

General information

Designation

Guaiacum spp. (L)

Typical uses

Bearing & bushing blocks; lining of stern tubes for steamship propeller shafts; underwater use; mallets; pulley sheaves; caster wheels; stencil; chisel block; turned articles; brush backs.

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 | * 6.7 | - | 10.8 | USD/kg |
| Price per unit volume | * 7.44e3 | - | 1.45e4 | USD/m^3 |

Physical properties

| | | | | |
|---------|--------|---|--------|--------|
| Density | 1.11e3 | - | 1.35e3 | kg/m^3 |
|---------|--------|---|--------|--------|

Mechanical properties

| | | | | |
|--|--------|---|------|----------|
| Young's modulus | * 12.1 | - | 14.8 | GPa |
| Yield strength (elastic limit) | * 79.6 | - | 97.3 | MPa |
| Tensile strength | * 133 | - | 163 | MPa |
| Elongation | * 2.97 | - | 3.63 | % strain |
| Compressive strength | 70.7 | - | 86.5 | MPa |
| Flexural modulus | 11 | - | 13.4 | GPa |
| Flexural strength (modulus of rupture) | * 143 | - | 175 | MPa |
| Shear modulus | * 0.9 | - | 1.1 | GPa |
| Shear strength | * 20.7 | - | 25.3 | MPa |
| Bulk modulus | * 5.19 | - | 5.85 | GPa |
| Poisson's ratio | * 0.35 | - | 0.4 | |
| Shape factor | 4.7 | | | |
| Hardness - Vickers | * 23.7 | - | 28.9 | HV |
| Hardness - Brinell | * 136 | - | 167 | HB |
| Hardness - Janka | * 23.7 | - | 28.9 | kN |

| | | | | |
|--|----------|---|--------|-------------------|
| Fatigue strength at 10 ⁷ cycles | * 43 | - | 52.6 | MPa |
| Mechanical loss coefficient (tan delta) | * 0.0068 | - | 0.0083 | |
| Differential shrinkage (radial) | * 0.32 | - | 0.39 | % |
| Differential shrinkage (tangential) | * 0.53 | - | 0.65 | % |
| Radial shrinkage (green to oven-dry) | * 3.2 | - | 7 | % |
| Tangential shrinkage (green to oven-dry) | * 6.8 | - | 11.5 | % |
| Volumetric shrinkage (green to oven-dry) | * 11 | - | 18 | % |
| Work to maximum strength | * 214 | - | 261 | kJ/m ³ |

Impact & fracture properties

| | | | | |
|--------------------|--------|---|------|----------------------|
| Fracture toughness | * 13.4 | - | 16.4 | MPa.m ^{0.5} |
|--------------------|--------|---|------|----------------------|

Thermal properties

| | | | | |
|-------------------------------|--------|---|--------|------------|
| Glass temperature | 77 | - | 102 | °C |
| Maximum service temperature | 120 | - | 140 | °C |
| Minimum service temperature | * -73 | - | -23 | °C |
| Thermal conductivity | * 0.54 | - | 0.66 | W/m.°C |
| Specific heat capacity | 1.66e3 | - | 1.71e3 | J/kg.°C |
| Thermal expansion coefficient | * 2 | - | 11 | µstrain/°C |

Electrical properties

| | | | | |
|--|--------|---|-------|---------|
| Electrical resistivity | * 6e13 | - | 2e14 | µohm.cm |
| Dielectric constant (relative permittivity) | * 12 | - | 14.7 | |
| Dissipation factor (dielectric loss tangent) | * 0.15 | - | 0.183 | |
| Dielectric strength (dielectric breakdown) | * 0.4 | - | 0.6 | MV/m |

Magnetic properties

| | |
|---------------|--------------|
| Magnetic type | Non-magnetic |
|---------------|--------------|

Optical properties

| | |
|--------------|--------|
| Transparency | Opaque |
|--------------|--------|

Critical materials risk

| | |
|-----------------------------------|----|
| Contains >5wt% critical elements? | No |
|-----------------------------------|----|

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 | * 11.6 | - | 12.8 | MJ/kg |
| CO2 footprint, primary production | * 0.574 | - | 0.633 | kg/kg |
| Water usage | * 665 | - | 735 | l/kg |

Processing energy, CO2 footprint & water

| | | | | |
|---|----------|---|--------|-------|
| Coarse machining energy (per unit wt removed) | * 1.08 | - | 1.2 | MJ/kg |
| Coarse machining CO2 (per unit wt removed) | * 0.0811 | - | 0.0897 | kg/kg |
| Fine machining energy (per unit wt removed) | * 6.54 | - | 7.23 | MJ/kg |
| Fine machining CO2 (per unit wt removed) | * 0.491 | - | 0.542 | kg/kg |
| Grinding energy (per unit wt removed) | * 12.6 | - | 13.9 | MJ/kg |
| Grinding CO2 (per unit wt removed) | * 0.946 | - | 1.05 | kg/kg |

Recycling and end of life

| | | | | |
|------------------------------------|--------|---|------|-------|
| Recycle | ✗ | | | |
| Recycle fraction in current supply | 8.55 | - | 9.45 | % |
| Downcycle | ✓ | | | |
| Combust for energy recovery | ✓ | | | |
| Heat of combustion (net) | * 19.8 | - | 21.3 | MJ/kg |
| Combustion CO2 | * 1.69 | - | 1.78 | kg/kg |
| Landfill | ✓ | | | |
| Biodegrade | ✓ | | | |

Notes

Warning

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

Links

ProcessUniverse

Reference

Shape