Advantages of Butyl Rubber

- Flexibility
- Air tight and gas impermeable (a property unique to butyl rubbers)
- Low glass transition temperature
- Good ozone resistance
- Displays high damping at ambient temperatures
- Good weathering, heat, and chemical resistance
- Good vibration damper
- Biocompatible

Butyl Rubber Processing

Butyl rubber must be compounded and vulcanized to yield useful, durable end use products for most applications. Different grades of butyl are developed based on specific property needs. Because of this, differing grades will show a range of molecular weights, unsaturation and cure rates.

Both the end use properties and the processing equipment used will be important factors in determining the right grade of butyl rubber in each specific application. Our selection of the proper fillers, stabilizers, processing aids and curatives will play a vital role in the ability of the butyl compound to meet the end product specifications and requirements.

The most widely used manufacturing process for butyl elastomers involves Lewis acid initiation in a reactor to form a slurry of fine rubber particles dispersed in methyl chloride from isobutylene and isoprene. The reaction that takes place is highly exothermic and, by controlling the polymerization catalyst level and temperature (between -90°C to -100°C), a high molecular weight can be achieved.

In this polymerization process, methyl chloride is used as the reaction diluent while boiling liquid ethylene is used to remove the heat of the reaction and maintain the low temperature needed. The final molecular weight of the butyl rubber is determined primarily by controlling the catalyst level, temperature, and the initiation and chain transfer reactions.

Butyl Rubber's Low Gas Permeability

Among other hydrocarbon elastomers, butyl rubber shows very good permeability to air and other gases. Permeation of gas through a polymeric membrane involves the gas dissolving in the polymer at the high pressure side, diffusion through the membrane, and subsequent evaporation at the low pressure surface. The rate of gas transfer through the membrane, or permeability, is determined by the solubility and diffusivity of the gas. The table below illustrates the permeability of butyl rubber in comparison to other elastomers such as natural rubber, styrene butadiene rubber (SBR), EPDM, and other special purpose elastomers.

Permeability of Various Elastomers to Gases at 25°C Relative to Natural Rubber Gum Vulcanizates (=100)⁵

<table>
<thead>
<tr>
<th>Elastomer</th>
<th>He</th>
<th>H₂</th>
<th>O₂</th>
<th>N₂</th>
<th>CO₂</th>
<th>Air</th>
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</thead>
</table>
Silicone Rubber - 1070 2200 3300 1600 2700
Natural Rubber 100 100 100 100 100 100
EPDM - - 88 80 66 83
Polybutadiene - 86 82 80 105 81
SBR 74 81 73 78 94 76
NBR (80/20 butadiene acrylonitrile) 55 51 35 31 48 33
NBR (73/27 butadiene acrylonitrile) 39 32 17 13 24 15
Polychloroprene - 27 17 14 20 15
NBR (68/32 butadiene acrylonitrile) 32 24 10 7.5 14 8.5
Butyl Rubber 27 15 5.6 5 4 4.8

Source: Exxon Mobile Chemicals
Note: Lower Rating is better

**Heat Resistance**
Rubber products made from butyl material prove to be more durable than those made with natural rubber as butyl rubber parts are better able to retain their properties at high temperatures.

**Tear Strength**
The molecular structure of butyl rubber allows it to enjoy a better aged tear strength retention when compared to natural rubber.

**Aging Resistance**
When looking at the effects of aging, exposure to oxygen and ozone in the atmosphere will cause natural rubber to oxidize, deteriorate, and eventually crack. Because of the materials good aging resistance, butyl rubber parts will have a longer life span without the need for additional antioxidant and antiozonants systems. In the example below, both butyl rubber and natural rubber parts where stretched by 20% and exposed for 72 hours at 40°C and 50 pphm of ozone.

**Butyl Rubber Applications**
- Sealant for rubber roof repair
- Tubeless tire liners
- Inner tubes
- Stoppers for glass bottles, medicine bottles and pharmaceuticals
- Used in sealants and adhesives
- Butyl O Rings
Pond Liners
Tank Liners
Construction sealants, hoses, and mechanical goods

**Body Mounts and Sound Damping**

The unique combination of high damping, barrier properties, resistance to ozone and heat aging make butyl products an ideal choice for many automotive non-tire applications. One of the largest applications of butyl rubber parts includes vibration control applications and dynamic parts including body mounts. Butyl rubber is widely used in these applications because of its high damping, fast reversion-resistant cures and its excellent aging properties, especially in respect to hot flex fatigue.