General information

Designation

Cotton

Typical uses

Fabric and ropes; bandages.

Composition overview

Compositional summary

Cellulose(C6H10O5)n/12% H20

Form		Fiber		
Material family		Natural		
Base material		Cellulose		
Renewable content		100		%

Composition detail (polymers and natural materials)

Natural material		100		%

Price

Price	*	2.07	-	4.15	USD/kg
Price per unit volume	*	3.11e3	-	6.64e3	USD/m^3

Physical properties

Density	1.5e3	-	1.6e3	kg/m^3

Mechanical properties

Young's modulus		5.5	-	28	GPa
Yield strength (elastic limit)		100	-	350	MPa
Tensile strength		287	-	597	MPa
Elongation		7	-	8	% strain
Flexural modulus	*	5.5	-	28	GPa
Shear modulus		1	-	2.1	GPa
Bulk modulus	*	2	-	6	GPa
Poisson's ratio	*	0.25	-	0.3	
Shape factor		1			
Mechanical loss coefficient (tan delta)	*	0.01	-	0.05	

Impact & fracture properties

Fracture toughness	*	1	-	2	MPa.m^0.5

Thermal properties

Glass temperature	110	-	130	℃

Maximum service temperature		110	-	130	℃
Minimum service temperature		-273			℃
Thermal conductivity	*	0.2	-	0.3	W/m.℃
Specific heat capacity		1.2e3	-	1.22e3	J/kg.℃
Thermal expansion coefficient	*	15	-	30	µstrain/℃

Electrical properties

Electrical resistivity	*	1e14	-	1e16	µohm.cm
Dielectric constant (relative permittivity)		3	-	6	
Dissipation factor (dielectric loss tangent)	*	0.003	-	0.02	
Dielectric strength (dielectric breakdown)		6	-	8	MV/m

Magnetic properties

Magnetic type	Non-magnetic

Optical properties

Transparency	Opaque

Critical materials risk

Contains >5wt% critical elements?	No

Durability

Water (fresh)	Acceptable
Water (salt)	Acceptable
Weak acids	Limited use
Strong acids	Unacceptable
Weak alkalis	Acceptable
Strong alkalis	Limited use
Organic solvents	Acceptable
Oxidation at 500C	Unacceptable
UV radiation (sunlight)	Fair
Flammability	Highly flammable

Primary production energy, CO2 and water

Embodied energy, primary production		43.3	-	47.8	MJ/kg

Sources

13 MJ/kg (Barber and Pellow, 2006); 26 MJ/kg (Barber and Pellow, 2006); 29 MJ/kg (Barber and Pellow, 2006); 49 MJ/kg (Shen and Patel, 2008); 50 MJ/kg (Shen and Patel, 2008); 54 MJ/kg (Barber and Pellow, 2006); 55 MJ/kg (Polartec); 59 MJ/kg (Shen and Patel, 2008); 60 MJ/kg (Shen and Patel, 2008); 60 MJ/kg (Barber and Pellow, 2006)

CO2 footprint, primary production	*	0.851	-	0.938	kg/kg
Water usage	*	7.38e3	-	8.16e3	l/kg

Processing energy, CO2 footprint & water

Fabric production energy	* 2.48	-	2.73	MJ/kg
Fabric production CO2	* 0.198	-	0.218	kg/kg
Fabric production water	* 1.03	-	1.55	l/kg

Recycling and end of life

Recycle	✗			
Recycle fraction in current supply	0.1			%
Downcycle	✓			
Combust for energy recovery	✓			
Heat of combustion (net)	* 17	-	17.9	MJ/kg
Combustion CO2	* 1.39	-	1.46	kg/kg
Landfill	✓			
Biodegrade	✓			

Notes

Other notes

Cotton is a cellulose material. This record refers to natural cotton fibers in the unwoven state.

Links

ProcessUniverse

Reference

Shape