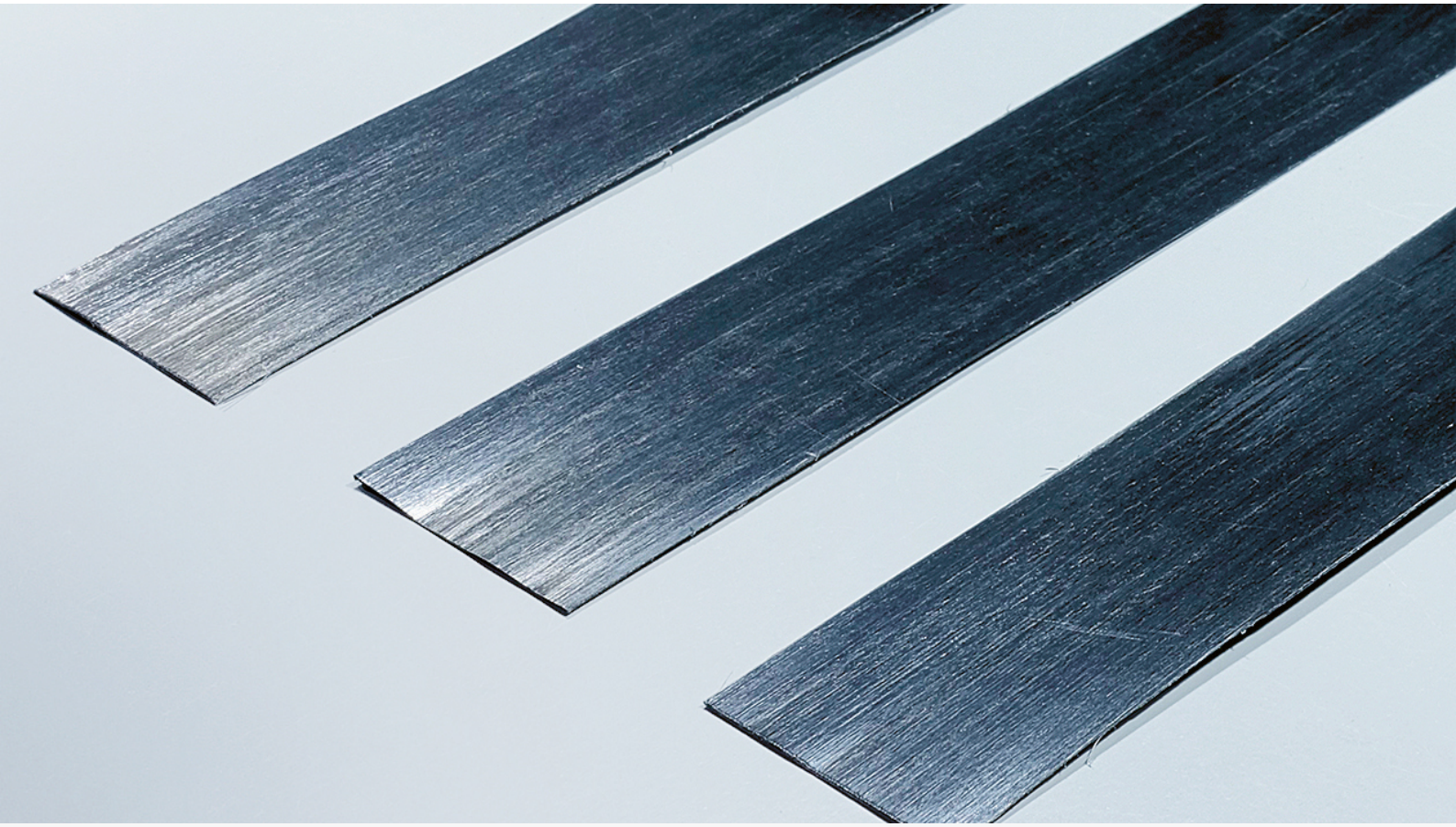

TABASKO: Stable as Steel

07/05/2025 TABASKO (from the German for 'tape-based carbon-fiber lightweight construction') can reduce the use of plastic materials; the process developed by Porsche Engineering also allows the use of post-consumer recycled material. This makes vehicle construction a bit more sustainable.

Lightweight construction is becoming increasingly important because safety technology, electronics, and increasing demands of comfort tend to increase the weight of vehicles. In addition, we are experiencing an ongoing switch to electric cars, which are usually heavier than vehicles with an internal combustion engine. To reduce weight elsewhere, the plastic polypropylene—known as PP for short—is used in the interior in most cases. It is comparatively inexpensive, easy to process, and can also be recycled relatively well. But it also has disadvantages: "Rigidity and heat resistance do not count among the positive properties of polypropylene," explains Michael Johann, Specialist Project Manager for Body System Development. "Glass fiber is typically added to improve it."

This glass-fiber-reinforced plastic is called PP-GFx. Many components of Porsche vehicles are made of it. Mr. Johann is fascinated by the topic of lightweight construction. Together with his team at Porsche Engineering, he develops series-production plastic components, for example for the roof lining of the Porsche Cayenne and for the trims on columns and doors. He and his colleagues are constantly

evaluating new design principles that can be used to combine maximum strength and minimum weight. This led to the birth of TABASKO, the name of which comes from the German for 'tape-based carbon-fiber lightweight construction'.

Michael Johann's vision was to achieve better material properties at a lower weight. Carbon was the material considered, because its fibers are made of almost pure carbon and are as strong as steel, but up to 80 percent lighter. However, the material is very expensive. Embedded in a thin polypropylene film, it becomes an extraordinary material: Carbon fiber tape, which opens up completely new possibilities. Mr. Johann's hypothesis was that if the PP currently used until now were reinforced with a few continuous carbon fiber tapes, the wall thicknesses of components could be reduced without losing stability. The reduced quantity of PP-GFx required could offset the additional costs of carbon. Calculations proved that his hypothesis was right. To illustrate the working principle, Mr. Johann went ahead and ironed carbon-fiber tapes onto PPGFx test pieces and carried out the first bending tests with a mallet as a weight. The idea passed its first rough test.

In the next step, Johann set out to find partners to implement his idea. He benefited from the close cooperation between Porsche Engineering and Porsche AG: Materials expert Frank Häusler was exactly the right person to contact—and was delighted with the concept. Many ideas cross Häusler's desk, and his task is to assess their potential for a possible series production. "Unfortunately, most proposals do not satisfy our demands," says Häusler. "In this case, it was different: The concept made a mature impression. It was well thought out, had figures to back it up, and was plausible." Johann and Häusler received support from Dr. Hubert Stadtfeld, Project Manager for Lightweight Construction in Production Development for Strategic Product and Process Design at Porsche AG, who also assumed patronage of the concept. In order to obtain a budget for prototype implementation and validation for this concept, an innovation project was registered in the production department.

Successful prototype tests

In search of a suitable component for a prototype, the developers encountered the luggage tray of the Porsche Taycan. It is made of glass-fiber-reinforced plastic as standard and is manufactured in an injection molding process. The series component is 65 centimeters in length, 120 centimeters in width, and 52 centimeters in height, making it comparatively large.

"If tests on a large component are successful, then the results can also be applied to smaller components," explains Johann. TABASKO now had to prove itself under professional conditions: Häusler and Johann produced a luggage tray made of 1.8-millimeter thick PP-GFx, reinforced with 0.2-millimeter thin carbon-fiber tape.

The special feature was that the percentage of carbon by weight only totaled one percent, because the continuous fibers are placed exactly at the points here they achieve the greatest effect. Three tests were carried out with the prototypes: First, a comparative punch test was carried out on both a current series-production luggage tray and on its counterpart made of TABASKO material. In the process, a

punch pressed onto the bottom of the tray from above with increasing force in order to measure how much it bent.

The result: For TABASKO, a 66 percent higher compressive force was required to achieve the same maximum permissible deflection—and the luggage tray was, at the same time, 15 percent lighter than the series-production luggage tray. The second test was a series of trials consisting of what are called four-point bending tests. To do this, the developers cut rectangular strips out of the bottom surface of the luggage tray. The strips were then bent from both sides, each at room temperature and at 90 degrees Celsius.

“Clearly visible was that the rigidity of the tape-reinforced samples was higher by a factor of 2.5 to 2.8,” explains Häusler. The third test determined the impact strength. This test is appropriate when foam injection molding is used, as it is in the manufacture of the TABASKO material.

“In doing so, this results in foam structures that could cause the impact resistance of the base material to suffer,” says Mr. Johann. The test showed that, in combination with tape on the tensile side, the impact resistance is approximately five times better. TABASKO proved its superiority here as well.

“Now came the most important step: Transfer to series production,” as Häusler reports. “The question was: How can you produce up to 80,000 parts a year— in a fully automated way and cost-neutral compared to today’s process?”

Johann, Häusler, and Stadtfeld worked together with a supplier and managed to develop a production process using conventional automated injection molding machines. “The tapes are inserted into the forming tools by means of a handling device and attached to either the top or the bottom of the component using vacuum channels,” explains Mr. Johann. “In principle, new machines or processes are not required, which is extremely advantageous for production costs.” In the meantime, six patents have been filed for TABASKO, for the material structure, the production method, the tool technology, and the process sequence in series production.

. The project proved that, thanks to TABASKO, components can have their weight significantly reduced, thereby allowing resources to be saved. In addition, recycled plastics are suitable for component production. This is important, because according to an EU legislative proposal, at least 25 percent post-consumer recycled (PCR) material should be used in all vehicle types from 2031. Recycled PP is obtained from old pipes, furniture, or bottles. However, the recycled material is not nearly as rigid as the original raw material. “We could compensate for this reduced rigidity by increasing the share of carbon fibers accordingly,” explains Mr. Johann.

The big advantage of TABASKO is that modifications of that nature could be easily integrated into the industrial manufacturing process. The preliminary development of the new material has meanwhile been completed. The technical department responsible for the luggage trays has already signaled interest in series production for future vehicles. Discussions are currently ongoing with the plastic suppliers. “It’s like when you let a child take its first steps into independence,” says Mr. Johann. “As a

pre-developer, you've done all you can." And, like a child, TABASKO is only at the beginning of its development opportunities.

Info

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