Nitrile rubber (NBR, 25-33% carbon black)

General information

Designation

Nitrile rubber / Acrylonitrile butadiene copolymer (NBR) : 25-33% carbon black filled, 5-10% oil/plasticizer

Tradenames

Buna-N, Perbunan, Krynac, Baymod N, NBR Nipol, Breon, Chemigum, Europrene N, Hycar, Nysyn, KER, Humex, JSR, Kosyn KNB, Nitriflex N, Arnipol, Chemaprene, Paracril, Polyblack

Typical uses

Automotive, seals, fuel and oil hose,

Composition overview

Compositional summary

Copolymer of 50-82% butadiene and 18-50% acrylonitrile (ACN), (CH2CH=CHCH2)n, (CH2CH(CN))m. Most common ACN content is 32-35%.
Properties on this datasheet are for a representative compound with NBR (34% ACN), 25-33% carbon black, 5-10% plasticizer.

Material family	Elastomer (thermoset, rubber)			
Base material	NBR (Nitrile butadiene rubber)			
% filler (by weight)	25	-	33	%
Filler/reinforcement	Carbon			
Filler/reinforcement form	Particulate			
Additive	Plasticizer/oil			
Polymer code	NBR-CD30-P			

Composition detail (polymers and natural materials)

Polymer	57	-	70	%
Plasticizer/oil	5	-	10	%
Carbon (powder)	25	-	33	%

Price

Price	* 1.17	-	1.47	USD/lb
Price per unit volume	* 81	-	103	USD/ft^3

Physical properties

Density	0.0402	-	0.0404	lb/in^3

Mechanical properties

Young's modulus	7.11e-4	-	0.00116	10^6 psi
Yield strength (elastic limit)	2.18	-	3.63	ksi
Tensile strength	2.18	-	3.63	ksi
Tensile stress at 100% strain	0.203	-	0.508	ksi
Tensile stress at 300% strain	1.45	-	2.18	ksi

Elongation		350	-	700	% strain
Elongation at yield		350	-	700	% strain
Compressive modulus	*	7.11e-4	-	0.00116	10^6 psi
Compressive strength	*	2.61	-	4.35	ksi
Flexural modulus		7.11e-4	-	0.00116	10^6 psi
Flexural strength (modulus of rupture)	*	4.05	-	6.2	ksi
Shear modulus		2.32e-4	-	3.92e-4	10^6 psi
Bulk modulus	*	0.218	-	0.29	10^6 psi
Poisson's ratio		0.48	-	0.495	
Shape factor		1.6			
Hardness - Vickers	*	5	-	8	HV
Hardness - Shore D	*	19	-	25	
Hardness - Shore A		65	-	75	
Fatigue strength at 10^7 cycles	*	0.87	-	1.45	ksi
Mechanical loss coefficient (tan delta)	*	0.1	-	0.2	
Compression set at 23°C	*	5	-	15	%
Compression set at 70°C	*	5	-	15	%
Compression set at 100°C		17	-	56	%
Tear strength	*	171	-	286	lbf/in

Impact & fracture properties

Fracture toughness		0.219	-	0.36	ksi.in^0.5
Impact strength, notched 23 °C		0.361	-	0.367	BTU/in^2
Impact strength, notched -30 °C	*	0.361	-	0.367	BTU/in^2

Thermal properties

Glass temperature		-40	-	-22	°F
Maximum service temperature		230	-	248	°F
Minimum service temperature		-22	-	-4	°F
Thermal conductivity	*	0.116	-	0.347	BTU.ft/hr.ft^2.°F
Specific heat capacity	*	0.358	-	0.406	BTU/lb.°F
Thermal expansion coefficient	*	100	-	111	µstrain/°F

Electrical properties

Electrical resistivity		3.94e9	-	3.94e15	µohm.in
Galvanic potential		0.07	-	0.15	V

Magnetic properties

Magnetic type	Non-magnetic

Optical properties

Transparency	Opaque				

Critical materials risk

Contains >5wt% critical elements?	No				

Absorption & permeability

Water absorption @ 24 hrs	*	0.05	-	0.2	%
Permeability (O2)	*	3.88e-7	-	1.61e-6	ft^2/day.atm

Processing properties

Polymer injection molding	Acceptable
Polymer extrusion	Acceptable
Polymer thermoforming	Unsuitable

Durability

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

Primary production energy, CO2 and water

Embodied energy, primary production	*	5.07e4	-	5.59e4	BTU/lb
CO2 footprint, primary production	*	2.92	-	3.22	lb/lb
Water usage	*	2.8e3	-	3.1e3	in^3/lb

Processing energy, CO2 footprint & water

Polymer molding energy	*	7.02e3	-	7.74e3	BTU/lb
Polymer molding CO2	*	1.31	-	1.44	lb/lb
Polymer molding water	*	321	-	482	in^3/lb
Grinding energy (per unit wt removed)	*	1.91e3	-	2.11e3	BTU/lb
Grinding CO2 (per unit wt removed)	*	0.333	-	0.368	lb/lb

Recycling and end of life

Recycle	✖	
Recycle fraction in current supply	0.1	%

Downcycle	✓			
Combust for energy recovery	✓			
Heat of combustion (net)	* 1.53e4	-	1.61e4	BTU/lb
Combustion CO2	* 3.09	-	3.24	lb/lb
Landfill	✓			
Biodegrade	✗			

Notes

Other notes

Strengths: Resistance to aliphatic hydrocarbon oils and fuels up to 100-120 C. Wear resistance, resilience.
Limitations: Weathering, oxidation/ozone attack, aromatic oils, modest strength.
Effect of composition: Acrylonitrile content increases strength, chemical resistance, Tg and heat resistance; it reduces low temperature flexibility, resilience, die swell, and gas permeability. ACN & Tg: 20%, -60C; 34%, -35C; 48%, -10C.

Links

ProcessUniverse

Producers

Reference

Shape