

New Lightweight Springs in 2015 Audi A6 Avant

Audi put new lightweight suspension springs made of glass fiber-reinforced polymer (GFRP) in the 2015 Audi A6 Avant Ultra. Since these new springs won't require shot peening, the success of components made from composites should be noted by the shot peening industry.

THE GFRP SPRING, which Audi developed in collaboration with the Sogefi Group, even looks different than a steel spring. It is light green, the fiber strand is thicker than the wire of a steel spring and it has a slightly larger overall diameter with a lower number of coils.

Most importantly, however, it is some 40 percent lighter. Whereas a steel spring for an upper mid-size model weighs nearly 2.7 kilograms (6.0 lb), a GFRP spring with the same properties weighs just approximately 1.6 kilograms (3.5 lb). Four GFRP suspension springs together reduce the weight by roughly 4.4 kilograms (9.7 lb); half of which pertains to the unsprung mass. “The

GFRP springs save weight at a crucial location in the chassis system. We are therefore making driving more precise and enhancing vibrational comfort,” said Dr. Ulrich Hackenberg, Member of the Board of Management for Technical Development at AudiAG.

The core of the springs consists of long glass fibers twisted together and impregnated with epoxy resin. A machine wraps additional fibers around this core — which is only a few millimeters in diameter — at alternating angles of plus and minus 45 degrees to the longitudinal axis. These tension and compression plies mutually support one another to optimally absorb the stresses acting on the component. In the last production step, the blank is cured in an oven at temperatures of over 100° C (212° F).

The GFRP springs can be precisely tuned to their respective task, and the material exhibits outstanding properties. It does not corrode, even after stone chipping, and is impervious to chemicals such as wheel cleaners. Last, but not least, production requires far less energy than the production of steel springs. Energy efficiency is crucial because the springs were used in the 2015 Audi A6 Avant Ultra—this Audi is marketed in the United Kingdom where it's sold with



The composite spring, on the left, is thicker than the wire of a metal spring with fewer coils.

an EU6-compliant engine. The EU6 is an European emission standard that defines the acceptable limits for exhaust emissions of passenger vehicles sold in EU member states.

What is Glass Fiber-Reinforced Polymer?

GFRP is a versatile material used in construction and architectural products including columns, roofs, cornices, sculptures and cupolas. It was first developed in the 1930s and its many advantages have been exploited over the years. Its strength and durability became widely publicized in the demolition

of Disneyland's “House of the Future” in 1967—the wrecking ball simply bounced off the fiberglass walls of the building. Audi's announcement of their GFRP suspension springs is one of the product's most public debuts in the automotive industry.

GFRP and Shot Peening

Sogefi Group, an Italian automotive components OEM, jointly developed the GFRP springs with Audi. According to the company's website: “The coil springs industry for mass production applications is currently based on steel. Despite some weight reduction during the last 20 years, this material has reached its physical limits. Steel's manufacturing process is also labor intensive with high energy consumption for heat and surface treatment, shot-peening, etc.” These reasons inspired the Sogefi Group to invest in the development of a the GFRP coil spring.

Even though composites have advantages over metals, the biggest drawback is their high production cost. Given that manufacturers are always looking for faster and better ways to produce their goods, the composite industry is worth watching. ●