ARLANXEO Tire & Specialty Rubbers Overview

The Tire & Specialty Rubber (TSR) business unit offers an extensive range of versatile elastomers including butyl rubber, styrene butadiene rubber and butadiene rubber to meet the increasing performance demands for a wide variety of applications. Within the butyl rubber portfolio we offer two major product groups, regular butyl and halobutyl rubber, manufactured at our three production sites located in Canada, Belgium, and Singapore. These plants ship to more than 45 countries world-wide.

ARLANXEO regular butyl rubber is the basis for all butyl rubber technology. After butyl is polymerized at a temperature of -100 °C, it is either dried and baled or dissolved in an organic solvent and modified to produce ARLANXEO halogenated butyl rubber. This is a very sophisticated and complex process that few manufacturers are able to manage successfully while maintaining a high standard of quality.

At ARLANXEO, supply-side reliability is not just a competitive edge, it is a market necessity. Over the last several decades, especially since the introduction of tubeless tires, there has been a particularly sharp increase in demand for our butyl rubber products. ARLANXEO has been one of the most proactive supply partners in the rubber industry. By identifying trends early on, ARLANXEO has been implementing process developments, new technology and improved raw material stability to help ensure that our customers have access to a reliable global butyl supply.

ARLANXEO TSR is strongly committed to research and development activities in the rubber industry. Our Research & Development and Technical Service & Development teams are working continuously with our customers around the globe to develop improved applications and future products. ARLANXEO TSR is your key partner with over 60 years of experience, and will continue to offer our customers our excellent services globally!

For additional information on ARLANXEO Tire & Specialty Rubber,

visit: http://tsr.arlanxeo.com | http://arlanxeo.com
ARLANXEO Butyl and Halobutyl

The major application area for ARLANXEO 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), chloroprene rubber (CR), ethylene-propylene rubber (EPDM), or butadiene rubber (BR).

ARLANXEO Regular Butyl Rubber (IIR)

Butyl rubbers are copolymers of isobutene with small amounts of isoprene. The incorporation of isoprene creates double bonds allowing vulcanization with sulfur and other agents. The vulcanizate properties of ARLANXEO butyl rubber make it particularly suitable for a variety of rubber products, such as tire inner tubes, curing bladders and protective clothing.

ARLANXEO Halogenated Butyl (HIIR)

ARLANXEO halobutyl rubber (ARLANXEO bromobutyl and ARLANXEO chlorobutyl) is produced in a continuous process by reacting bromine or chlorine with butyl rubber. Halogenation allows for co-vulcanization and improved compatibility with other diene rubbers in addition to improvements in the vulcanization rates, states of cure and reversion resistance.

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.

Chemical Structure of Butyl Rubber (IIR)

Key Properties
• high impermeability to gas and moisture
• excellent ageing stability
• high hysteresis for energy absorption
• resistance to heat
• chemical resistance
• slow vulcanization reactions (low levels of unsaturation)

Chemical Structure of Halobutyl Rubber (XIIIR)

Key Properties
• high impermeability to gas and moisture
• 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
ARLANXEO Butyl for Tire Applications**

The tire industry consumes >80% of the world’s supply of butyl rubber. Global demand is dominated by halogenated butyl rubber (ARLANXEO bromobutyl and ARLANXEO chlorobutyl).

**Tire Inner Liners and Sidewalls**

Using halobutyl rubber within the tire inner liner helps the tire to maintain proper inflation pressure. It is well known within the tire industry that a tire retaining proper inflation pressure has improved rolling resistance and fuel economy compared to conditions where it is under inflated. Halobutyl inner liners also protect vulnerable tire components from oxygen attack by reducing intercarcass pressure. ARLANXEO bromobutyl and ARLANXEO chlorobutyl are well-suited for the production of white sidewall and non-staining black sidewall because of their resistance to weathering, adhesion, bend and flex characteristics.

**Tire Curing Envelopes and Bladders**

Compounds based on ARLANXEO halobutyl are ideal for curing envelopes used in the retreading of tires due to the low modulus and compression set requirements. Heat and steam resistance and suitability for resin cures also make ARLANXEO butyl perfect for curing bladders used for tire press molds. In addition, the use of lower unsaturation butyl products can improve the flex fatigue properties and further extend the curing bladder life.

Tire Inner tubes

ARLANXEO Regular Butyl is still used extensively for inner tubes in countries where the road infrastructure is not highly developed and in low-speed tire applications such as construction, farm equipment and recreational vehicles.

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* These items are provided as general information only. They are approximate values and are not considered part of the product specifications.

** As with any product, use of the products mentioned in this publication in a given application must be tested (including field testing, etc.) by the user in advance to determine suitability.
ARLANXEO Butyl for Non-Tire Applications**

High quality ARLANXEO Butyl and Halobutyl rubbers for pharmaceutical closures applications.

ARLANXEO Butyl for the Medical Industry

The demands by the medical and pharmaceutical sectors on elastomers and their compounds and vulcanizates are extremely high. ARLANXEO halobutyl is widely used in pharmaceutical rubber products, such as closures for infusion containers, injection vials, lyophilization and blood collection tubes. Manufactured to stringent requirements, pharmaceutical closures often come into direct contact with pharmaceutical products, either dissolved or in other forms. Therefore, they must comply with existing standards and regulations relating to the contact of rubber articles with pharmaceuticals.

ARLANXEO halobutyl is generally preferred because they ensure adequate protection of sterile pharmaceutical products against external contamination during storage and use. ARLANXEO halogenated grades are also found as O-rings and gaskets in a variety of aerosol containers, personal care and cosmetic spray pumps and inhalers. In addition, they are used in plungers for applications such as infusion pumps, pre-filled syringes, insulin injectors and dental anesthetics. ARLANXEO regular butyl also plays a significant role in the medical and pharmaceutical industry in respirator masks and tubes.

ARLANXEO Butyl for the Food Industry

ARLANXEO X_Butyl® RB 101-3 is a specialty product manufactured for the chewing gum industry. This application requires ARLANXEO to apply the most stringent quality controls consistent with international food regulations and standards worldwide. Because of its low permeability, flavor is retained longer than with natural rubber-based products and the transmission of air and water are minimized. Its low-temperature flexibility prevents it from becoming brittle and shattering, even in heavily filled compounds. Butyl's outstanding stability and resistance to ageing resists hardening during shelf storage, thus helping to retain the soft texture required for stick gums. It also serves as a hydrophobic plasticizer, providing softness and smoothness to enhance chewing.

Food contact: Information concerning compliance with FDA, BfR and other global food contact regulations can be obtained upon request from your ARLANXEO Butyl Rubber Sales or Technical Marketing contact.

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ARLANXEO Butyl for Body Mounts and Sound Damping

The unique combination of properties, such as high permeation barrier, high damping, resistance to ozone and heat ageing make ARLANXEO butyl rubber ideal for many automotive non-tire applications. Among the largest of these applications are vibration control applications and dynamic parts including body mounts. ARLANXEO halobutyl is widely used because of its high damping, fast reversion-resistant cures and excellent ageing properties, especially with respect to hot flex fatigue. Compared to regular butyl, ARLANXEO halobutyl can also be formulated to have an intermediate level of oil resistance for use in engine and transmission mounts and automotive exhaust hanger compounds.

ARLANXEO Butyl for Automotive Air-conditioning Systems

Automotive air-conditioning systems use rubbers in seals around the fittings and shafts, and in hoses that conduct both gaseous and liquid refrigerant. ARLANXEO halobutyl rubbers are considered by many air-conditioning hose manufacturers as the base polymer for this application, because of their excellent permeation resistance to the refrigerant R-134a, high damping of low frequency vibrations, excellent low temperature properties and excellent heat ageing. The vulcanisates based on ARLANXEO halobutyl rubbers, when correctly compounded, meet the most stringent specification requirements and prevent the ingestion of moisture into the air conditioning system.

ARLANXEO Butyl for Protective Clothing and Equipment

Protective clothing made with ARLANXEO regular butyl and Halobutyl rubber not only has very good barrier properties, but it is lightweight and maintains a high degree of flexibility. With excellent tear and abrasion resistance, ARLANXEO butyl vulcanizates allows the material to drape naturally and not crack as easily as plastic. ARLANXEO butyl products are well suited for Nuclear, Biological, Chemical (NBC) clothing as well as face masks and respirators that must remain impervious to gases, yet be flexible enough to deliver a positive mask seal.

ARLANXEO Butyl for Tank Linings

Halobutyl rubbers from ARLANXEO have high resistance to numerous chemicals, making them an ideal material for the production of linings where chemical resistance is required. In addition, they offer cure versatility, easy bonding and very low volume swell in contact with various chemicals.

ARLANXEO Butyl for Rubber Closures of Electrical Condensers in Electrical Appliances

The assembly of an electrical condenser (or capacitor) is sealed by a rubber closure to prevent leakage of the contents. ARLANXEO Regular Butyl rubbers are the choice for this application primarily because of the excellent impermeability to the electrolyte, which provides good sealability.

ARLANXEO Butyl for Sport Balls and High-End Shoe Soles

ARLANXEO bromobutyl offers excellent air retention, making it a key component in ball bladders used in the sporting goods industry. ARLANXEO butyl and ARLANXEO bromobutyl can be blended with natural rubber to improve spliceability and cure rates, while still retaining good air retention properties. ARLANXEO bromobutyl can be blended with other polymers to improve the wet grip properties of high-end shoe soles, while retaining wear and durability characteristics for applications such as hiking and climbing footwear, river fishing and running shoes.

ARLANXEO Butyl for Adhesives

ARLANXEO butyl’s tack, ageing resistance and low permeability make it the ideal polymer for a variety of adhesive and sealing applications. Our butyl products are used in adhesive formulations for transparent tapes, hot melt pressure sensitive adhesives, mastic for pipe wrap tapes, vinyl floor tile adhesives and roofing adhesives. They are also used for self-fusing, semi-conducting electrical splicing tapes, eliminating the need for separate adhesive coats.
ARLANXEO Butyl Grades at a Glance

Product range and typical properties

### Butyl Rubber (IIR)

<table>
<thead>
<tr>
<th>Name</th>
<th>Production Site</th>
<th>Unsaturation (mol%)</th>
<th>Mooney Viscosity (MU)</th>
<th>Density (g/cm³)</th>
<th>Physical Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>X_Butyl® RB 100</td>
<td>Zwijndrecht</td>
<td>0.90</td>
<td>33</td>
<td>0.92</td>
<td>Bales</td>
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<tr>
<td>X_Butyl® RB 301</td>
<td>Sarnia, Singapore, Zwijndrecht</td>
<td>1.85</td>
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<td>X_Butyl® RB 402</td>
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<td>2.25</td>
<td>33</td>
<td>0.92</td>
<td>Bales</td>
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<tr>
<td>X_Butyl® RB 101-3</td>
<td>Zwijndrecht, Sarnia</td>
<td>1.75</td>
<td>51</td>
<td>0.92</td>
<td>Bales</td>
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</tbody>
</table>

**Food Grade**

### Bromobutyl Rubber (BIIR)

<table>
<thead>
<tr>
<th>Name</th>
<th>Production Site</th>
<th>Bromine Content (mol%)</th>
<th>Mooney Viscosity (MU)</th>
<th>Density (g/cm³)</th>
<th>Physical Form</th>
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</thead>
<tbody>
<tr>
<td>X_Butyl® BB 2030</td>
<td>Sarnia, Singapore, Zwijndrecht</td>
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<td>32</td>
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<tr>
<td>X_Butyl® BB2040</td>
<td>Sarnia</td>
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<td>0.93</td>
<td>Bales</td>
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<td>Bales</td>
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### Chlorobutyl Rubber (CIIR)

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<th>Name</th>
<th>Production Site</th>
<th>Chlorine Content (mol%)</th>
<th>Mooney Viscosity (MU)</th>
<th>Density (g/cm³)</th>
<th>Physical Form</th>
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<td>Sarnia, Zwijndrecht</td>
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<td>38</td>
<td>0.92</td>
<td>Bales</td>
</tr>
</tbody>
</table>
The World of ARLANXEO

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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 ARLANXEO products mentioned in this publication. For materials mentioned which are not ARLANXEO 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., safety data sheets and product labels. Consult your ARLANXEO representative or contact the Product Safety and Regulatory Affairs Department.

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Note: The information contained in this publication is current as of May 2017. Please contact ARLANXEO USA LLC to determine if this publication has been revised.