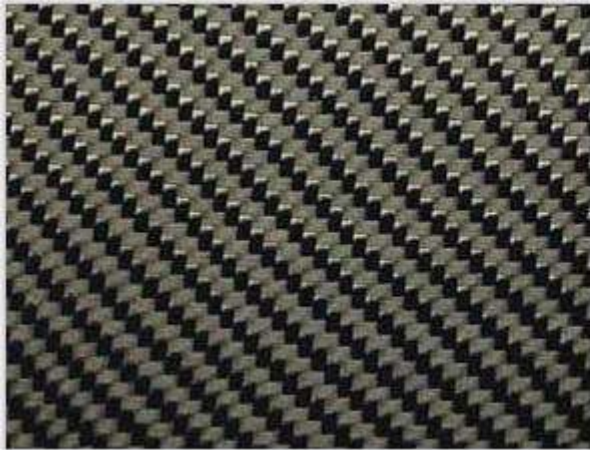


Description

Image



Caption

1. Close-up of the material. © Chris Lefteri 2. CFRP bike frame weighing only 1.08 kg. © TREK

The material

Carbon fiber reinforced composites (CFRPs) offer greater stiffness and strength than any other type, but they are considerably more expensive than GFRP (see record). Continuous fibers in a polyester or epoxy matrix give the highest performance. The fibers carry the mechanical loads, while the matrix material transmits loads to the fibers and provides ductility and toughness as well as protecting the fibers from damage caused by handling or the environment. It is the matrix material that limits the service temperature and processing conditions.

Composition (summary)

Epoxy + continuous HS carbon fiber reinforcement (0, +45, 90), quasi-isotropic layup.

General properties

Density	1.5e3	-	1.6e3	kg/m ³
Price	* 28.6	-	31.8	GBP/kg

Mechanical properties

Young's modulus	69	-	150	GPa
Yield strength (elastic limit)	550	-	1.05e3	MPa
Tensile strength	550	-	1.05e3	MPa
Elongation	* 0.32	-	0.35	% strain
Hardness - Vickers	* 10.8	-	21.5	HV
Fatigue strength at 10 ⁷ cycles	* 150	-	300	MPa
Fracture toughness	* 6.12	-	20	MPa.m ^{0.5}

Thermal properties

Maximum service temperature	* 140	-	220	°C
Thermal conductor or insulator?	Poor insulator			
Thermal conductivity	* 1.28	-	2.6	W/m.°C
Specific heat capacity	* 902	-	1.04e3	J/kg.°C
Thermal expansion coefficient	* 1	-	4	μstrain/°C

Electrical properties

Electrical conductor or insulator?	Poor conductor			
------------------------------------	----------------	--	--	--

Optical properties

Transparency	Opaque
--------------	--------

Eco properties

Embodied energy, primary production	* 655	-	723	MJ/kg
CO2 footprint, primary production	* 45.8	-	50.5	kg/kg
Recycle	✗			

Supporting information

Typical uses

Lightweight structural members in aerospace, automotive components and sports equipment such as golf clubs, oars, boats and racquets, springs, pressure vessels.

Links

ProcessUniverse
