PERFORMANCE ENERGIZED BY LANXESS

TIRE & SPECIALTY RUBBERS PRODUCT PORTFOLIO 2016

We are the inventor of synthetic rubber and we are still at the forefront of innovation – for high-performance tires as well as for a variety of high profile special applications. **www.lanxess.com**

CONTENTS

- High-cis Neodymium Butadiene Rubber Buna[®] Nd EZ
- High-cis Neodymium Butadiene Rubber Buna[®] CB
- High-cis Cobalt Butadiene Rubber Buna[®] CB
- Low-cis Butadiene Rubber Buna[®] CB
- Butadiene for Plastic Modification Buna[®] CB
- Functionalized Solution **Styrene Butadiene Rubber** Buna[®] FX
- Solution Styrene Butadiene Rubber Buna[®] VSL
- Solution Styrene Butadiene Rubber Buna[®] SL
- Styrene Butadiene Latex Taktene® Latex
- Emulsion Styrene Butadiene Rubber Buna® SE
- Butyl and Halobutyl X Butyl™
- Regular Butyl Rubber X Butyl™
- Halogenated Butyl Rubber X Butyl™
- Contact Technical Service, Sales
- Contact **TSR Sites**
- Disclaimer Health and safety information

Versatile performance specialist 03

04

05

05

06

07

08

09

The business unit TSR (Tire & Specialty Rubbers) of LANXESS is the world's leading supplier of high quality rubbers for the tire industry and for other highly demanding rubber related industries. With a truly global production footprint, TSR has the scale needed to tackle supply driven challenges throughout the entire rubber supply chain. With comprehensive rubber know-how, research and development and application technology under one roof, we offer a broad portfolio of versatile elastomers, such as butyl and butadiene rubbers, that are predominantly used in the production of tires. Our butyl rubber products, such as halogenated butyl rubbers (Halobutyl), are used in the innerliner of tires to provide excellent retention of the desired inflated pressure. Our solution styrene butadiene rubbers (S-SBR), Buna VSL, and neodymium catalyzed butadiene rubbers (Nd-BR), Buna CB and Buna Nd EZ, are used in treads, sidewalls and other components of tires. Also included in our portfolio are the general purpose emulsion styrene butadiene rubbers (E-SBR), Buna SE.



Intensive cooperation with customers 16

As the inventor of synthetic rubber, we are still at the forefront of innovation and production. With research and development centers around the world, we are working closely with our customers to develop products, processes and solutions that meet their continually changing needs. This, coupled with our excellent reputation and reliable deliveries, provides a solid basis for growing strategic cooperations and long-term personal contacts, while striving to establish excellent client relationships.

HIGH-CIS NEODYMIUM BUTADIENE RUBBER

Properties

The Buna® Nd EZ family of products is a new generation of high-cis butadiene rubbers that presents a modified polymeric structure that enables remarkable improvements in the processing performance of rubber compounds but without sacrificing dynamic properties. This new family of butadiene rubber catalyzed by neodymium has a very high 1.4-cis content combined with a low 1.2-vinyl content and a narrow molecular weight distribution but has an increased degree of branching when compared to our standard Nd-BR family of products.

This increased degree of branching leads to a lower final compound viscosity and improved downstream processing on the mill or extruder for example. Subsequently the modified structure leads to improved polymer phase distribution and therefore improved filler distribution which results in excellent dynamic properties. These new grades of easy processing Nd-BR overcome the conflict between superior tire properties and challenging processing.

Product Portfolio

Name	Plant	ML(1+4)	Remark	Physical Form
Buna [®] Nd 22 EZ	Dormagen	63	modified and long chain branched	in bales
Buna® Nd 24 EZ	Dormagen	44	modified and long chain branched	in bales



Applications

Typical applications are tires, retreads, conveyor belts and anti-vibration bushings etc. It can be blended with NR for good having thick sections thereby providing high resistance to heat induced reversion (such as buffers and truck tire treads) and roll covers and belts needing high abrasion resistance and reduced rolling resistance. With S-SBR they can blended to improve abrasion resistance and rolling resistance in tire tread sections. Provided that the compounds are formulated and processed correctly, the vulcanizates have good resistance to aging, reversion, abrasion and flex cracking with good low temperature flexibility and high resilience.



HIGH-CIS NEODYMIUM BUTADIENE RUBBER



HIGH-CIS COBALT BUTADIENE RUBBER

Properties

High-cis butadiene rubbers present a polymeric structure that enables remarkable improvements in the performance of rubber vulcanizates.

LANXESS butadienes catalyzed by neodymium have a very high 1.4-cis content together with a very low 1.2-vinyl content, a relatively narrow molecular weight distribution and a low degree of branching.

Applications

Typical applications are tires, conveyor belts, caterpillar tread blocks, golf balls, footwear soles, V-belts etc. They can be blended with NR for goods having thick sections and requiring high resistance to reversion, besides improving the abrasion resistance. The vulcanizates have good resistance to aging, reversion, abrasion and flex cracking, good low temperature flexibility and high resilience.

Product Portfolio

Name	Plant	ML(1+4)	Remark	Physical Form
Buna [®] CB 21	Dormagen	73	highly linear	in bales
Buna® CB 22	Dormagen, Pt. Jérôme, Cabo, Orange, Singapore	63	highly linear	in bales
Buna® CB 24	Dormagen, Pt. Jérôme, Cabo, Orange, Singapore	44	highly linear	in bales
Buna® CB 25	Dormagen	44	long chain branched	in bales
Buna [®] CB 29 MES	Dormagen	37	MES-oil extended	in bales
Buna® CB 29 TDAE	Dormagen	37	TDAE-oil extended	in bales



Properties

High-cis butadiene rubbers present a polymeric structure that enables remarkable improvements in the performance of rubber vulcanizates.

LANXESS butadiene rubbers catalyzed by cobalt have a high 1.4-cis content combined with higher 1.2-vinyl content and a broader molecular weight distribution with an increased degree of branching that allows easier processing and high quality rubber goods.

Product Portfolio

Name	Plant	ML(1+4)	Remark	Physical Form
Buna® CB 1221	Orange	53	highly branched	in bales
Buna® CB 1203	Orange	43	branched	in bales
Buna [®] CB 1220	Orange	40	highly branched	in bales

LOW-CIS BUTADIENE RUBBER

Properties

Low-cis butadiene rubber is a linear polymer used in classical tire formulations around the bead area of the tire. The Buna® CB 60 grade is star branched to allow the incorporation of high loadings of filler yet allowing good processibility in, for example, apex compounds.

Product Portfolio

Name	Plant	ML(1+4)	Remark	Physical Form
Buna [®] CB 60	Pt. Jérôme	60	star branched	in bales
Buna® CB 55 NF	Pt. Jérôme	55	linear	in bales
Buna [®] CB 55 H	Cabo	54	linear	in bales
Buna® CB 55 L	Cabo	51	linear	in bales
Buna [®] CB 45	Cabo, Orange	45	linear	in bales





Applications

Co-BRs can be used in sidewall and tread compounds for tires. Further typical applications are conveyor belts, golf balls, footwear soles, etc. They can be blended with NR for goods having thick sections, high resistance to reversion and high abrasion resistance.



Applications

Technical rubber goods, apex areas of the tire, shoe soles and in applications where low temperature flexibility is important.

BUTADIENE RUBBER FOR PLASTIC MODIFICATION



LANXESS butadiene rubbers for plastic modification are produced by a solution polymerization process which enables the production of very pure, virtually gel-free, very clear and almost colorless products. These rubbers are manufactured either in an anionic process or using Ziegler-Natta catalyst systems. The use of organometallic catalysts produces highly uniform polymers that are particularly suited for use in high impact polystyrene (HIPS) and for the mass-solution polymerization of acrylonitrile-butadiene-styrene resins (m-ABS).

Stabilization System

Regarding the different requirements of customers and various regional legislations, LANXESS offers a range of different antioxidant systems within its portfolio. These systems are characterised by different abbreviations "T", "IP" & "GPT". For more detailed information please contact your regional technical service representative that you can find on page 14.

Product Portfolio (Anionic process)

Name	Plant	Туре	SV * (mPas)	ML(1+4)	Physical Form
Buna® CB 70 GPT	Pt. Jérôme	Li-BR	250	69.5	in bales
Buna® CB 55 GPT	Pt. Jérôme	Li-BR	165	52.5	in bales
Buna® CB 530 T	Pt. Jérôme	Li-BR	250	68	in bales
Buna® CB 550 T	Pt. Jérôme	Li-BR	163	54	in bales
Buna® CB 550 IP	Pt. Jérôme	Li-BR	163	54	in bales
Buna® CB 565 T	Pt. Jérôme	Li-BR – star branched	44	60	in bales
Buna® CB 550	Orange	Li-BR	163	54	in bales
Buna [®] CB 380	Orange	Li-BR	90	38	in bales

Product Portfolio (Ziegler-Natta catalyst systems)

Name	Plant	Туре	SV * (mPas)	ML(1+4)	Physical Form
Buna® CB 728 T	Orange	Nd-BR	160	44	in bales

*5,43 % rubber solution in toluene

Macrostructure of Butadiene Rubbers

The use of the different types of polymerization systems influences the macrostructure of the final polymers that may be linear or branched having a significant effect over the rheological behavior of the rubber itself, such as in its solution viscosity, Mooney viscosity and cold flow. The properties of HIPS are also significantly affected by the macrostructure of the rubber used.

Product Portfolio (Ziegler-Natta catalyst systems)

Name	Туре	MWD (Mw/Mn)	ML4/SV
Buna® CB 380	Li-BR	~ 2.2	~ 0.42
Buna® CB 55 GPT, Buna®CB 550 T, Buna® CB 550 IP	Li-BR	~ 2.0	~ 0.32
Buna® CB 530 T, Buna® CB 70 GPT	Li-BR	~ 2.0	~ 0.27
Buna® CB 565 T	Li-BR - star branched	~ 1.6	~ 1.36
Buna® CB 728 T	Nd-BR	~ 2.0	~ 0.20 - 0.28

BUNA® FX – FUNCTIONALIZED SOLUTION STYRENE BUTADIENE RUBBER (S-SBR)



The Buna[®] FX product group is a brand new family of high performance solution styrene butadiene rubber (S-SBR) that compliments the popular Buna[®] VSL family. This grade has been functionalised with polar groups to increase the interaction with silica fillers. This reduces the hysteresis inside the tread compound thus reducing the rolling resistance of the tire. Traction indicators have also been improved.

The first grade – Buna® FX 3234A-2 HM – has a Mooney Viscosity of 80 after the addition of 37,5 phr of TDAE oil. The high Mooney imparts excellent treadwear performance. The high styrene content set at 34% imparts a high level of dynamic stiffness making the grade especially suitable for high performance summer tires. The glass transition temperature of the product comes in at -30°C.

Composition of silica tire tread compound:

- 70 phr S-SBR
- 30 phr Nd-BR
- 90 phr Silica

Status of the continuous process:

- Specifically suited for high styrene S-SBR grades, but also for all other microstructures
- Fine tuning of tire properties possible

Product Portfolio (Ziegler-Natta catalyst systems)

Name	Plant	styrene (%)	vinyl (%)	ML (1+4)	type of oil	oil (phr)	Tg (°C)	Physical Form
Buna® FX 3234A-2 HM	Pt. Jérôme	34	32	80	TDAE	37.5	-30	in bales
Buna® VP PBR 4078	Pt. Jérôme	23	49	65	TDAE	25	-27	in bales



Buna® FX S-SBRs provide significant improvements in tire properties



SOLUTION VINYL STYRENE **BUTADIENE RUBBER**



SOLUTION STYRENE **BUTADIENE RUBBER**

Properties

Solution Vinyl Styrene Butadiene rubbers have a modified microstructure with a higher vinyl content than for example Buna[®] SL grades. Their vinyl and styrene contents increase the Tg values which enable an excellent balance of important properties in tire compounds like handling, traction and rolling resistance to be achieved provided that the compounds are formulated and processed correctly. Due to our vast experience with these kinds of synthetic rubbers, LANXESS can offer a broad portfolio of different types of S-SBRs such as a wide range in microstructure (vinyl/ styrene), varied types of coupling, adjusted glass transition temperature (Tg), targeted functionalizations and Mooney viscosity values. Vulcanizates prepared with these rubbers present a good resistance to reversion and a good resilience, besides keeping flexibility at relatively low temperatures.

Applications

Typical applications are tires, mainly high performance tires. Buna® VSL is used, for example, as a component in the polymer blend of tire treads to improve grip and rolling

Product Portfolio

Name	Plant	styrene (%)	vinyl (%)	ML (1+4)	type of oil	oil (phr)	Tg (°C)	Physical Form
Buna® VSL 5025-2 HM	Pt. Jérôme	25	50	62	TDAE	37.5	-29	in bales
Buna® VSL 4526-2	Pt. Jérôme	26	44.5	50	TDAE	37.5	-30	in bales
Buna® VSL 4526-2 HM	Pt. Jérôme	26	44.5	62	TDAE	37.5	-30	in bales
Buna® VSL 5228-2	Pt. Jérôme	28	52	50	TDAE	37.5	-20	in bales
Buna® VSL 2538-2	Pt. Jérôme	38	25	50	TDAE	37.5	-31	in bales
Buna® VSL 2438-2 HM	Pt. Jérôme	38	24	80	TDAE	37.5	-32	in bales
Buna® VSL 3038-2 HM	Pt. Jérôme	38	30	80	TDAE	37.5	-26	in bales

Properties

Provided that the compounds are formulated and processed correctly, the vulcanizates have good resistance to reversion. The low temperature flexibility, resilience and abrasion resistance depend on the polymer's styrene and vinyl content. The low vinyl content provides a low Tg which gives an excellent low temperature flexibility, abrasion resistance and low rolling resistance.

Product Portfolio

Name	Plant	ML(1+4)	styrene (%)	type of oil	oil (phr)	Physical Form
Buna® SL4525-0	Cabo	45	25	none	-	in bales
Buna® SL 4518-3	Cabo	45	18	hydrotreated naphthenic	37.5	in bales
Buna [®] SLVP PBR 4087	Cabo	45	18	hydrotreated naphthenic	37.5	in bales
Buna® SLVP PBR 4089	Cabo	75	18	hydrotreated naphthenic	15.0	in bales

STYRENE BUTADIENE LATEX

Properties

Foams produced with Taktene® Latex present good elasticity, rebound and dimensional stability. Asphalt binders modified with Taktene® Latex show elastic properties that reduce rutting (permanent deformation) and fatigue cracking, increasing pavement's durability and reducing its maintenance costs. This modification also allows an expansion of the temperature range of service.

Product Portfolio					
Name	Plant	Total Solids (%)	Brookfield visc.	bound styrene (%)	Physical Form
Taktene [®] Latex S 62	Caxias	68	800	24	Bulk
Taktene [®] Latex S 62 F	Caxias	68	800	24	Bulk



Applications

Buna® SL has excellent properties in the manufacture of tires, retreads, moulded technical parts, injected or extruded goods, surgical goods, shoe soles and automotive industry parts. In tire manufacture it is blended with NR, BR or emulsion SBR.



Applications

Taktene[®] Latex is used in the production of gel and non-gel laminated foam, molded foam, lining impregnation, carpet backing, agglomerates of coconut fiber and cork, manufacture of insoles and in modification of asphalt emulsions. Taktene® Latex S 62 F contains no biocide and allows the use in food applications such as production of chewing gum base.

EMULSION STYRENE BUTADIENE RUBBER



LANXESS BUTYL AND HALOBUTYL

Properties

Emulsion Styrene Butadiene Rubbers have a macrostructure with high polydispersions and a low to medium degree of branching. These features make them excellent processing grades allowing a high filler loading incorporation in rubber compounds. Provided that the compounds are formulated and processed correctly, the vulcanizates produced with these rubbers have good resistance to reversion, good flexibility at low temperatures, besides having good resilience and abrasion resistance.

Applications

Buna[®] SE is used in order to achieve excellent resistance to wear and tear besides high resistance to cracking. It processes easily in extrusion and calendering, due to its particular macrostructure. It is used in tires, retreads, conveyor belts, piping, hoses, tubings, carpets, molded products in general and shoe soles.

Product Portfolio

Name	Plant	styrene (%)	ML (1+4)	type of oil	oil (phr)	Stabilisation	Physical Form
Buna [®] SE 1500	Caxias	23.5	52	none	-	staining	in bales
Buna® SE 1502 H	Triunfo	23.5	53	none	-	non-staining	in bales
Buna® SE 1502 L	Triunfo	23.5	49	none	-	non-staining	in bales
Buna® SE 1712 TE	Caxias	23.5	51	TRAE	37.5	staining	in bales
Buna® SE 1721 TE	Caxias	40.0	55	TRAE	37.5	staining	in bales



A look at the production process for LANXESS Butyl Rubber: The material before the pressing operation.

The major application area for LANXESS Butyl Rubber products is the tire industry, but its unique properties also make it a key polymer for a variety of technical rubber applications. Butyl vulcanizates offer an attractive range of properties including low permeability, high damping, good ageing, chemical resistance and excellent mechanical properties.

Halogenated grades have a rapid cure rate and can be blended with natural rubber (NR) or synthetic rubbers such as nitrile rubber (NBR), styrene-butadiene rubber (SBR), polychloroprene rubber (CR), ethylenepropylene rubber (EPDM), or butadiene rubber (BR).







Key Properties

- excellent ageing stability
- high impermeability to gases
- high resistance to heat
- high hysteresis for energy absorption
- slow vulcanization reactions (low levels of unsaturation)

Key Properties

- high impermeability to gases
- improved weather and ozone resistance
- improved chemical resistance
- cure versatility
- faster cure rate with lower amount of curatives
- cure compatibility with unsaturated rubbers
- good adhesion to other types of rubber
- heat resistance

REGULAR BUTYL RUBBER (IIR)



HALOGENATED BUTYL RUBBER (HIIR)



Butyl rubbers are copolymers of isobutylene with small amounts of isoprene. The incorporation of isoprene creates double bonds allowing vulcanization with sulfur and other agents.

Product Portfolio

Name	Plant	Level of unsatur- ation (mol %)	Mooney viscosity (ML (1+8) 125 °C)	Density (g/cm³)	Physical Form
X_Butyl™ RB 100	Zwijndrecht	0.90	33	0.92	in bales
X_Butyl™ RB 301	Sarnia, Singapore, Zwijndrecht	1.85	51	0.92	in bales
X_Butyl™ RB 402	Sarnia, Zwijndrecht	2.25	33	0.92	in bales
X_Butyl™ RB 101-3 (Food grade)	Sarnia	1.75	51	0.92	in bales

Applications



The excellent properties of our new butyl polymer optimize the production of curing bladders - for example



LANXESS Butyl isobutene-isoprene rubber for tire inner tubes meet all requirements



The vulcanizate properties of LANXESS X_ButyI™ make it

particularly suitable for a variety of rubber products, such as

tire inner tubes, curing bladders and protective clothing.

Effective protection through reliable material: High quality LANXESS Butyl Rubbers

Properties

LANXESS Halogenated X_ButyI[™] Rubber (Bromobutyl and Chlorobutyl) is produced in a continuous process by reacting bromine or chlorine with butyl rubber. Halogenation allows co-vulcanization and improved compatibility with other diene rubbers in addition to improvements in the vulcanization rates, states of cure and reversion resistance.

Product Portfolio

Name	Plant	Halogen content (mol %)	Mooney viscosity (ML (1+8) 125 °C)	Density (g/cm³)	Physical Form
X_Butyl™ BB 2030	Sarnia, Singapore, Zwijndrecht	1.80	32	0.93	in bales
X_Butyl™ BB 2040	Sarnia	1.80	39	0.93	in bales
X_ButyI™ BB X2	Sarnia, Singapore, Zwijndrecht	1.80	46	0.93	in bales
X_Butyl™ CB 1240	Sarnia, Zwijndrecht	1.25	38	0.92	in bales

Specialty LANXESS Butyl for chewing gum applications





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Applications

Many of the properties of halobutyl vulcanizates are virtually identical, regardless of the halogen employed. With bromobutyl rubber however, the bromine sites are more reactive, resulting in faster cures and better adhesion to unsaturated rubbers. The versatility of halobutyl rubber has led to a significant growth of its use in a diverse range of tire and non-tire applications.

Y Chlorobutyl





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TSR Sites



Trial product

(VP = Versuchsprodukt = trial product). The information contained herein is merely preliminary data. Testing as to properties and applications is not final. Further information, including data which could change or add hazards with use, may be developed. Such information may be needed to properly evaluate or use this product. Use is undertaken at the sole risk of the user.

Product Safety:

Relevant safety data and references as well as the possibly necessary warning labels are to be found in the corresponding safety data sheets.

Health and Safety Information:

Appropriate literature has been assembled which provides information concerning the health and safety precautions that must be observed when handling the LANXESS products mentioned in this publication. For materials mentioned which are not LANXESS products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be followed. Before working with any of these products, you must read and become familiar with the available information on their hazards, proper use and handling. This cannot be overemphasized. Information is available in several forms, e.g., material safety data sheets and product labels. Consult us through your LANXESS TSR representative.

Health and Safety Information

Regulatory Compliance Information:

Some of the end uses of the products described in this publication must comply with applicable regulations, such as the FDA, BfR, NSF, USDA and CPSC. If you have any questions on the regulatory status of these products, contact your LANXESS TSR representative.

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Therefore, it is imperative that you test our products, technical assistance and information to determine to your own satisfaction whether they are suitable for your intended uses and applications. This application-specific analysis must at least include testing to determine suitability from a technical as well as health, safety, and environmental standpoint. Such testing has not necessarily been done by us. Unless we otherwise agree in writing, all products are sold strictly pursuant to the terms of our standard conditions of sale. All information and technical assistance is given without warranty or guarantee and is subject to change without notice. It is expressly understood and agreed that you assume and hereby expressly release us from all liability, in tort, contract or otherwise, incurred in connection with the use of our products, technical assistance and information.

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The current range of synthetic rubbers from LANXESS:

The most suitable compounds for tires of all kinds. From cars to high-speed motorcycles, from trucks to gigantic construction vehicles, from bicycles to aircraft tires. In addition, in the spotlight: Our perfected range of specialty rubbers for a variety of very different and most demanding applications.



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