Polychloroprene (Neoprene, CR)

Description

Image

Caption

1. Close-up of a wetsuit showing the texture of the material. © Yoruno at en.wikipedia - (CC BY-SA 3.0) 2. Surfer in a polychloroprene wetsuit. © Johntex at en.wikipedia - (CC BY-SA 3.0)

The material

Polychloroprenes (Neoprene, CR) – the materials of wetsuits – are the leading non-tire synthetic rubbers. First synthesized in 1930, they are made by a condensation polymerization of the monomer 2-chloro –1,3 butadiene. The properties can by modified by copolymerization with sulfur, with other chloro-butadienes and by blending with other polymers to give a wide range of properties. Polychloroprenes are characterized by high chemical stability, resistance to water, oil, gasoline and UV radiation.

Composition (summary)

(CH2-CCl-CH2-CH2)n

General properties

Density		76.8	-	78	lb/ft^3
Price	*	2.4	-	2.68	USD/lb
Date first used		1931			

Mechanical properties

Young's modulus		1.02e-4	-	2.9e-4	10^6 psi
Shear modulus		2.9e-5	-	9.72e-5	10^6 psi
Bulk modulus	*	0.174	-	0.189	10^6 psi
Poisson's ratio		0.48	-	0.495	
Yield strength (elastic limit)		0.493	-	3.48	ksi
Tensile strength		0.493	-	3.48	ksi
Compressive strength		0.54	-	4.18	ksi
Elongation		100	-	800	% strain
Fatigue strength at 10^7 cycles	*	0.222	-	1.74	ksi
Fracture toughness	*	0.091	-	0.273	ksi.in^0.5
Mechanical loss coefficient (tan delta)	*	0.95	-	2.3	

Thermal properties

Glass temperature		-54.7	-	-45.7	°F
Maximum service temperature		215	-	233	°F
Minimum service temperature		-63.7	-	-54.7	°F
Thermal conductor or insulator?		Good insulator			
Thermal conductivity		0.0578	-	0.0693	BTU.ft/h.ft^2.F
Specific heat capacity	*	0.478	-	0.525	BTU/lb.°F

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Thermal expansion coefficient		319	-	339	µstrain/°F

Electrical properties

Electrical conductor or insulator?		Good insulator			
Electrical resistivity		1e19	-	1e23	µohm.cm
Dielectric constant (relative permittivity)		6.7	-	8	
Dissipation factor (dielectric loss tangent)	*	1e-4	-	0.001	
Dielectric strength (dielectric breakdown)		401	-	599	V/mil

Optical properties

Transparency		Translucent			
Refractive index		1.55	-	1.57	

Processability

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

Eco properties

Embodied energy, primary production	*	6.63e3	-	7.32e3	kcal/lb
CO2 footprint, primary production	*	1.61	-	1.78	lb/lb
Recycle		✕			

Supporting information

Design guidelines

Polychloroprenes are characterized by exceptional chemical resistance, ability to be colored, and useful properties up to 175 C. Some have low gas permeability and low hysteresis, minimize heating when cyclically loaded, and resist burning. They are exceptionally tough, having high tear resistance due to stress induced crystallization.
A number of other chlorinated hydrocarbons have similar properties and compete with Neoprene. Among them are chlorinated polyethylene (CPE or CM) and chlorosulfonated polyethylene (Hypalon, CSM).

Typical uses

Brake seals, diaphragms, hoses and o-rings, tracked-vehicle pads, footwear, wetsuits.

Links

Reference

ProcessUniverse

Producers