ExxonMobil

Model formula radial medium truck tire innerliner Exxon™ bromobutyl 2235 (80PHR), natural rubber (20PHR) blend

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Exxon™ bromobutyl is readily blended with other materials to improve processibility or take advantage of material properties from other types of rubber.

Material	Units	Amount
Exxon bromobutyl 2235	PHR (1)	80.0
Natural rubber TSR 20	PHR	20.0
Carbon black grade N660	PHR	60.0
Naphthenic oil	PHR	8.0
Aromatic & aliphatic hydrocarbon resin blend	PHR	7.0
Phenolic tackifying resin	PHR	4.0
Stearic acid	PHR	1.0
Zinc oxide	PHR	1.0
Sulfur	PHR	0.5
Benzothiazyl disulfide (MBTS)	PHR	1.25
Total (PHR)		**182.75**

Properties	Test method based on	Units and conditions	Typical values (2)
Mooney viscosity ML (1+ 4) at 100°C	ASTM D1646	MU, 100°C	53
Mooney scorch (tested at 125°C)	ASTM D1646		
Minimum viscosity	ASTM D1646	MU	43
Time to 5pt rise	ASTM D1646	minutes	12.8
Time to 10pt rise	ASTM D1646	minutes	14.4
MDR rheometer		160°C; 30 minutes; 0.5 deg. arc	
M_l (minimum torque)	ASTM D5289	dNm	1.7
M_h (maximum torque)	ASTM D5289	dNm	4.5
M_h - M_l (delta torque)	ASTM D5289	dNm	2.8
Tc_{10} (time to 10% torque increase)	ASTM D5289	minutes	1.3
Tc_{50} (time to 50% torque increase)	ASTM D5289	minutes	4.2
Tc_{90} (time to 90% torque increase)	ASTM D5289	minutes	17.1
Cure rate (reak rate)	ASTM D5289	dNm/min	0.5

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Properties	Test method based on	Units and conditions [2]	Typical values [3]
MDR rheometer	ASTM D5289	180°C; 30 minutes; 0.5 deg. arc	
M_l (minimum torque)	ASTM D5289	dNm	1.4
M_h (maximum torque)	ASTM D5289	dNm	4.3
M_h - M_l (delta torque)	ASTM D5289	dNm	2.9
Tc_{10} (time to 10% torque increase)	ASTM D5289	minutes	0.6
Tc_{50} (time to 50% torque increase)	ASTM D5289	minutes	1.3
Tc_{90} (time to 90% torque increase)	ASTM D5289	minutes	3.5
Cure rate (peak rate)	ASTM D5289	dNm/min	1.8
Stress strain properties		cure time[3] 19.1 minutes at 160°C	
Tensile strength	ASTM D412	MPa	9.3
Elongation at break	ASTM D412	%	760
Modulus 100%	ASTM D412	MPa	0.9
Modulus 200%	ASTM D412	MPa	1.8
Modulus 300%	ASTM D412	MPa	3.0
Energy to break	ASTM D412	joules	9.3
Tear Strength (die B)	ASTM D624	kN/m	40.9
Hardness	ASTM D2240	shore A	39
Fatigue to failure (cycles)	ExxonMobil method	kilo cycles at 134% strain	365
Oxygen permeability coefficient at 40°C	ExxonMobil method	cc*mm (m^2-day-mmHg)	0.68
ARES dynamic properties at 0°C	ExxonMobil method	2% strain, 1.0 Hz.	
G'		MPa	4.4
G"		MPa	1.2
Tan_delta			0.27
ARES dynamic properties at 30°C	ExxonMobil method	2% strain, 1.0 Hz.	
G'		MPa	3.1
G"		MPa	0.45
Tan_delta			0.15
ARES dynamic properties at 0°C	ExxonMobil method	2% strain, 10.0 Hz.	
G'		MPa	6.1
G"		MPa	3.2
Tan_delta			0.52
ARES dynamic properties at 30°C	ExxonMobil method	2% strain, 10.0 Hz.	
G'		MPa	3.5
G"		MPa	0.7
Tan_delta			0.20

1. Parts per hundred rubber.
2. Values given are typical and should not be interpreted as a specification.
3. Samples cured Tc 90 + 2 at 160°C.

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