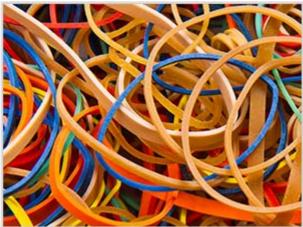


## **Description**

### **Image**





### Caption

1. Rubber trees in Kerala, India © M.arunprasad at en.wikipedia - (CC BY-SA 3.0) 2. Rubber bands in different colors. © Bill Ebbesen at en.wikipedia - (CC BY-SA 3.0)

#### The material

Natural Rubber was known to the natives of Peru many centuries ago, and is now one of Malaysia's main exports. It made the fortune of Giles Macintosh who, in 1825, devised the rubber-coated waterproof coat the still bears his name. Latex, the sap of the rubber tree, is cross-linked (vulcanized) by heating with sulfur; the amount of the cross-linking determines the properties. It is the most widely used of all elastomers - more than 50% of all produced.

#### Compositional summary

(CH2-C(CH3)-CH-CH2)n

### **General properties**

Density	57.4	-	58.1	lb/ft^3
Price	* 0.862	-	1.09	USD/lb
Date first used	1751			

### **Mechanical properties**

Young's modulus	2.18e-4	-	3.63e-4	10^6 psi
Shear modulus	8.7e-5	-	1.16e-4	10^6 psi
Bulk modulus	* 0.203	-	0.218	10^6 psi
Poisson's ratio	0.499	-	0.5	
Yield strength (elastic limit)	2.9	-	4.35	ksi
Tensile strength	3.19	-	4.64	ksi
Compressive strength	3.19	-	4.79	ksi
Elongation	500	-	800	% strain
Fatigue strength at 10^7 cycles	0.609	-	0.653	ksi
Fracture toughness	0.137	-	0.228	ksi.in^0.5
Mechanical loss coefficient (tan delta)	* 0.8	-	1.9	



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Glass temperature	-109	-	-81.7	°F
Maximum service temperature	156	-	224	°F
Minimum service temperature	-69.1	-	-45.7	°F
Thermal conductor or insulator?	Good insulator			
Thermal conductivity	0.0578	-	0.0809	BTU.ft/h.ft^2.F
Specific heat capacity	0.43	-	0.597	BTU/lb.°F
Thermal expansion coefficient	83.3	-	250	μstrain/°F

## **Electrical properties**

Electrical conductor or insulator?	Good insulator				
Electrical resistivity	1e15	-	1e16	μohm.cm	
Dielectric constant (relative permittivity)	3	-	4.5		
Dissipation factor (dielectric loss tangent)	7e-4	-	0.003		
Dielectric strength (dielectric breakdown)	406	-	584	V/mil	

## **Optical properties**

Transparency

Processability			
Castability	4	-	5
Moldability	4	-	5
Machinability	2	-	3
Weldability	1		

Translucent

## **Eco properties**

Embodied energy, primary production	* 6.96e3	-	7.69e3	kcal/lb
CO2 footprint, primary production	* 1.97	-	2.18	lb/lb
Recycle	×			

## **Supporting information**

### Design guidelines

Natural rubber is an excellent, cheap, general-purpose elastomer with large stretch capacity and useful properties from -50 C to 115 C, but with poor oil, oxidation, ozone and UV resistance. It has low hysteresis - and is thus very bouncy.

### Typical uses

Gloves, Car tires, seals, belts, anti-vibration mounts, electrical insulation, tubing, rubber lining pipes and

### Links

Reference		
ProcessUniverse		

# Natural rubber (NR)



Producers