TRINSEO™

Product Safety
Overview

SYNTHETIC RUBBER
Styrene Butadiene Copolymer and Polybutadiene

Note: *This product safety overview summarizes information on a group of products, their use, their potential hazards, and the management of any risk(s) associated with exposure. This overview is NOT intended to provide emergency response information, medical information, or treatment information. In-depth safety and health information can be found in the safety data sheet (SDS) for the specific product of interest.*

Product Summary

Synthetic Rubber is a man-made elastomer. Unlike natural rubber that is made from rubber trees, synthetic rubber is produced from petroleum-based feedstocks. Manufactured as a crumbly solid resin, packaged in bales, synthetic rubber can be processed and vulcanized in the same method as natural rubber.

Synthetic rubber from Trinseo is used to make tires, industrial rubber goods, and as an additive to plastics. Different types of synthetic rubber are used depending on the application and the mechanical and chemical properties required. Some of these products contain a refined petroleum-based distillate as an extender oil. Many of the products have additives blended into the formulations to affect processability or other characteristics. (See also the “Physical/Chemical Properties” section of this document.)

Trinseo does not sell synthetic rubber for direct consumer use; rather, these rubbers are converted into articles used by consumers. (See also the “Uses and Applications” section of this document.) Synthetic rubber is typically supplied in rectangular 30 kg bales wrapped in polyethylene film and shipped in boxes containing 40 bales (nominal 1200 kg). Repeated exposure to synthetic rubber is not anticipated to cause any adverse health effects. (See also the “Health and Environmental Information” section of this document.)

Some synthetic rubbers are utilized in food-contact plastics or indirect food-contact applications. Synthetic rubbers are thermally stable at typical-use temperatures. However, exposure to elevated temperatures can cause the product to decompose. (See also the “Human and Environmental Exposure” section of this document.)

Types of rubber produced by Trinseo include:

- Solution-Styrene Butadiene Rubber (S-SBR)
- Emulsion-Styrene Butadiene Rubber (E-SBR)
- Lithium-Butadiene Rubber (Li-BR)
- Nickel-Butadiene Rubber (Ni-BR)

Product Description/Chemical Identity

Petrochemical feedstocks provide the critical raw materials for producing synthetic rubber. Crude oil is the principal source of the two reactive monomers used in rubber production – styrene and butadiene. These raw materials react under controlled conditions either in a water-based emulsion polymerization or in a solvent-based polymerization.

Solution-Styrene Butadiene Rubber (S-SBR)
Solution-SBR is produced by an anionic polymerization process in a hydrocarbon solvent where water is strictly excluded. Polymerization is initiated by alkyllithium compounds promoting a controlled polymerization by monomer addition. Once the reaction is complete, the rubber is coagulated into crumbs, washed, dried, and baled ready for shipment.

Emulsion-Styrene Butadiene Rubber (E-SBR)
E-SBR produced by emulsion polymerization as initiated by free radicals like persulfates and peroxides. Reaction vessels are typically charged with the two monomers (styrene and butadiene), a free radical generator, and a chain transfer agent such as an alkyl mercaptan. These chain transfer agents control the molecular weight of the rubber. Emulsifying agents (surfactants) allow for the polymerization to occur as a milky white polymer dispersion in water. Once the reaction is complete, the rubber is coagulated into crumbs, washed, dried, and baled ready for shipment.

Lithium-Butadiene Rubber (Li-BR)
Using an alkyllithium (e.g. butyllithium) as the catalyst produces a polybutadiene rubber referred to as “low-cis” content rubber. The cis double bonds cause a bend in the polymer chain, preventing polymer chains from aligning. Despite its high liquid-glass transition, low-cis polybutadiene is used in tire manufacturing and is blended with other tire polymers. It can also be used advantageously as an additive in plastics due to its low content of gels.

About 25% of the produced polybutadiene is used to improve the mechanical properties of plastics, in particular of high-impact polystyrene (HIPS) and to a lesser extent acrylonitrile butadiene styrene (ABS). The addition of polybutadiene rubber to polystyrene transforms it from a fragile and delicate material to a ductile and resistant one. The quality of the production process is particularly important when using these rubbers as plastic modifiers, especially when it comes to rubber color and content of gels, which have to be as low as possible. In addition, these products may need to meet a list of health and safety requirements due to their use in the food contact applications.

Nickel-Butadiene Rubber (Ni-BR)
This type of rubber is considered a “high-cis” polybutadiene resulting in a more flexible elastomer. It is manufactured using Ziegler-Natta catalysts based on transition metals like nickel. Depending on the metal used, the properties of the rubber can vary.

Trinseo Rubber Product Grades

	Solution-Styrene Butadiene Rubber	Emulsion-Styrene Butadiene Rubber	Lithium-Butadiene Rubber	Nickel-Butadiene Rubber
Abbreviation:	S-SBR	E-SBR	Li-BR	Ni-BR
CAS Number:	9003-55-8	9003-55-8	9003-17-2	9003-17-2
	• SPRINTAN™ SLR 3402-SCHKOPAU • SPRINTAN™ SLR 4502-SCHKOPAU • SPRINTAN™ SLR 4601-SCHKOPAU • SPRINTAN™ SLR 4602-SCHKOPAU • SPRINTAN™ SLR 4630-SCHKOPAU • SPRINTAN™ SLR 6430-SCHKOPAU	• BUNA™ SB 1500-SCHKOPAU • BUNA™ SB 1502-SCHKOPAU • BUNA™ SB 1723-SCHKOPAU • BUNA™ SB 1739-SCHKOPAU	• SE PB 3501-SCHKOPAU • SE PB 5800-SCHKOPAU	• BUNA™ Cis 132-SCHKOPAU

Uses and Applications

Typical S-SBR Applications	Typical E-SBR Applications	Typical Li-BR Applications	Typical Ni-BR Applications
• Industrial Rubber Goods • Tires	• Industrial Rubber Goods • Tires	• Polymer Modification	• Automotive Interiors • Footwear • Industrial Rubber Goods • Recreational Products • Tires

Trinseo is a leading producer of solution-styrene butadiene rubber (S-SBR) grades, which are used in manufacturing high performance tires. Trinseo’s proprietary functionalization technologies effectively improve interaction of the S-SBR polymer with fillers like carbon black and silica, thereby leading to significantly higher elasticity and reduced dynamic heat build-up.

E-SBR is predominantly used for the production of car and light truck tires and truck tire retread compounds. With its non-staining stabilizer, BUNA™ SB 1502-Schkopau can also be used for light colored rubber articles and products for food contact applications.

Low-cis Li-BR is used as an impact modifier in polystyrene and acrylonitrile butadiene styrene (ABS). Li-BR grades are used to toughen polystyrene, creating high impact polystyrene (HIPS) for use in applications such as inner liners of refrigerators, consumer electronics housings, food packaging, and other uses requiring both durability and functionality.

Trinseo’s high-cis Ni-BR series has over 95% cis content, produced using a catalyst system based on nickel. Our Ni-BR grades are applicable for use in tire tread and sidewall compounds, in conveyor belts, and in a variety of mechanical goods requiring good dynamic properties.

Benefits

Styrene butadiene rubber (SBR) has similar chemical and physical properties to natural rubber. Some properties are superior to natural rubber such as abrasion resistance, better aging, and heat resistance. Synthetic rubber has excellent electrical insulation properties as well.

For use in high-performance tires, Trinseo's S-SBR products provide an excellent balance between wet grip, low rolling resistance, and abrasion resistance, when formulated with silica and carbon black compounds.

Polybutadiene has a high resistance to wear and can improve the toughness (impact resistance) of plastics. High-cis polybutadiene has a high elasticity and is, therefore, highly desirable to increase the service life of continuous use rubber articles. This rubber can increase abrasion resistance of an article while dissipating the heat generated while in use.

Physical/Chemical Properties

Styrene butadiene rubbers and polybutadiene rubbers are typically supplied in bales wrapped in plastic film. These products should be kept away from sources of ignition and should be stored in an adequately ventilated area where it will not be subjected to direct sunlight or temperatures in excess of 30°C.

The following data represent typical values from various rubber products.

Physical State	S-SBR Bales	E-SBR Bales	Li-BR Bales	Ni-BR Bales		
Typical Physical Properties[1]	Nominal Value	Nominal Value	Nominal Value	Nominal Value	Unit	Test Method[2]
Specific Gravity, 73°F (23°C)	0.93	0.93	0.91	0.91	g/cm^2	–
Mooney Viscosity	50-80	49-53	45-51	~45	MU	ASTM D1646
Volatile Matter	~0.20	~0.30	~0.25	~0.25	%	ASTM DS 668

This information is provided for comparative purposes only.

Notes
[1]Typical properties: these are not to be construed as specifications.
[2]Tested in accordance with ISO 10350. 23°C/50% RH unless otherwise noted.

Health and Environmental Information

Human Health
Based upon the thorough evaluation of human toxicological data associated with styrene-butadiene rubber (SBR) and polybutadiene (BR), these products pose very low risks under intended use conditions. SBR and BR rubbers are non-hazardous substances. In workplace processing of rubber, contact with heated fumes may cause eye, skin, and respiratory irritation. Contact with hot molten material may cause thermal burns and require careful removal (please refer to the SDS). Inhalation of smoke under fire conditions is considered hazardous.

Environmental Health
These high-molecular-weight polymers are considered nontoxic in land and water systems. These polymers do not readily degrade in soil or landfill and should be fully recovered from land spills. Photo degradation is expected with exposure to sunlight.

Human and Environmental Exposure

Workplace Processing Exposure
Although these resins are considered nontoxic, workers producing and processing these products can be exposed to vapors particularly when handling at elevated temperatures. Good equipment design, adequate ventilation, proper handling, and personal hygiene procedures should be utilized to minimize workplace exposures. Although these products are essentially non-irritating to skin at normal temperatures, hand protection is advised.

Public Exposure
Due to the use of these rubbers in commercial products, the general public is exposed to finished products based upon these polymers. Consumers using rubber articles are not at risk of any negative health effects.

Environmental Exposure
The presence of rubber articles in the environment or rubber particles from the industrial workplace (or during transport) may be due to improper disposal or poor housekeeping. Once in the environment, these rubbers are persistent in land and water systems, and they will not readily biodegrade. Exposure to sunlight will produce polymer degradation. THESE PRODUCTS SHOULD NEVER BE DUMPED INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER. All disposal practices must be in compliance with all Federal, State/Provincial, and local laws and regulations. Rubber product waste can be collected for chemical or mechanical recycling or used as high-energy fuel in industrial thermal energy recovery systems.

Risk Management/Product Stewardship Recommendations

Trinseo and its affiliated companies have a fundamental concern for all who make, distribute, and use their products and for the environment in which we live. This concern is the basis for our Product Stewardship philosophy by which we assess the safety, health, and environmental information on our products so that appropriate steps may be taken to protect employee and public health and our environment. The success of our Product Stewardship program rests with each and every individual involved with Trinseo products – from the initial concept and research to manufacture, use, sale, disposal, and recycle of each product.

Trinseo carefully reviews all relevant information on the safety and suitability of our products for their known and intended uses.

Trinseo is committed to sharing information on the safe handling and end-use of our products with customers and other interested parties. Safety data sheets (SDSs) are provided to our customers and can be accessed through our customer information group (CIG). Many of our products have storage, handling, and safety guides, along with technical processing information (refer to www.trinseo.com).

Responsible Care®

Trinseo is a certified Responsible Care® company and a member of the American Chemistry Council and Plastics Europe. Through these and other industry associations, we actively monitor and participate in public regulatory processes impacting our products. We seek to support sustainable solutions for plastic recycling and other health and environmental challenges. We actively support industry sponsored product testing initiatives supporting responsible actions, sound science, and life cycle stewardship of our products.

References

- Trinseo Web Product Finder
- UL Prospector Web
- Trinseo Safety Data Sheets
- Harper C.A. (1975) Handbook of Plastic, Elastomers, and Composites McGraw-Hill, New York, pp. 1–3,1–62, 2–42, 3–1, ISBN 0070266816

For more detailed information on products from this family, please refer to the specific safety data sheet for the product of interest. For more information, visit www.trinseo.com, or contact us as indicated below.

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