



COMMERCIAL CARBON FIBER

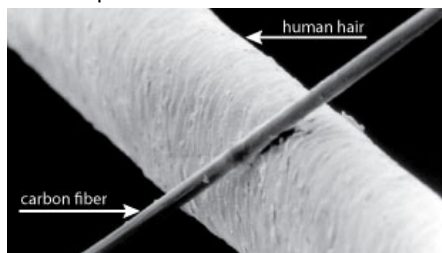
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## Carbon Fiber

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### What is Carbon Fiber?

A carbon fiber is a long, thin strand of material about 0.0002-0.0004 in (0.005-0.010 mm) in diameter and composed mostly of carbon atoms. The carbon atoms are bonded together in microscopic crystals that are more or less aligned parallel to the long axis of the fiber. The crystal alignment makes the fiber incredibly strong for its size. Several thousand carbon fibers are twisted together to form a yarn, which may be used by itself or woven into a fabric. The yarn or fabric is combined with epoxy and wound or molded into shape to form various composite materials. Carbon fiber-reinforced composite materials are used to make aircraft and spacecraft parts, racing car bodies, golf club shafts, bicycle frames, fishing rods, automobile springs, sailboat masts, and many other components where light weight and high strength are needed.



Carbon fibers are classified by the tensile modulus of the fiber. The English unit of measurement is pounds of force per square inch of cross-sectional area, or psi. Carbon fibers classified as “low modulus” have a tensile modulus below 34.8 million psi (240 million kPa). Other classifications, in ascending order of tensile modulus, include “standard modulus,” “intermediate modulus,” “high modulus,” and “ultrahigh modulus.” Ultrahigh modulus carbon fibers have a tensile modulus of 72.5 -145.0 million psi (500 million-1.0 billion kPa). As a comparison, steel has a tensile modulus of about 29 million psi (200 million kPa). Thus, the strongest carbon fibers are ten times stronger than steel and eight times that of aluminum, not to mention much lighter than both materials, 5 and 1.5 times, respectively. Additionally, their fatigue properties are superior to all known metallic structures, and they are one of the most corrosion-resistant materials available, when coupled with the proper resins.

Thirty years ago, carbon fiber was a space-age material, too costly to be used in anything except aerospace. However today, carbon fiber is being used in wind turbines, automobiles, sporting goods, and many other applications. Thanks to carbon fiber manufacturers like Zoltek who are committed to the commercialization concept of expanding capacity, lowering costs, and growing new markets, carbon fiber has become a viable commercial product.

#### PRODUCTS

Panex 35  
Panex 30  
Pyron

#### APPLICATIONS

Wind Energy  
Automotive  
Offshore Drilling  
Infrastructure  
CNG/Pressure Vessels  
Thermoplastic  
Compounding  
Marine  
Energy Storage  
Friction Resistance

#### COMPANY

Zoltek Companies, Inc., through our wholly owned subsidiaries, engages in the development, manufacture, and marketing of carbon fibers for various applications. Our carbon fibers are used as the primary building material in commercial products. We sell our commercial grade carbon fibers under the PANEX trade name and our oxidized acrylic fiber under the PYRON trade name. Our operations are primarily in the United States, Mexico and Europe and we sell our products worldwide.

Today Zoltek products are increasing the energy output of wind turbines, creating more fuel efficient vehicles, and lifting other industries to higher levels of performance.

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Sporting Goods

