Mahogany (swietenia macrophylla) (t)

General information

Designation

Swietenia macrophylla (T)

Typical uses

Furniture; cabinetwork; interior trim; pattern making; boat construction; fancy veneers; musical instruments; paneling; turnery; carving.

Composition overview

Compositional summary

Cellulose/Hemicellulose/Lignin/12%H2O

Material family	Natural			
Base material	Wood (tropical)			
Renewable content	100			%

Composition detail (polymers and natural materials)

Wood	100			%

Price

Price	* 3.04	-	4.88	USD/lb

Physical properties

Density	0.0166	-	0.0206	lb/in^3

Mechanical properties

Young's modulus	* 0.119	-	0.133	10^6 psi
Yield strength (elastic limit)	* 0.313	-	0.383	ksi
Tensile strength	* 0.522	-	0.638	ksi
Elongation	* 1.29	-	1.58	% strain
Compressive strength	* 0.554	-	0.677	ksi
Flexural modulus	0.109	-	0.122	10^6 psi
Flexural strength (modulus of rupture)	* 0.522	-	0.638	ksi
Shear modulus	* 0.0123	-	0.017	10^6 psi
Shear strength	* 3.31	-	4.04	ksi
Rolling shear strength	* 0.122	-	0.367	ksi
Bulk modulus	* 0.0609	-	0.0682	10^6 psi
Poisson's ratio	* 0.02	-	0.04	
Shape factor	5.5			
Hardness - Vickers	3.2	-	3.91	HV
Hardness - Brinell	* 3.12	-	3.81	ksi
Hardness - Janka	719	-	879	lbf

Fatigue strength at 10^7 cycles	* 0.157	-	0.191	ksi
Mechanical loss coefficient (tan delta)	* 0.026	-	0.033	
Differential shrinkage (radial)	0.11	-	0.15	%
Differential shrinkage (tangential)	0.17	-	0.22	%
Radial shrinkage (green to oven-dry)	2.7	-	3.3	%
Tangential shrinkage (green to oven-dry)	3.7	-	4.5	%
Volumetric shrinkage (green to oven-dry)	* 11	-	18	%
Work to maximum strength	* 0.0568	-	0.0689	ft.lbf/in^3

Impact & fracture properties

Fracture toughness	* 0.303	-	0.37	ksi.in^0.5

Thermal properties

Glass temperature	171	-	216	°F
Maximum service temperature	248	-	284	°F
Minimum service temperature	* -99.4	-	-9.4	°F
Thermal conductivity	0.0722	-	0.0878	BTU.ft/hr.ft^2.°F
Specific heat capacity	0.396	-	0.408	BTU/lb.°F
Thermal expansion coefficient	* 14.7	-	20.3	µstrain/°F

Electrical properties

Electrical resistivity	* 2.1e14	-	7e14	µohm.cm
Dielectric constant (relative permittivity)	* 3.07	-	3.75	
Dissipation factor (dielectric loss tangent)	* 0.039	-	0.048	
Dielectric strength (dielectric breakdown)	* 25.4	-	50.8	V/mil

Magnetic properties

Magnetic type	Non-magnetic

Optical properties

Transparency	Opaque

Restricted substances risk indicators

RoHS (EU) compliant grades?	✓

Durability

Water (fresh)	Limited use
Water (salt)	Limited use
Weak acids	Limited use
Strong acids	Unacceptable
Weak alkalis	Acceptable
Strong alkalis	Unacceptable

Organic solvents	Acceptable			
Oxidation at 500C	Unacceptable			
UV radiation (sunlight)	Good			
Flammability	Highly flammable			

Primary production energy, CO2 and water

Embodied energy, primary production	* 4.99e3	-	5.5e3	BTU/lb
CO2 footprint, primary production	* 0.574	-	0.633	lb/lb
NOx creation	0.00257	-	0.00284	lb/lb
SOx creation	0.00656	-	0.00725	lb/lb
Water usage	* 1.84e4	-	2.03e4	in^3/lb

Processing energy, CO2 footprint & water

Coarse machining energy (per unit wt removed)	* 238	-	263	BTU/lb
Coarse machining CO2 (per unit wt removed)	* 0.0415	-	0.0459	lb/lb
Fine machining energy (per unit wt removed)	* 541	-	598	BTU/lb
Fine machining CO2 (per unit wt removed)	* 0.0944	-	0.104	lb/lb
Grinding energy (per unit wt removed)	* 878	-	970	BTU/lb
Grinding CO2 (per unit wt removed)	* 0.153	-	0.169	lb/lb

Recycling and end of life

Recycle	✗			
Recycle fraction in current supply	8.55	-	9.45	%
Downcycle	✓			
Combust for energy recovery	✓			
Heat of combustion (net)	* 8.49e3	-	9.16e3	BTU/lb
Combustion CO2	* 1.69	-	1.78	lb/lb
Landfill	✓			
Biodegrade	✓			

Eco-indicators for principal component

Eco-indicator 95	2.99			millipoints/lb
EPS value	62.7	-	69.3	

Notes

Warning

All woods have properties which show variation; they depend principally on growth conditions and moisture content.

Links

ProcessUniverse

Reference

Shape

Maple (acer macrophyllum) (t)

General information

Designation

Acer macrophyllum (T)

Typical uses

Furniture; boxes; pallets; venetian blinds; sash; doors; veneer;

Composition overview

Compositional summary

Cellulose/Hemicellulose/Lignin/12%H2O

Material family		Natural		
Base material		Wood (hardwood)		
Renewable content		100		%

Composition detail (polymers and natural materials)

Wood		100		%

Price

Price	*	0.608	-	0.912	USD/lb

Physical properties

Density		0.0173	-	0.0213	lb/in^3

Mechanical properties

Young's modulus	*	0.135	-	0.151	10^6 psi
Yield strength (elastic limit)	*	0.296	-	0.357	ksi
Tensile strength		0.493	-	0.595	ksi
Elongation	*	1.08	-	1.32	% strain
Compressive strength		0.674	-	0.825	ksi
Flexural modulus		0.123	-	0.138	10^6 psi
Flexural strength (modulus of rupture)	*	0.493	-	0.609	ksi
Shear modulus	*	0.0139	-	0.0191	10^6 psi
Shear strength	*	4.66	-	5.69	ksi
Rolling shear strength	*	0.173	-	0.518	ksi
Bulk modulus	*	0.0696	-	0.0783	10^6 psi
Poisson's ratio	*	0.02	-	0.04	
Shape factor		5.6			
Hardness - Vickers		3.4	-	4.16	HV
Hardness - Brinell	*	2.76	-	3.35	ksi
Hardness - Janka		764	-	935	lbf
Fatigue strength at 10^7 cycles	*	0.148	-	0.183	ksi

Mechanical loss coefficient (tan delta)	* 0.025	-	0.031	
Differential shrinkage (radial)	0.17	-	0.23	%
Differential shrinkage (tangential)	0.25	-	0.32	%
Radial shrinkage (green to oven-dry)	3.3	-	4.1	%
Tangential shrinkage (green to oven-dry)	6.4	-	7.8	%
Volumetric shrinkage (green to oven-dry)	10.4	-	12.8	%
Work to maximum strength	* 0.058	-	0.0713	ft.lbf/in^3

Impact & fracture properties

Fracture toughness	* 0.323	-	0.395	ksi.in^0.5

Thermal properties

Glass temperature	171	-	216	°F
Maximum service temperature	248	-	284	°F
Minimum service temperature	* -99.4	-	-9.4	°F
Thermal conductivity	0.0867	-	0.104	BTU.ft/hr.ft^2.°F
Specific heat capacity	0.396	-	0.408	BTU/lb.°F
Thermal expansion coefficient	* 15.1	-	20.6	µstrain/°F

Electrical properties

Electrical resistivity	* 2.1e14	-	7e14	µohm.cm
Dielectric constant (relative permittivity)	* 3.17	-	3.87	
Dissipation factor (dielectric loss tangent)	* 0.041	-	0.05	
Dielectric strength (dielectric breakdown)	* 25.4	-	50.8	V/mil

Magnetic properties

Magnetic type	Non-magnetic

Optical properties

Transparency	Opaque

Bio-data

Food contact	Yes

Restricted substances risk indicators

RoHS (EU) compliant grades?	✓

Durability

Water (fresh)	Limited use
Water (salt)	Limited use
Weak acids	Limited use
Strong acids	Unacceptable

Weak alkalis	Acceptable
Strong alkalis	Unacceptable
Organic solvents	Acceptable
Oxidation at 500C	Unacceptable
UV radiation (sunlight)	Good
Flammability	Highly flammable

Primary production energy, CO2 and water

Embodied energy, primary production	4.99e3	-	5.5e3	BTU/lb

Sources

0.5 MJ/kg (Ximenes, 2006); 2 MJ/kg (Ximenes, 2006); 9.1 MJ/kg (Hammond and Jones, 2008); 11.6 MJ/kg (Hubbard and Bowe, 2010); 23.7 MJ/kg (Ecoinvent v2.2); 26 MJ/kg (Ecoinvent v2.2)

CO2 footprint, primary production	0.574	-	0.633	lb/lb

Sources

0.229 kg/kg (Ecoinvent v2.2); 0.412 kg/kg (Ecoinvent v2.2); 0.862 kg/kg (Hammond and Jones, 2008); 0.909 kg/kg (Hubbard and Bowe,

NOx creation	0.00257	-	0.00284	lb/lb
SOx creation	0.00656	-	0.00725	lb/lb
Water usage	* 1.84e4	-	2.03e4	in^3/lb

Processing energy, CO2 footprint & water

Coarse machining energy (per unit wt removed)	* 244	-	269	BTU/lb
Coarse machining CO2 (per unit wt removed)	* 0.0425	-	0.047	lb/lb
Fine machining energy (per unit wt removed)	* 599	-	662	BTU/lb
Fine machining CO2 (per unit wt removed)	* 0.104	-	0.115	lb/lb
Grinding energy (per unit wt removed)	* 994	-	1.1e3	BTU/lb
Grinding CO2 (per unit wt removed)	* 0.173	-	0.192	lb/lb

Recycling and end of life

Recycle	✗			
Recycle fraction in current supply	8.55	-	9.45	%
Downcycle	✓			
Combust for energy recovery	✓			
Heat of combustion (net)	* 8.49e3	-	9.16e3	BTU/lb
Combustion CO2	* 1.69	-	1.78	lb/lb
Landfill	✓			
Biodegrade	✓			

Eco-indicators for principal component

Eco-indicator 95	2.99			millipoints/lb
EPS value	62.7	-	69.3	

Notes

Warning

All woods have properties which show variation; they depend principally on growth conditions and moisture content.

Links

ProcessUniverse

Reference

Shape

Mahogany (khaya spp.) (t)

General information

Designation

Khaya spp. (L)

Typical uses

Furniture; cabinetwork; interior finish; boat construction;

Composition overview

Compositional summary

Cellulose/Hemicellulose/Lignin/12%H2O

Material family	Natural	
Base material	Wood (tropical)	
Renewable content	100	%

Composition detail (polymers and natural materials)

Wood	100	%

Price

Price	* 1.47	-	1.61	USD/lb

Physical properties

Density	0.0166	-	0.0206	lb/in^3

Mechanical properties

Young's modulus	* 0.119	-	0.133	10^6 psi
Yield strength (elastic limit)	* 0.287	-	0.357	ksi
Tensile strength	* 0.479	-	0.595	ksi
Elongation	* 1.2	-	1.47	% strain
Compressive strength	* 0.554	-	0.677	ksi
Flexural modulus	0.109	-	0.122	10^6 psi
Flexural strength (modulus of rupture)	* 0.479	-	0.595	ksi
Shear modulus	* 0.0123	-	0.017	10^6 psi
Shear strength	* 4.06	-	4.95	ksi
Rolling shear strength	* 0.149	-	0.45	ksi
Bulk modulus	* 0.0609	-	0.0682	10^6 psi
Poisson's ratio	* 0.02	-	0.04	
Shape factor	5.5			
Hardness - Vickers	3.32	-	4.06	HV
Hardness - Brinell	* 2.97	-	3.63	ksi
Hardness - Janka	746	-	913	lbf
Fatigue strength at 10^7 cycles	* 0.144	-	0.178	ksi

Mechanical loss coefficient (tan delta)	* 0.026	-	0.033	
Differential shrinkage (radial)	0.11	-	0.15	%
Differential shrinkage (tangential)	0.2	-	0.22	%
Radial shrinkage (green to oven-dry)	2.3	-	2.8	%
Tangential shrinkage (green to oven-dry)	4.1	-	5	%
Volumetric shrinkage (green to oven-dry)	* 11	-	18	%
Work to maximum strength	* 0.0616	-	0.0761	ft.lbf/in^3

Impact & fracture properties

Fracture toughness	* 0.303	-	0.37	ksi.in^0.5

Thermal properties

Glass temperature	171	-	216	°F
Maximum service temperature	248	-	284	°F
Minimum service temperature	* -99.4	-	-9.4	°F
Thermal conductivity	* 0.0445	-	0.0543	BTU.ft/hr.ft^2.°F
Specific heat capacity	0.396	-	0.408	BTU/lb.°F
Thermal expansion coefficient	* 14.7	-	20.3	µstrain/°F

Electrical properties

Electrical resistivity	* 2.1e14	-	7e14	µohm.cm
Dielectric constant (relative permittivity)	* 3.07	-	3.75	
Dissipation factor (dielectric loss tangent)	* 0.039	-	0.048	
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Magnetic properties

Magnetic type	Non-magnetic

Optical properties

Transparency	Opaque

Bio-data

Food contact	Yes

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RoHS (EU) compliant grades?	✓

Durability

Water (fresh)	Limited use
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Weak acids	Limited use
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Weak alkalis	Acceptable			
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Oxidation at 500C	Unacceptable			
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Grinding energy (per unit wt removed)	* 878	-	970	BTU/lb
Grinding CO2 (per unit wt removed)	* 0.153	-	0.169	lb/lb

Recycling and end of life

Recycle	✗			
Recycle fraction in current supply	8.55	-	9.45	%
Downcycle	✓			
Combust for energy recovery	✓			
Heat of combustion (net)	* 8.49e3	-	9.16e3	BTU/lb
Combustion CO2	* 1.69	-	1.78	lb/lb
Landfill	✓			
Biodegrade	✓			

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