



FORD PERFORMANCE



Ford Performance and Carbon Revolution Offer Wide Range of Benefits Through Carbon Fiber Wheels

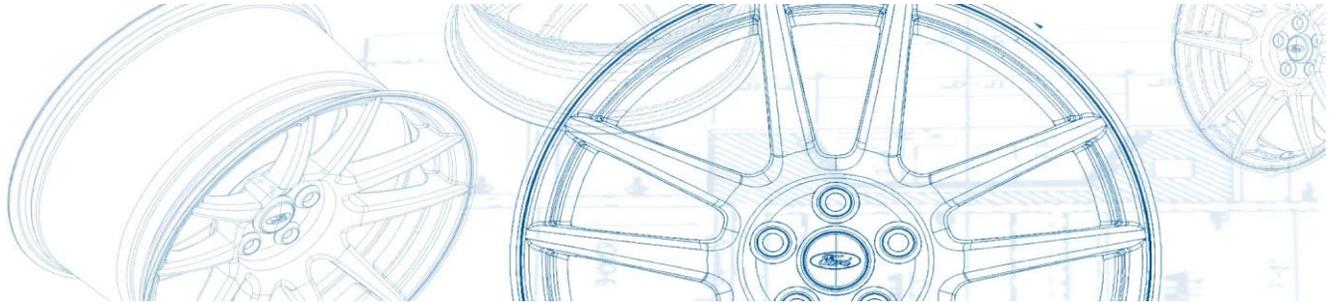
- Ford Performance and partner Carbon Revolution offer the first standard production original equipment manufacturer carbon fiber wheel for Shelby® GT350R Mustang; now, an optional carbon fiber wheel for all-new Ford GT will be available as well
- Ford Performance and Carbon Revolution continue to work closely in development of the most innovative carbon fiber wheels
- Benefits of carbon fiber go well beyond weight savings in Ford Performance vehicle applications – improving performance in terms of ride comfort and vehicle dynamics

The all-new Ford GT supercar will offer the most advanced carbon fiber wheels to date, with improved style and functionality over current lightweight wheels in the industry.

Ford Performance partnered with Carbon Revolution to benefit from its many years of experience with composite technology and work in aerospace and automotive design. The unique properties of carbon fiber – it's light, very strong and stiff – provide a remarkable performance improvement in both Shelby® GT350R Mustang and the all-new Ford GT supercar. Using cutting-edge computer modeling tools, composite structures are optimized to very precise specifications – ensuring carbon fiber wheels lead to an increase in acceleration, braking, vehicle dynamics performance and ride comfort, as well as a reduction in overall weight.

- **Acceleration and braking performance**
Less weight means less work, with lightweight wheels reducing the rotational inertia of the system while generating improved acceleration and deceleration.
- **Comfort**
While significantly lighter, carbon fiber wheels are able to maintain equivalent or superior stiffness. Carbon fiber's unique material properties allow the advanced material to damp vibration, which reduces road noise and provides greater refinement in terms of ride comfort.
- **Unsprung weight**
Carbon fiber wheels enhance the suspension's ability to maintain contact with the road surface – improving traction and driver control. Through a substantial reduction in wheel inertia, steering feel is sharper and chassis response is quicker – making the car more predictable and controllable.

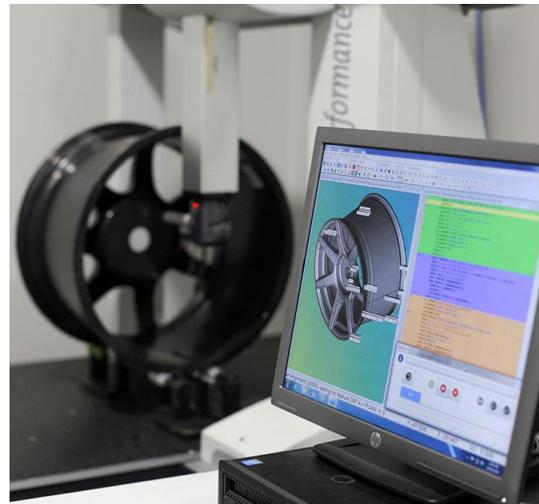




Development of original equipment manufacturer carbon fiber wheel

Both Ford Performance and Carbon Revolution employ virtual product development. Carbon Revolution runs computer models able to simulate wheel durability and stiffness. Manufacturing options can be investigated, as well as analysis of weight and moments of inertia to forecast wheel performance for Ford Performance. Once the final design concept has been selected, the wheel is optimized through the use of finite element analysis. This advanced tool – which is capable of modeling each individual carbon ply – makes it possible to simulate such demanding on-vehicle conditions as hard cornering or driving over a curb, while changing the carbon layup in real-time to enable a fully optimized structure for the given wheel design. The ultimate goal is to get the design right the first time to accelerate testing and validation. Testing is done before physical parts are created – saving time and money as prototyping and tooling is minimized, and the final product performs exactly as engineering intended.

- **Manufacturing**
Carbon Revolution employs a smart factory with a radio frequency identification quality tracking system. Each wheel is fitted with a radio frequency identification chip allowing it to be tracked throughout the manufacturing process and service life. This process ensures 100 percent part tracking, identification and verification of all material batches, processes, operators, processing data and end-of-line testing.



- **Raw material**
Carbon fiber has reshaped the world of aerospace and motorsports over the last decade. Now, it is being used to transform the auto industry by improving vehicle efficiency, comfort and control.

130 **10**

13x STRONGER

Carbon Fiber's tensile strength, the ability to withstand longitudinal stress, is 13x stronger than Aluminum

1/10 DIAMETER OF HUMAN HAIR

Each individual carbon fiber is 1/10th the diameter of a human hair, yet has tremendous strength





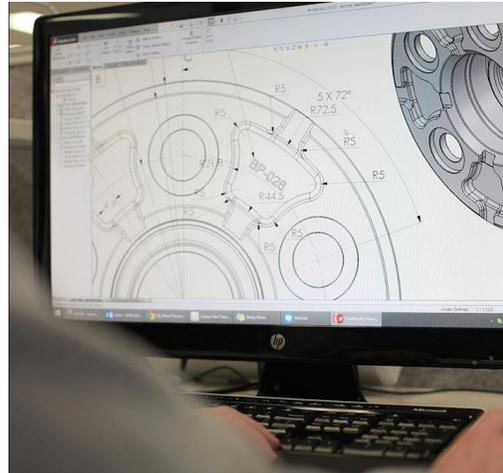
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Carbon Revolution employs a proprietary dry fiber manufacturing process that allows full control of fiber placement and material properties. It is also using next-generation carbon fiber materials to continue advancing its leading single-piece carbon fiber wheel technology.

- Fabrication

A proprietary, patented manufacturing process shapes and forms the carbon fiber into the complex internal structure of the wheel. Automated operations result in high-volume, precision fabrication of the carbon fiber preforms, which are then quality-checked and prepared for resin infusion.



- Infusion

Preformed carbon fiber components get injected with resin, then a barrage of computer checks and measurements are made using state-of-the-art instruments controlling temperatures, pressures and hundreds of other processing parameters. The one-piece carbon fiber wheel is then released for final machining and additional quality checks.

- Quality

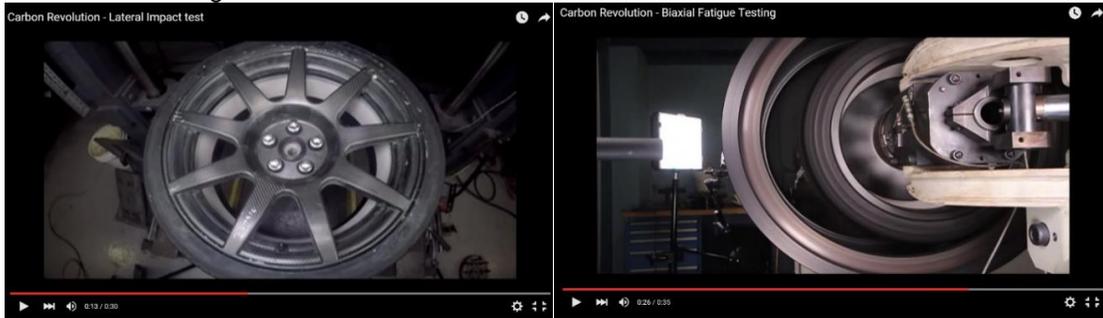
Wheels ready for final inspection are put through 181 additional checks and measured at 2,000 data points. Every wheel completes a three-dimensional CT X-ray scan and inspection after it is coated and prepared for shipping to the assembly location for Ford Performance. Every step in the quality process is tracked and logged by the radio frequency identification chip, and is highly repeatable and controllable – ensuring every wheel is set to the high original equipment manufacturer standards of Ford Performance.



- Testing

Carbon Revolution and Ford Performance subject their carbon fiber composite wheel to the highest testing standards to ensure strength and durability to last the life of the model the wheel is

designed for. Testing is focused in three general areas including impact testing, fatigue testing and vehicle testing.



Impact tests are designed to simulate impacts from potholes and curbs using a calibrated striker to verify the strength of the wheel design and quality of manufacturing. To ensure the one-piece carbon fiber wheels can go the distance, a bi-axial testing fixture is used for simulating any type of driving conditions to prove out the wheels for hundreds of thousands of miles. While testing in the lab has tremendous value in creating repeatable tests, real-world testing is the ultimate validation. Ford Performance conducts extensive vehicle testing for potholes and curb strikes, as well as durability testing to make sure the wheels meet original equipment manufacturer standards.

The highlight of vehicle validation is the Ford Performance track durability procedure that aims to test the entire vehicle at its handling limit on a road course for a customer-correlated life of recreational track days. The carbon fiber wheels must not only withstand the test, but show no degradation in dynamic performance at the end. This testing goes above and beyond typical passenger car validation, and aims to ensure performance enthusiasts take delivery of a highly capable vehicle that remains so throughout its life.