ExxonMobil

Model formula for an automobile tire innerliner 90/10 Exxon™ bromobutyl 2222 natural rubber 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 2222	PHR (1)	90.00
Natural rubber (technical specified rubber, TSR20)	PHR	10.00
Carbon black N660	PHR	60.00
Naphthenic oil	PHR	8.00
Aromatic and aliphatic hydrocarbon resin blend	PHR	7.00
Phenolic tackifying resin	PHR	4.00
Magnesium oxide	PHR	0.15
Stearic acid	PHR	1.00
Zinc oxide	PHR	1.00
Sulfur	PHR	0.50
Mercaptobenzothiazyl disulfide (MBTS)	PHR	1.25
Total (PHR)		**182.90**

Properties	Test method based on	Units and conditions	Typical values (2)
Mooney viscosity ML (1+4) at 100°C	ASTM D1646	MU, 100°C	57.0
Mooney scorch (tested at 125°C)	ASTM D1646		
Minimum viscosity	ASTM D1646	MU	23.0
Time to 5pt rise	ASTM D1646	minutes	18.0
Time to 10pt rise	ASTM D1646	minutes	31.0
MDR rheometer	ASTM D5289	160°C; 30 minutes; 0.5 deg. arc	
M_l (minimum torque)	ASTM D5289	dNm	1.4
M_h (maximum torque)	ASTM D5289	dNm	5.9
M_h - M_l (delta torque)	ASTM D5289	dNm	4.5
Tc_{10} (time to 10% torque increase)	ASTM D5289	minutes	2.8
Tc_{50} (time to 50% torque increase)	ASTM D5289	minutes	8.4
Tc_{90} (time to 90% torque increase)	ASTM D5289	minutes	16.1
Cure rate (peak rate)	ASTM D5289	dNm/min	0.4

Model formula for an automobile tire innerliner
90/10 Exxon™ bromobutyl 2222, natural rubber blend

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	1.2
M_h (maximum torque)	ASTM D5289	dNm	6.0
M_h - M_l (delta torque)	ASTM D5289	dNm	4.8
Tc_{10} (time to 10% torque increase)	ASTM D5289	minutes	1.0
Tc_{50} (time to 50% torque increase)	ASTM D5289	minutes	2.4
Tc_{90} (time to 90% torque increase)	ASTM D5289	minutes	4.0
Cure rate (rate at tc50)	ASTM D5289	dNm/min	1.9
Stress strain properties		cure time[3] 25 minutes at 160°C	
Tensile strength	ASTM D412	MPa	10.0
Elongation at break		%	796
Modulus 100%		MPa	1.1
Modulus 200%		MPa	2.1
Modulus 300%		MPa	3.3
Energy to break		joules	12.1
Tear strength (die B) peak load	ASTM D624	N	97.2
Tear strength (die B) mean		KN/m	50.6
Hardness	ASTM D2240	shore A	47.0
Fatigue to failure (cycles)	ASTM 4482	cycles at 136% strain	158486
Mocon oxygen permeability coefficient	ExxonMobil method	cc*mm (m^2-day-mmHg) at 60° C	0.92

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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