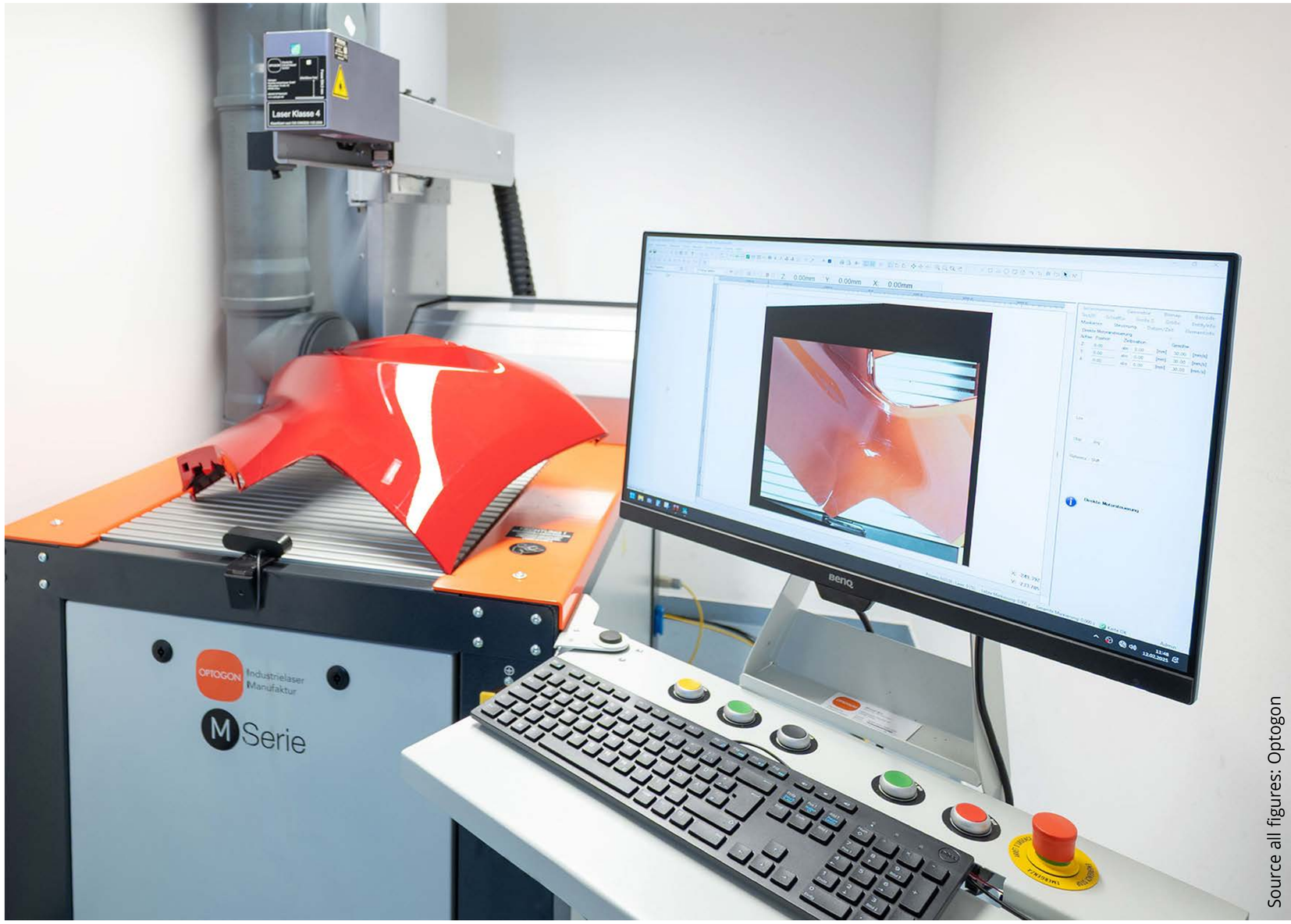
Ansbach University of Applied Sciences claims revolution in recycling

A new high-tech laser system can process large, complex 3D components efficiently. The principle is as simple as it is ingenious: the paint is dissolved by laser and can be removed like a film – residue-free and without harmful substances. An innovation with great potential for the circular economy.

The plastics processing laboratory at Ansbach University of Applied Sciences is conducting research into the efficient separation of paint and hybrid components – a key technology for sustainable recycling. The comparison of different processes shows: Laser decoating is precise, economical and environmentally friendly.

Research focus: Recycling of hybrid components

Professor Alexandru Sover and Markus Zink are active in teaching and research in the field of materials science, with a particular focus on plastics technology, its processing and testing. The plastics processing laboratory of the faculty of engineering is excellently equipped and offers a wide range of equipment – from plastic extruders, thermoforming machines, 3D printers, shredders and compounders to various analytical devices for characterizing plastics (including DSC, DMA) and test equipment for determining mechanical properties.



Source all figures: Optogon

Fig. 1 The computer screen shows a live camera preview of the hybrid component directly at the Optogon M Serie laser: precise and large-area laser decoating using automatic focus interpolation

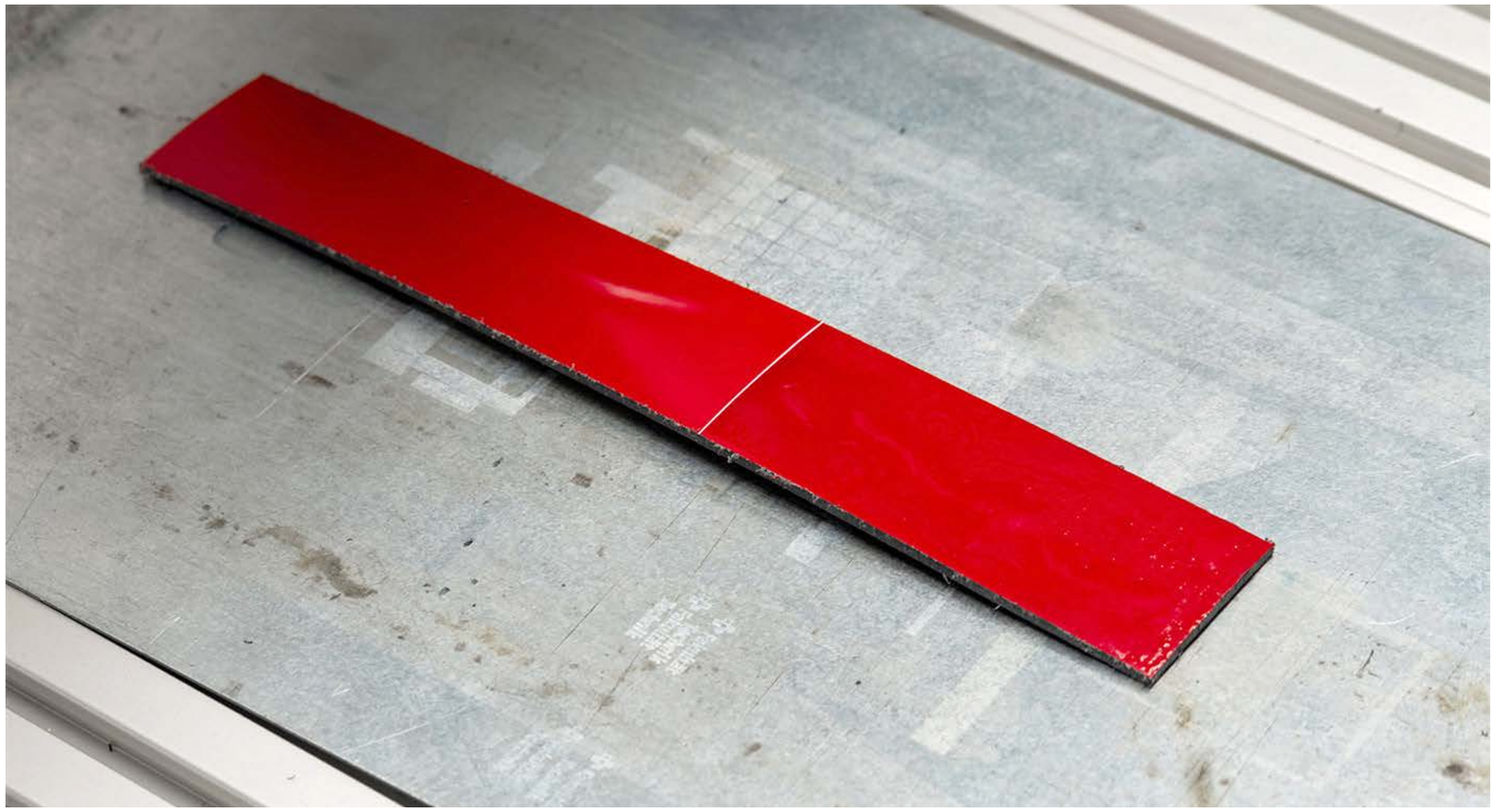


Fig. 2 A simple but ingenious process: the paint is separated from the substrate by laser, whereby a slight color change (right) becomes visible

The laboratory is available to students as part of their practical courses and dissertations. At the beginning of the year, it was also expanded to include a state-of-the-art laser system.

The research laboratory collaborates with industry and research partners and investigates application-oriented problems such as material contamination. Prof Sover explains: “The questions that industrial partners ask us concern production in relation to plastics and their processes. We carry out extensive investigations and research projects in our laboratory and provide support in the search for causes and solutions.” Particular attention is paid to the characterization of materials and the recycling of plastics.

Material-oriented recycling requires separation of paint and plastics

The recycling of plastics requires a high degree of purity of the base materials. Although plastic components and the paint are both made of plastics, they are completely different. While the base material is usually made of thermoplastic and can be easily recycled, the paint is a thermoset that must be fed into a different recycling process.

The lacquer is used to protect the products on one hand and to improve their appearance on the other. Very large quantities of painted products have to be recycled at the end of their life cycle, and the number of painted products is constantly increasing. Manufacturers and recycling companies face major challenges, as there is still no technology that enables hybrid components to be separated efficiently and in an environmentally friendly manner.

Hochschule Ansbach

Ansbach University of Applied Sciences is a popular universities in Germany and was once again recognized in the StudyCheck Awards 2025. Around 4,000 students are enrolled on 19 bachelor’s and 17 master’s degree programs. The university combines three faculties – Business, Engineering and Media – and offers optimal conditions for teaching and research with modern laboratories and an efficient infrastructure.

www.hs-ansbach.de

OPTOGON

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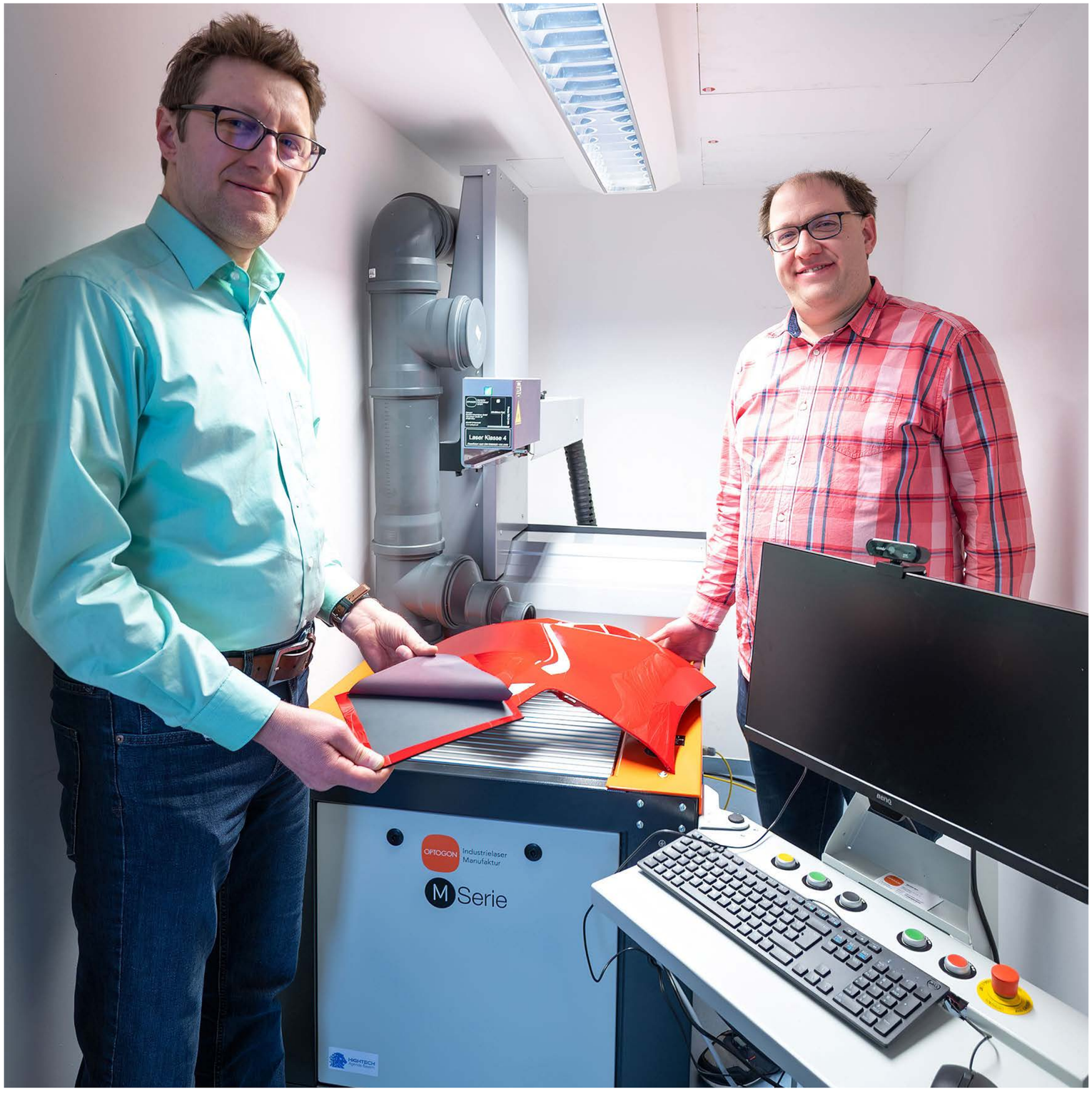

Fig. 3 Prof Dr-Ing Alexandru Sover (l) and MEng Markus Zink at the open laser system by Optogon, Prof Sover with the processed sample: the paint was successfully separated from the plastic substrate and can be peeled off

Comparison of different decoating processes

The research laboratory carried out tests with various decoating technologies. Processes such as chemical decoating, abrasive decoating with blasting media such as dry ice, sand or glass beads, decoating with high-pressure water and the use of laser technology were investigated.

- Chemical stripping: A standard process that is relatively inexpensive, but has many disadvantages. Employees are exposed to toxic substances and environmentally hazardous vapors are produced, as well as problematic logistics and disposal processes.
- Abrasive methods: Blasting media such as sand or glass beads must be disposed of as hazardous waste and there is a risk that the base material will be damaged.
- Laser decoating: The studies with laser showed promising results. The procedure is efficient, sustainable and avoids health risks.

Decoating with high-pressure water has proven to be difficult from the start. Coated components in the automotive industry in particular are tested for everyday stresses such as high-speed driving and regular use of car washes and optimized accordingly. The coating should provide effective protection and not peel off.

Fig. 4 On the left, the hybrid component: a thermoplastic as a base material with a thermoset paint layer that was successfully removed by laser. The paint can be easily removed after the laser process. In the middle the removed paint, on the right the recycled, granulated thermoplastic – ready for reuse

The advantages of laser decoating

Prof Sover has already gained experience with laser processing of plastics in the past. He praises the simple handling, effectiveness and sustainable processing.

"What does the laser need? The laser and filter system need electricity. That's it," he says. Very positive results were achieved with an existing laser in the laboratory.

In a research project, the investigations were extended and a wide variety of materials were tested with different types of paint. This led to reliable results, and the positive results generated interest in industry, resulting in new collaborations.

New challenges in the recycling industry

"There was a lot of interest. We received many components in different sizes and with distinctive three-dimensional geometries and highly curved surfaces, such as bumpers and spoilers."

Sover and Zink identified a further need in addition to the recycling of hybrid components:

In the automotive industry, many painted components become rejects (up to 15 %) even with the smallest defect in the paint layer. The requirements for exposed components such as bumpers and spoilers are extremely high in the automotive industry. The production of these hybrid components is often very complex and expensive, with the paint layer only accounting for around 2 % of the total weight of the hybrid component.

"When the customer takes delivery of a car for a five or six-figure sum, it has to be perfect. A speck of dust under the paint layer of a bumper means rejects," Sover says.

Decoating with a laser and subsequent repainting could make economic sense here.

High requirements for the new laser system

The previous laser system in the laboratory was not suitable for processing large three-dimensional components. The installation space was limited and the disadvantage that only flat parts could be decoated made it necessary to purchase a new laser system.

The new laser system should be able to process large and very large components as well as three-dimensional components such as exterior mirror covers, bumpers, spoilers and similar components. In addition, the performance must be sufficiently high to meet the economic aspect.

The search for a suitable partner took place online and at trade fairs. Several manufacturers were contacted before the choice fell on a flexible and open laser system that met the requirements. The system enables the seamless processing of very large surfaces and is also suitable for free-form and 3D surfaces – without manual axis adjustment. Automatic focus interpolation compensates height differences and ensures a precise laser focus on the component surface.

The paint can then be peeled off

The new system was launched in January 2025 after a one-day training course. The process is as simple as it is ingenious: the paint is separated from the substrate with the laser and can then be removed like a film. No additives are required and the process is very fast and efficient in many cases. As the paint is not burnt, there is virtually no pollution. Professor Sover explains: "Modern and resistant paint systems are increasingly being used in painting technology. As a result, there are painted products that are difficult or almost impossible to strip using laser technology." Nevertheless, numerous coating systems have already been successfully tested on different substrates.

The 3D processing of components with the laser is new to the laboratory and the team is currently working on optimizing the process. Sover explains: "We want to reproduce the entire paint stripping process: from the preparation of the component to the laser removal and the corresponding air filter systems and cleaning of the stripped components."

Plastics manufacturers are obliged to recycle their products and dispose them properly, which confronts them with new challenges. Another aspect is to involve manufacturers from the very beginning in the development of coatings that are suitable for the recycling process of hybrid components.

"At the moment, manufacturers are contacting us with finished products and components and we are developing a solution for recycling and separating the materials. We want to sensitize the industry to recycling. We are already in discussion with manufacturers about developing new coatings that include recycling right from the start," Sover says.

The future of laser decoating

Another advantage of laser decoating, according to Sover, is that the laser systems can be easily automated. Integration into existing production processes can be implemented very easily.

The process is future-proof, with the focus on cost-effectiveness.

The team has already received initial inquiries for this topic from a wide range of sectors – from the automotive industry, the aviation industry and the household and furniture industry, which is producing more and more painted components.

Prof Sover summarizes: "We want to progress scientifically. The ideas are universally applicable as far as hybrid components are concerned. We are confident that we can bring this process to industry and significantly improve recycling efficiency."

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Text and photographs: Thilo von Grafenstein, www.grafenstein.design, on behalf of Optogon Industrielaser Manufaktur.

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