



## RAW MATERIAL

## CARBON FIBER

# WOVEN MAGIC

Invented in 1879, carbon fiber has become the 21st century's secret ingredient—it's in everything from batting helmets to violins.



### STARTED WITH EDISON

Thomas Edison stumbled upon a carbon-fiber precursor while experimenting with lightbulb filaments in 1879. He superheated splinters of bamboo and produced strands of carbon that could withstand high temperatures and conduct electricity. Physicist Roger Bacon expanded on this process in 1958, creating "whiskers" roughly 10 times the tensile strength and more than three times the stiffness of steel. Researchers eventually learned how to manufacture these carbon whiskers into a pliable weave, chemically bonding the fibers to substances like plastic to create strong composite materials.

### FIRE-BREWED

Modern CF is a far cry from Edison's filaments. Today, manufacturers start by chemically treating thermoplastics and spinning the resulting material into strands. From there, the strands are baked in a series of industrial furnaces reaching up to 3,000 degrees Celsius, while also being exposed to highly pressurized gases. This trial by fire

ultimately crystallizes the carbon molecules, leaving behind strands that can consist of more than 90 percent carbon. Finally, the strands are chemically treated again in preparation for bonding, molding, and application.

### BUILT FOR DANGER

Because it's so light, carbon fiber is a very useful material for aerospace and racing engineers. Both NASA and Nascar have shifted away from metals in favor of carbon fiber-reinforced components. But lighter vehicles and the resulting increase in fuel efficiency aren't the only advantages: Resistance to heat and stretching during high-speed maneuvers ensures the survival of astronauts and race-car drivers alike.

### MANY FLAVORS

All CF is relatively strong; that's why it pops up in aircraft brakes and iPhone cases. However, not all carbon fiber is created equal. Different starting materials, chemical mixes, and baking temperatures all have an impact on the strength and structural integrity of the resulting strands. This variety allows manufacturers to cook up the perfect mix, whether it's for bicycles or buildings.

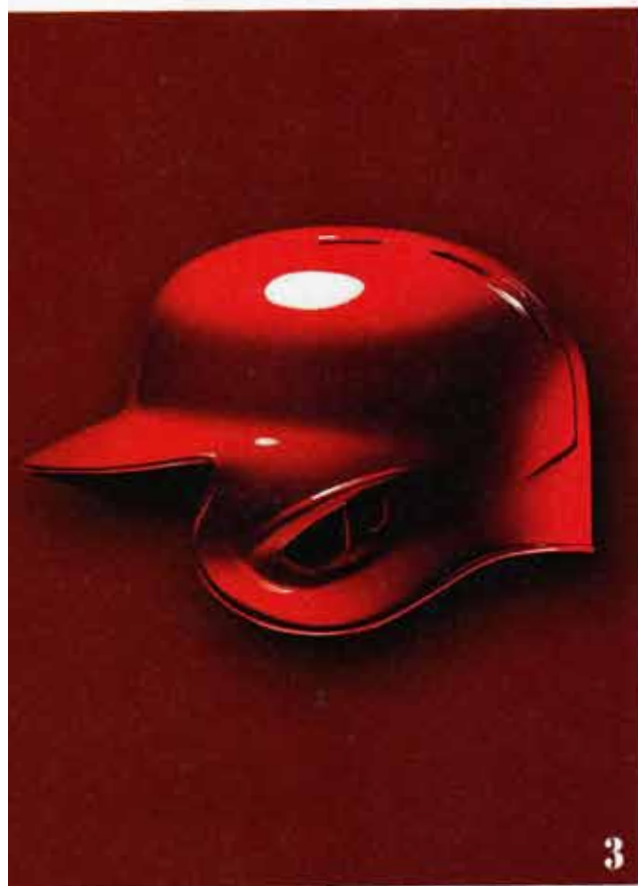
TURN THE PAGE TO SEE  
5 COOL CARBON-FIBER  
PRODUCTS.

BY TERENCE RUSSELL

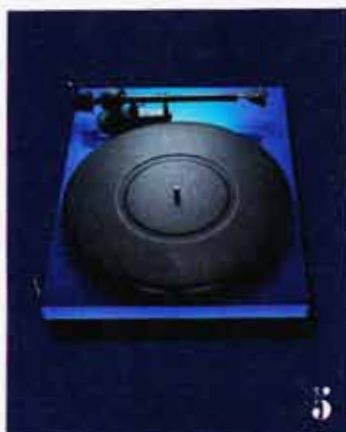




## PRODUCTS WITH CARBON FIBER INSIDE



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### 1 LUIS AND CLARK VIOLIN

Unlike its wooden siblings, this violin won't crack or go out of tune during sudden decreases in humidity. Yo-Yo Ma relies on a Luis and Clark cello for some of his chillier outdoor gigs. \$5,539

### 2 NIKE AIR JORDAN XX8

The latest Jordans deploy composites in two spots: A carbon-fiber shank plate under the arch prevents excess torsion during quick changes in direction, and the external heel also relies on the material, adding rigidity and support without weighing down dribblers. \$250

### 3 RAWLINGS S100 PRO COMP HELMET

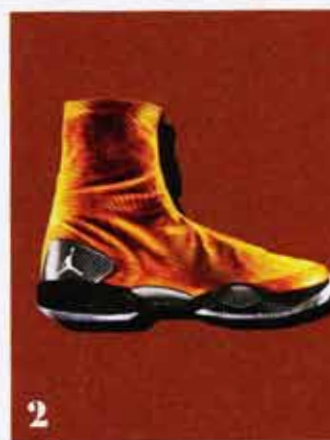
Major League Baseball switched to this CF-fortified lid at the start of the 2013 season. The carbon fiber and epoxy resin shell make it three times stiffer, 130 times stronger, and five ounces lighter than its ABS plastic predecessor. \$600

### 4 OAKLEY X THE MACALLAN: THE FLASK

For every mission-critical use of carbon fiber, there are a dozen unapologetically "cool" applications. Oakley wrapped this flask in all sorts of durable materials: steel, aluminum, and a CF composite. The result? A flask that keeps your hooch safe—drop after drunken drop. \$1,500

### 5 PRO-JECT DEBUT CARBON

This turntable's entry-level exterior—and price—masks a bit of audiophile-grade kit. The Debut's tonearm eschews traditional aluminum in favor of carbon fiber, which helps it deliver whisper-quiet playback. \$399



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