

Lamborghini: 30 years of carbon fibre

Amanda Jacob visited Lamborghini's headquarters in Sant'Agata Bolognese, Italy, to learn about this famous manufacturer of extreme supercars' expertise in carbon fibre composites.

Lamborghini is celebrating its 50th anniversary this year, and it boasts around 30 years of experience with composite materials and production technologies.

In 1983, engineers in Sant'Agata built a prototype of the the famous Countach

model using an occupant cell made entirely from carbon fibre reinforced plastic (CFRP). The car underwent extensive test driving but met its end in a crash test. Series production of this vehicle was not feasible at the time and it was in 1985 that the first components made from glass fibre

reinforced plastics (GRP) made it into series production in the front hood and engine cover of the Countach Quattrovalvole.

In 1990, the introduction of the Diablo marked Lamborghini's first significant application of carbon fibre composite.



Automobili Lamborghini is one of Italy's most famous brands. The company was founded by Ferruccio Lamborghini in Sant'Agata Bolognese in May 1963.



The Aventador (top picture), launched in 2011, is built around a carbon fibre reinforced plastic monocoque (lower picture), manufactured in-house at Sant'Agata by Lamborghini.

It was used in virtually all the exterior panels and an underbody/tunnel component made from CFRP provided stiffening for the tubular steel structure. The proportion of glass and carbon fibre composite used grew substantially in the 1993 Diablo Roadster – with the entire exterior skin, the hard top and the spoiler made from reinforced plastic.

The 2001 Murciélago brought further developments. In this model the centre tunnel, substantial parts of the underbody and the wheel arches were made from CFRP and provided additional stiffening to the tubular steel structure. With the Murciélago Roadster came further composite sub-assemblies, such as the structural framework around the driveline.

In the limited-edition Reventón and Reventón Roadster from 2008 and 2009 all exterior panels and significant parts of the bodysell structure were produced in CFRP.

Current production

The company is currently producing the Gallardo and Aventador models at Sant'Agata.

The Gallardo LP 570-4 Superleggera and Gallardo LP 570-4 Spyder Performante demonstrate targeted application of carbon fibre – on the bodysell and in the interior – on an aluminium structure. Lamborghini claims that the engine bonnet on these models is the automotive industry's largest carbon fibre component with Class A surface finish.

The Aventador, launched in 2011, takes Lamborghini's composites expertise even further, with its first CFRP monocoque structure. Lamborghini reports that the Aventador is the only production car with a full CFRP monocoque (tub and roof), and that it is the only company to manufacture a CFRP monocoque for a production vehicle in-house. It is produced at the company's Sant'Agata composite production facility (*more of this in a separate article*).

When talking about carbon fibre, it's also important to mention the Sesto Elemento concept car, unveiled at the 2010 Paris Auto Show. This is Lamborghini's carbon fibre technology demonstrator. Like the Aventador this car is based around a CFRP monocoque passenger cell, but this time manufactured in a one-shot process. The front subframe (incorporating the suspension points) and the crash boxes, exterior panels, major suspension components (control arms), the wheels and the drive shaft are also made of CFRP.

Partnerships

Following an unsettled period characterised by a number of changes in ownership, Lamborghini was acquired by Audi (part of the Volkswagen Group) in 1998. Like Lamborghini, Audi is also an expert in



The Sesto Elemento concept car demonstrates Lamborghini latest carbon fibre technologies.

lightweight engineering, and particularly in the high-volume application of aluminium, which Lamborghini uses in the Gallardo's space frame. In the area of composites Audi and Lamborghini exchange their knowledge.

Automotive technologies on display at COMPOSITES EUROPE 2013

My visit to Lamborghini was part of a press trip organised by Reed Exhibitions, the organiser of the COMPOSITES EUROPE trade show (www.composites-europe.com). The five largest carbon fibre producers – SGL, Toho Tenax, Mitsubishi Rayon, Toray and Zoltek – will exhibit at COMPOSITES EUROPE 2013 in Stuttgart on 17-19 September. The accompanying COMPOSITES Forum and AVK International Conference will also overview composites manufacturing trends in the automotive industry.

Lamborghini is also working with a number of other partners in its development of carbon fibre technology, including Boeing, the University of Washington and golf equipment manufacturer Callaway.

The Forged Composite® technology employed in the Sesto Elemento was developed in partnership with Callaway, which also uses the material to produce golf club heads.

The partnership with Boeing and the University of Washington in Seattle was signed in 2010. Lamborghini provides the Advanced Composite Structures Laboratory (ACSL) at the University of Washington with substantial funding, supporting long-term research work. Topics include repair technologies for CFRP structures, and material analysis and simulation. Crash behaviour of composite structures is another core project.

The future

Following its acquisition by Audi Lamborghini has entered a phase of stability and growth. Since 2000 the company has doubled its workforce to more than 900, tripled its number of dealers worldwide to 125, and it's selling more cars. A new model expected to launch in 2017 is currently in the pipeline.

Lamborghini has invested heavily in carbon fibre composite and intends to stay at the forefront of the technology. Stephan Winkelmann, President and CEO of Automobili Lamborghini, has stated that every new Lamborghini will make use of carbon fibre technology for optimum weight reduction. The objective is to improve the power-to-weight ratio of the car (to improve the driving experience in terms of handling and acceleration), and because carbon dioxide (CO₂) emissions are relevant for super sports cars too! ■