

BIIR bromobutyl rubber

PARAMETER	UNIT	VALUE	REFERENCES
GENERAL			
Common name	-	bromobutyl rubber	
Acronym	-	BIIR	
CAS number	-	68441-14-5	
HISTORY			
Person to discover	-	R A Crawford and R T Morrissey	
Date	-	1954	
Details	-	BFGoodrich researchers obtained 3 patents for bromination of butyl rubber	
SYNTHESIS			
Isoprene contents	mol%	1.7-2	Xiong, X; Wang, J; Jia, H; Fang, E; Ding, L, Polym. Deg. Stab., 98, 2208-14, 2013.
Bromine contents	wt%	1.8-2.2	
Method of synthesis	-	the manufacture of the bromobutyl rubber is a two step process: the polymerization of isobutylene and isoprene to produce butyl rubber, followed by bromination to form bromobutyl rubber; a slurry of fine particles of butyl rubber dispersed in methyl chloride is formed in the reactor after Lewis acid initiation; bromine is added to the butyl solution in highly agitated reaction vessels	
Catalyst	-	aluminum trichloride, alkyl aluminum dichloride, boron trifluoride, tin tetrachloride, and titanium tetrachloride	
Mass average molecular weight, M_w	dalton, g/mol, amu	350,000-450,000	
Polydispersity, M_w/M_n	-	1.5	
STRUCTURE			
Trans content	%	50-60 (isoprenyl units)	
COMMERCIAL POLYMERS			
Some manufacturers	-	ExxonMobil; Lanxess	
Trade names	-	Bromobutyl rubber; Bromobutyl	
PHYSICAL PROPERTIES			
Density at 20°C	g cm ⁻³	0.92-0.93	
Color	-	amber	
Odor	-	none to mild	
Decomposition temperature	°C	>170	
Activation energy of thermal decomposition	kJ mol ⁻¹	213	Xiong, X; Wang, J; Jia, H; Fang, E; Ding, L, Polym. Deg. Stab., 98, 2208-14, 2013.
Thermal conductivity	W m ⁻¹ K ⁻¹	0.125	Xiong, X; Wang, J; Jia, H; Fang, E; Ding, L, Polym. Deg. Stab., 98, 2208-14, 2013.
Long term service temperature	°C	316 (dry), 232 (wet)	
Vicat temperature VST/A/50	°C	85	
Permeability to oxygen, 25°C	cm ³ mm m ⁻² day ⁻¹ mm Hg ⁻¹	0.71-0.78	

BIIR bromobutyl rubber

PARAMETER	UNIT	VALUE	REFERENCES
MECHANICAL & RHEOLOGICAL PROPERTIES			
Tensile strength	MPa	9.3-14	
Elongation	%	400-840	
Tear strength	kN m ⁻¹	54-59; 92-114 (peak load)	
Rebound, 23°C	%	9.8-10	
Fatigue to failure (ASTM 4482)	cycles at 136% strain	240,000-340,000	
Shore A hardness	-	47-50	
Mooney viscosity	-	28-64	
CHEMICAL RESISTANCE			
Acid dilute/concentrated	-	good	
Alkalis	-	good	
Aliphatic hydrocarbons	-	poor	
Aromatic hydrocarbons	-	poor	
Halogenated hydrocarbons	-	poor	
FLAMMABILITY			
Ignition temperature	°C	>210	
Autoignition temperature	°C	>300	
Volatile products of combustion	-	CO, CO ₂	
TOXICITY			
NFPA: Health, Flammability, Reactivity rating	-	1/1/0; 1/1/0 (HMIS)	
Carcinogenic effect	-	not listed by ACGIH, NIOSH, NTP	
PROCESSING			
Typical processing methods	-	calendering, mixing, molding, vulcanization	
Processing temperature	°C	150 (vulcanization)	
Process time	min	20	
Additives used in final products	-	accelerator (MTBS); antidegradants (amine type), antioxidant; curing agents (ZnO, Zn stearate); fillers (carbon black and mineral fillers, such as silica, clays, talc, whiting), peroxide (e.g. dicumyl); release agent (metal stearates), retarder (MgO); plasticizers (petroleum based oils), sulfur; tackifying resins (phenolic, phenol-formaldehyde, phenol-acetylene, hydrocarbon resins; UV stabilizer (carbon black)	
Applications	-	automobile tires, conveyor belts, hoses, membranes, pharmaceutical stoppers, seals, protective clothing, tank lining, tire interliners	
Outstanding properties	-	fast cure, low gas transition temperature, low permeability to air, gases, moisture, processing safety	
BLENDS			
Suitable polymers	-	butyl rubber, chlorobutyl rubber, EPDM, SBR	