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TECHNOLOGICAL INNOVATIONS – BUGATTI PRINTS TRIM COVERS MADE OF TITANIUM

Bugatti hyper sports cars such as Pur Sport and Super Sport 300+ make use of 3D printing.

As fine and accurate as a spider's web, yet as stable as a solid steel structure and extremely light: components created by means of 3D printing offer a range of benefits, but they are very complex to produce. This is why they are mostly used in the aerospace industry.
However, this production technology is also highly beneficial to the French luxury manufacturer Bugatti. The hyper sports cars Chiron Pur Sport and Chiron Super Sport 300+ are extreme in all aspects. That’s why they make use of vehicle parts that are produced using a 3D printer.

''Bugatti is all about French-style luxury and exceptional vehicles, but it's a brand that stands for innovative technology, too,'' says Stephan Winkelmann, President of Bugatti. ''In addition to the iconic 8.0 litre 16-cylinder engine with 1,500 PS, technical innovation is just as much part of our brand essence — such as our components made of titanium or a special alloy that are produced by 3D printing.'' Bugatti is in fact continuing a long-standing tradition here: the company founder Ettore Bugatti himself developed unique vehicles using groundbreaking technologies. His inventions include lightweight aluminium wheels and a hollow front axle.

As the only company in the automotive industry, Bugatti uses 3D printing to produce tailpipe trim covers made of titanium for its newly developed hyper sports car. The cover is the first visible part to be 3D-printed in metal that is officially approved for use on the roads. The approximately 22-centimetre long, 48-centimetre wide and 13-centimetre high trim cover at the rear of the Chiron Pur Sport weighs just 1,85 kilograms including grille and bracket — some 1.2 kilograms less than the cover on the Chiron.

Four 400-watt lasers simultaneously print titanium to produce the component — the wall thickness at the thinnest point is just 0.4 millimetres. Approximately 4,200 layers of metal powder are stacked on each other and are firmly fused together. ''Wherever possible we designed the trim cover for the Chiron Pur Sport with a single layer so as to further reduce weight,'' says Nils Weimann, Head of Body Development at Bugatti. ''The minimal material thickness in multi-layer areas is made possible by its so-called lattice structure — where the cavity is filled with numerous filigree struts. In this way, the walls provide stable support for each other during the construction process — enabling minimal use of material. We use a bionic honeycomb structure in the single-layer area to increase the surface rigidity of the walls. Even large components gain a high degree of surface stiffness,'' explains Weimann. Yet the filigree cover is still able to withstand temperatures of over 650 degrees Celsius. This is because the outer wall is double-layered for thermal insulation. In this way, the cover protects surrounding components from excessive heat dissipation under full engine load. At the same time, fresh air around the cover cools the component.

BUGATTI HAS BEEN USING 3D PRINTING SINCE 2018

This is not the first time that Bugatti has developed components using 3D printing. The engineers have been producing this special trim cover for the Chiron Sport and Divo since 2018. The 2019 editions ''La Voiture Noire'', the ultimate Grand Tourisme for Bugatti enthusiasts, and the Centodieci, a reinterpretation of the EB110, also make use of this printed component. The material Inconel 718 — a particularly heat-resistant, hard and light nickel-chrome alloy — is used to produce a 53-centimetre wide and 22-centimetre long trim cover for the Chiron Sport. This material is otherwise used in gas turbines, aircraft turbine blades, space ships and transport rocket engines. Aluminium would melt here.

The trim cover of the Chiron Sport covers four tailpipes of the six-branch exhaust system at the rear, offering not just visual benefits but technical advantages, too: with its large and sturdy tubes, it helps conduct the waste heat from the hot exhaust gases away from the rear so that no heat accumulation occurs. With 1,500 PS and a top speed of up to 420 km/h, it is these details that make the car a genuine Bugatti and a perfect hyper sports car. Another advantage: at 2.2 kilograms, the printed part weighs 800 grams less than a normal cover. True to Ettore Bugatti's motto ''weight is the enemy'', Bugatti always looks at each individual component to find ways to reduce weight.

3D PRINTING OFFERS SEVERAL ADVANTAGES

With 3D printing carried out using a special laser printing system, one or more lasers successively melt a thin layer of powder with a thickness of three to four µ. ''The advantage of the 3D printing process lies in the geometric shapes that are possible. It is possible to create very finely wrought, complex forms which would tear if made using other techniques such as forging or forming,'' says Nils Weimann. This is an ideal production method for Bugatti: there are no tool costs, production is comparatively fast and individual adjustments to the shape are easily possible. As a result, organic geometries can be developed as if from the world of plants — there are virtually no limits.

It takes several days to print the exhaust trim cover. After printing with the material Inconel 718, material testers scan the component in a computer tomograph (CT) to detect any misprints with air inclusions. In the case of the titanium printing for the Chiron Pur Sport and Chiron Super Sport 300+, test engineers measure the component optically using the 3D process. Thanks to the extremely thin-walled design, air inclusions of any relevant size can already be detected on the outside. The cover blank of the Chiron Sport is then finely blasted with corundum and elegant protection is applied in the form of a high-temperature black ceramic paint finish. The titanium trim covers of the Chiron Pur Sport and Super Sport 300+ retain their elegant matt titanium look. Every component undergoes another check — only perfect trim covers are then fitted.

With the new trim covers, the exhaust systems of the hyper sports cars acquire even more harmonious contours, a more elegant design, and functional styling — all in keeping with the ideology of Ettore Bugatti:

An automobile component must be technically perfect. But it must be elegant and beautiful, too.

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[3] Bolide: Not subject to Directive 1999/94/EC, as it is a racing vehicle not intended for use on public roads.

[3] Centodieci: WLTP fuel consumption, l/100 km: low phase 40.3 / medium phase 22.2 / high phase 17.9 / extra high phase 17.1 / combined 21.5; CO2 emissions combined, g / km: NA; efficiency class: G

[3] Chiron Pur Sport: WLTP fuel consumption, l/100 km: low phase 44.6 / medium phase 24.8 / high phase 21.3 / extra high phase 21.6 / combined 25.2; CO2 emissions combined, g/km: 572; efficiency class: G