Bamboo

Description

Image



Caption

1. Bamboo bridge to the island of Kaoh Pen, Kampong Cham, Cambodia. © Rob Glover at Flickr - (CC BY-SA 2.0) 2. Bamboo scaffolding held together by nylon strips, Hong Kong. © Chong Fat at en.wikipedia - (CC BY-SA 3.0) 3. Bamboo scaffolding surrounding a

The material

Bamboo is nature's gift to the construction industry. Think of it: a hollow tube, exceptionally strong and light, growing so fast that it can be harvested after a year, and - given a little longer - reaching a diameter of 0.3 meters and a height of 15 meters. This and its hard surface and ease of working makes it the most versatile of materials. Bamboo is used for building and scaffolding, for roofs and flooring, for pipes, buckets, baskets, walking sticks, fishing poles, window blinds, mats, arrows and furniture. Tonkin bamboo is strong and flexible (fishing poles); Tali bamboo is used for structural applications (houses or furniture); Eeta bamboo is the fastest growing and is used as a source of cellulose for the production of cellulose or Rayon.

Composition (summary)

Cellulose/Hemicellulose/Lignin/12% H2O

General properties

Density		37.5	-	49.9	lb/ft^3
Price	*	0.608	-	0.912	USD/lb
Date first used		-5000			

Mechanical properties

Young's modulus		2.18	-	2.9	10^6 psi
Shear modulus		0.116	-	0.197	10^6 psi
Bulk modulus		0.112	-	0.16	10^6 psi
Poisson's ratio		0.03	-	0.46	
Yield strength (elastic limit)		5.08	-	6.38	ksi
Tensile strength		5.22	-	6.53	ksi
Compressive strength		7.25	-	14.5	ksi
Elongation		2.88	-	5.5	% strain
Hardness - Vickers		2	-	12	HV
Fatigue strength at 10^7 cycles	*	3.63	-	5.08	ksi
Fracture toughness		4.55	-	6.37	ksi.in^0.5
Mechanical loss coefficient (tan delta)		0.012	-	0.022	

Thermal properties

Glass temperature		170	-	215	°F
Maximum service temperature		242	-	278	°F

Minimum service temperature	*	-99.7	-	-9.67	°F
Thermal conductor or insulator?		Good insulator			
Thermal conductivity		0.0578	-	0.104	BTU.ft/h.ft^2.F
Specific heat capacity		0.396	-	0.408	BTU/lb.°F
Thermal expansion coefficient		1.44	-	5.56	µstrain/°F

Electrical properties

Electrical conductor or insulator?		Poor insulator			
Electrical resistivity	*	6e13	-	7e14	µohm.cm
Dielectric constant (relative permittivity)	*	5	-	7	
Dissipation factor (dielectric loss tangent)	*	0.07	-	0.1	
Dielectric strength (dielectric breakdown)	*	12.7	-	25.4	V/mil

Optical properties

Transparency		Opaque			

Processability

Moldability		1	-	2	
Machinability		4			

Eco properties

Embodied energy, primary production		444	-	650	kcal/lb
CO2 footprint, primary production		0.299	-	0.33	lb/lb
Recycle		✗			

Supporting information

Design guidelines

The stems of bamboo are hollow and jointed, and have an extremely hard, durable, outer surface. Its natural tubular structure gives it excellent bending stiffness and strength at low weight. It is joined by binding; fasteners requiring holes must be avoided. The wood is visually appealing and hardwearing, making it attractive for flooring and furniture as well as its other diverse uses.

Technical notes

Bamboo is a grass, not a tree. It grows most commonly in Indonesia, The Philippines and Southern Asia where it is one of the principal structural materials.

Typical uses

Building & construction; scaffolding; furniture; pulp & paper making; ropes; reinforcement for concrete; frames for early aircraft, pipes, baskets, walking sticks, fishing poles, window blinds, mats, arrows and furniture.

Links

Reference

ProcessUniverse