Materials mechanical and environmental properties

Bamboo

Stiff and strong in along grain, in the fiber direction. A tough material, good fatigue resistance. Large variation (roughly +/- 50% on values below) depending on for example species, age of culm, top or bottom part of culm, inner or outer part of wall and node or not node section. Species called Tonkin is regarded as the stiffest and strongest.

- density 0.65 kg/dm³
- elastic modulus 18 GPa (along grain)
- tensile strength 150 MPa (along grain)
- specific modulus 28 GPa/kg/dm³ (along grain)
- specific strength 230 MPa/kg/dm³ (along grain)
- embodied energy less than 5 MJ/kg

Flax (50% epoxy)

Flax fibres come from the flax plant, one species of Linum usitatissimum is bred, and is widely cultivated in West Europe where the daily temperature is generally below 30 °C. The flax plant has a life cycle of 90–125 days including vegetative, flowering and maturation periods. The diameter of the flax stem is in the range of 1–2 mm, with a height of about 80 cm. There are three layers—bark, bundle and xylem—in the flax stem. The outer layer of bark functions as a protective cover from external attacks except for the penetration of water and other nutrients.

- density 1.31 kg/dm³
- elastic modulus 31 GPa (unidirectional)
- tensile strength 294 MPa (unidirectional)
- specific modulus 24 GPa/kg/dm³ (unidirectional)
- specific strength 224 MPa/kg/dm³ (unidirectional)
- embodied energy 6.5 MJ/kg (flax fiber only)
- embodied energy 33 MJ/kg (50% fiber 50% epoxy)

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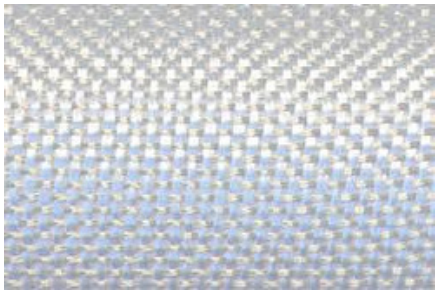
Materials mechanical and environmental properties

S-glass (55% epoxy)

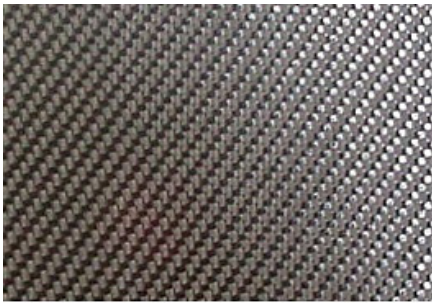
The glass fibers are made of various types of glass depending upon the fiberglass use. These glasses all contain silica or silicate, with varying amounts of oxides of calcium, magnesium, and sometimes boron. To be used in fiberglass, glass fibers have to be made with very low levels of defects.



- density 1.8 kg/dm³
- elastic modulus 40 GPa
- tensile strength 870 MPa
- specific modulus 22 GPa/kg/dm³
- specific strength 480 MPa/kg/dm³
- embodied energy 23 MJ/kg
- embodied energy 43 MJ/kg (45% fiber 55% epoxy)

Carbon (40% epoxy)

Carbon is the 15th most abundant element in the Earth's crust, and the fourth most abundant element in the universe by mass after hydrogen, helium, and oxygen. Carbon's abundance, its unique diversity of organic compounds, and its unusual ability to form polymers at the temperatures commonly encountered on Earth enables this element to serve as a common element of all known life. It is the second most abundant element in the human body by mass (about 18.5%) after oxygen.



- density 1.6 kg/dm³
- elastic modulus 140 GPa (unidirectional)
- tensile strength 1730 MPa (unidirectional)
- specific modulus 89 GPa/kg/dm³ (unidirectional)
- specific strength 1080 MPa/kg/dm³ (unidirectional)
- embodied energy 230 MJ/kg (carbon fiber only)
- embodied energy 160 MJ/kg (60% fiber 40% epoxy)

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Materials mechanical and environmental properties

Steel (AISI 4000 grade)

Steel is an alloy of iron and other elements, primarily carbon, widely used in construction and other applications because of its high tensile strength and low cost. The base metal, iron, is able to take on two crystalline forms (allotropic forms), body centered cubic (BCC) and face centered cubic (FCC), depending on its temperature. It is the interaction of those allotropes with the alloying elements, primarily carbon, that gives steel and cast iron their great range of unique properties.

- density 7.8 kg/dm³
- elastic modulus 210 GPa
- tensile strength 590 MPa
- specific modulus 26 GPa/kg/dm³
- specific strength 73 MPa/kg/dm³
- embodied energy 45 MJ/kg

Aluminum (6061 alloy)

Aluminium is a chemical element in the boron group with symbol Al and atomic number 13. It is a silvery-white, soft, nonmagnetic, ductile metal. Aluminium is the third most abundant element in the Earth's crust (after oxygen and silicon) and its most abundant metal. Aluminium makes up about 8% of the crust by mass, though it is less common in the mantle below.

- density 2.7 kg/dm³
- elastic modulus 73 GPa
- tensile strength t450 MPa
- specific modulus 27 GPa/kg/dm³
- specific strength 170 MPa/kg/dm³
- embodied energy 230 MJ/kg

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Materials mechanical and environmental properties

Stainless steel (304 alloy)

Stainless steel does not readily corrode, rust or stain with water as ordinary steel does. However, it is not fully stain-proof in low-oxygen, high-salinity, or poor air-circulation environments. There are different grades and surface finishes of stainless steel to suit the environment the alloy must endure. Stainless steel is used where both the properties of steel and corrosion resistance are required.

- density 8 kg/dm³
- elastic modulus 200 GPa
- tensile strength 505 MPa
- specific modulus 25 GPa/kg/dm³
- specific strength 63 MPa/kg/dm³
- embodied energy 160 MJ/kg

SUSTAINABILITY BY SHARED BIO MASS PIPELINE

Not all carbon is created equal. Our reisine replace petroleum based carbon with renewable plant-based carbon. The raw materials going into our resins are co-products or waste products of other industrially important processes. These materials do not compete with food sources or displace food-based agriculture. Using an international standard method of radio carbon dating, we verify the renewable content of the resins so you know exactly where they come from.

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