

ELASTOMERS

Europrene[®]

SOL B/R

S-SBR



versalis



Europrene®

SOL B/R S-SBR

BACKGROUND

Solution polymerized SBR (S-SBR) was developed in the 1960's as an alternative to emulsion SBR (E-SBR). It offers many advantages, including the ability to manufacture tailor made polymers for the tyre industry and other markets, in terms of micro and macro structure. Versalis R&D based in Ravenna, Italy, has refined these products to create an extensive portfolio. The first S-SBR production line was built in Grangemouth (UK) in 1995, based on batch process technology. This was followed in 1999 with an additional production line based on continuous technology.

PROCESS

Solution polymerized styrene-butadiene rubber is obtained by the anionic polymerization of styrene and butadiene initiated by lithium alkyls in hydrocarbon solvent. The distribution of the styrene units in the polymer chain results in either Block or Random copolymers. This is controlled by the use of a suitable modifier. The finishing process consists of solvent stripping and stabilization with non-staining antioxidant(s). The extender oil is added where required. The resultant polymer crumb is then dried, baled, packaged.

SUSTAINABILITY

All grades in portfolio are available with ISCC Plus Certification through Mass Balance approach: "Bio Attributed (BA)" and "Bio-Circular Attributed (BCA)" products are obtained using bio naphtha. "Circular Attributed (CA)" grades are made using "recycled oil" (r-Oil), a pyrolysis product obtained from the chemical recycling of mixed plastic waste. BA, BCA and CA raw materials can be used in production processes together with traditional raw materials. In order to increase the sustainability level of the final product.

Grades obtained through the Mass Balance approach show identical performance, quality and properties vs corresponding traditional grades, as they do not differ in chemical composition and process technology.

MAIN PROPERTIES

Block and Random S-SBR impart very different properties to the polymer and are used in different applications. Partial Block S-SBR are more suitable for calendaring and extrusion processes. They are also used for bitumen modification, adhesives and HIPS/ABS.

Random S-SBR provide a versatile platform for the manufacturing of a "tailored" product by varying macro and microstructure. This means that polymers can be produced with different glass transition temperature (T_g), which in turn will influence important properties such as good processability, rolling resistance, grip and abrasion. These properties make random S-SBR particularly useful in the tyre sector. Random S-SBR technology can be further enhanced by the use of polymer chain coupling, chain branching and functionalization.

GRADE SELECTION

S-SBR are produced at Grangemouth-UK and Ravenna-Italy facilities. Partial Block S-SBR are produced in UK only. Functionalized grades are produced in Italy only.

Europrene® SOL B

→ Europrene® SOL B 1205: used in Technical Rubber Goods, including flooring and footwear, adhesives and bitumen modification.

AGON® SOL C283 is mainly designed for HIPS application

Europrene® SOL R

→ Europrene® SOL R 72614: oil-extended grade designed to provide an excellent performance .

→ Europrene® SOL R C 3737 and C3743: oil-extended grades designed for high grip in silica compounds for HP/UHP tyres

→ Europrene® SOL R 74618 T: batch grade oil extended with TDAE, designed to provide high performance in HP/UHP tyres.

Functionalized Europrene®

Product portfolio is expanding to functionalized S-SBR grades for silica, produced by batch technology with improved performance

→ Europrene® SOL R X 72616: provides improved rolling resistance.

→ **AGON® SOL RX FZ595 and FZ360: new generation functionalized grades** with improved rolling resistance, wet grip and abrasion resistance. Designed summer, winter and all-season tyres. FZ360 is a low T_g grade.



GRADE LIST

Partial block types

GRADE	BOUND STYRENE %WT	BLOCK STYRENE %WT	MOONEY VISCOSITY ML (1+4) 100 °C	VISCOSITY CP 5% STY 25°C	MAIN APPLICATIONS
Europrene® SOL B 1205	26	50	-	-	Calendered and extruded Technical Rubber Goods, flooring, footwear, adhesives, bitumen modification, HIPS manufacturing
Agon® SOL C 283	11	8	-	30	Construction, polymer modification, manufacture of ABS and HIPS



Random oil extended types

GRADE	BOUND STYRENE %WT	VINYL CONTENT ⁽¹⁾ %WT	MOONEY VISCOSITY ML (1+4) 100 °C	OIL		MAIN APPLICATIONS
				TYPE	P.H.R.	
Europrene® SOL R 72614	25	64	55	TDAE	37.5	Silica-based compounds for low rolling resistance tyre treads, winter tyre treads
Europrene® SOL R C3737	36.5	38	75	TDAE	37.5	Silica-based compounds for high grip and low rolling resistance type treads (HP/UHP)
Europrene® SOL R C 3743	36.5	43	75	TDAE	37.5	Silica-based compounds for high grip and low rolling resistance tyre treads (HP/UHP)
Europrene® SOL R 74618 T	35	58	60	TDAE	37.5	UHP tyre tread compounds
Agon® SOL R 73521	35	58	80	TDAE	25	Tyre tread compound for HP/UHP tyres. It shows enhanced balance between grip and rolling resistance

(1) Referred to butadiene portion

Functionalised random types

GRADE	BOUND STYRENE %WT	VINYL CONTENT ⁽¹⁾ %WT	MOONEY VISCOSITY ML (1+4) 100 °C	OIL		MAIN APPLICATIONS
				TYPE	P.H.R.	
Europrene® SOL R X 72616	21	63	68	-	-	Functionalised for silica premium tyre treads compounds with low rolling resistance
Agon® SOL R X FZ 360	15	32	60	-	-	New generation low Tg functionalized polymer. Main applications: silica-based compounds for winter and all season tyres.
Agon® SOL R X FZ 595	27	59	61	-	-	New generation functionalized polymer. Main applications: silica-based compounds for premium tyres, in particular summer and all-season types

(1) Referred to butadiene portion

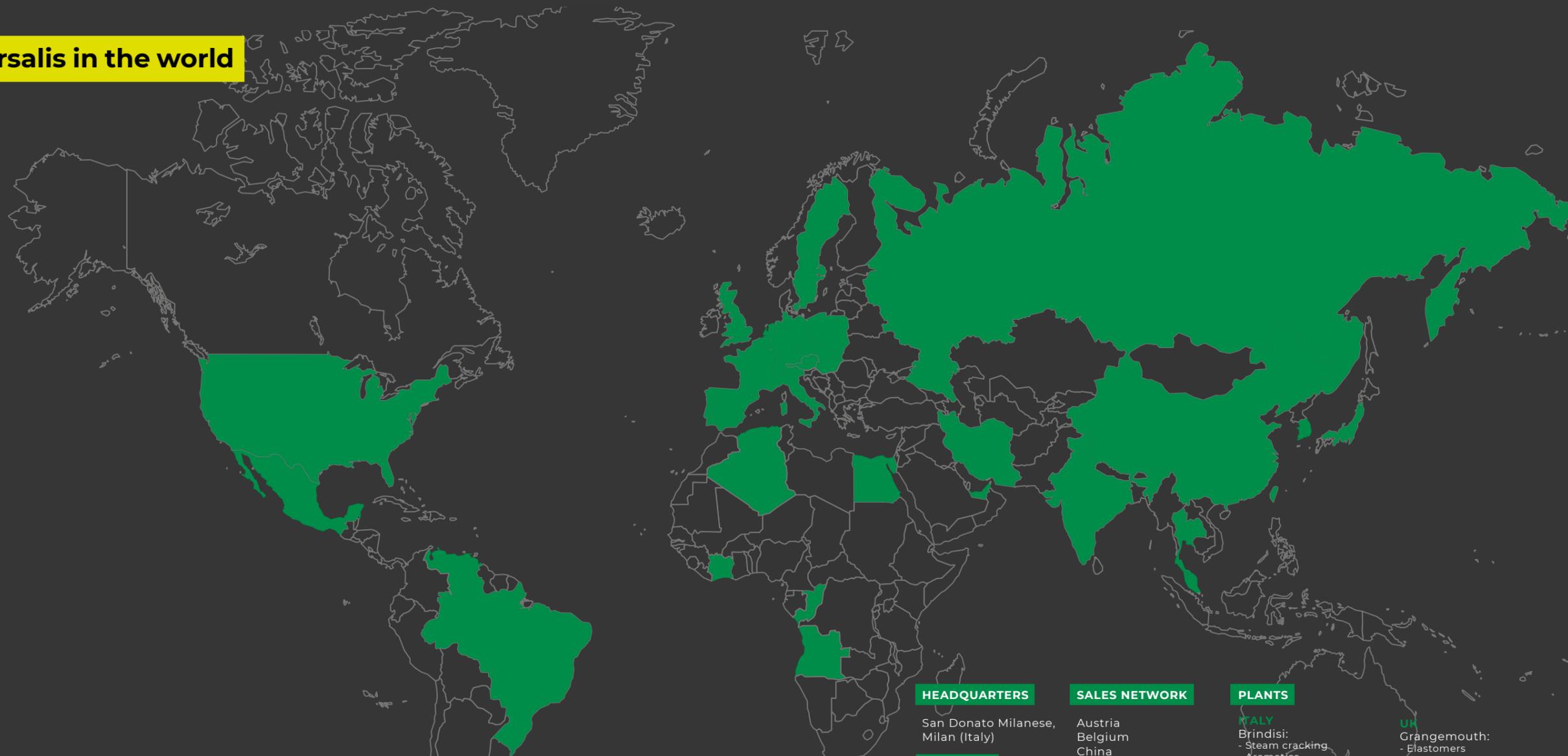
STORAGE AND PACKAGING

The Europrene® SOL grades should be stored in a vented, dry area at a temperature between 20°C and 30°C with the avoidance of exposure to direct sunlight. The shelf life of Europrene® SOL grades is 12 months minimum.



GRADE	PACKAGING	DIMENSION (mm)	NOMINAL NET WEIGHT (kg)	PHYSICAL FORM	BALE DIMENSION (mm)	BALE WEIGHT (kg)	BALES TOTAL	BALES X LAYER	FILM TYPE
Europrene® SOL B 1205	Returnable metal crate	1465x1150xh1123	990	Bales	660x330xh200	33	30	6x5	PE
Agon® SOL C 283	Returnable metal crate	1465x1150xh1123	1080	Bales	660x350xh200	30	36	6x6	PS
Agon® SOL R X FZ 360	Returnable metal crate	1465x1150xH1123	1260	Bales	660x350xh200	35	36	6X5	PE
Agon® SOL R X FZ 595	Returnable metal crate	1465x1150xH1123	1260	Bales	660x350xh200	35	36	6X5	PE
Europrene® SOL R 72614	Returnable metal crate	1465x1150xh1123	990	Bales	660x330xh200	33	30	6x5	PE
Europrene® SOL R 74618 T	Returnable metal crate	1465x1150xh1123	990	Bales	660x330xh200	33	30	6x5	PE
Agon® SOL R 73521	Returnable metal crate	1465x1150xH1123	840	Bales	660x350xh200	28	30	6X5	PE
Europrene® SOL R C3737	Returnable metal crate	1465x1150xh1123	990	Bales	660x330xh200	33	30	6x5	PE
Europrene® SOL R C3743	Returnable metal crate	1465x1150xh1123	990	Bales	660x330xh200	33	30	6x5	PE
Europrene® SOL R X 72616	Returnable metal crate	1465x1150xh1123	1260	Bales	660x330xh200	35	36	6x6	PE

Versalis in the world



HEADQUARTERS

San Donato Milanese, Milan (Italy)

LICENSING

Algeria
Brazil
China
Egypt
India
Iran
Japan
Malaysia
Portugal
Qatar
Romania
Russian Federation
Slovak Republic
South Korea
Spain
Taiwan
USA
Venezuela

R&D

ITALY
Ferrara
Mantua
Novara
Porto Torres
Ravenna
Rivalta Scrivia

SALES NETWORK

Austria
Belgium
China
Congo
Czech Republic
Denmark
France
Germany
Ghana
Greece
Hungary
India
Italy
Mexico
Poland
Portugal
Romania
Russian Federation
Singapore
Slovak Republic
South Korea
Spain
Switzerland
Sweden
Turkey
United Arab Emirates (VPM, a joint venture with Petrochem/Mazrui Energy Services)
UK
USA

PLANTS

ITALY
Brindisi:
- Steam cracking
- Aromatics
- Polyethylene
Crescentino:
- Bio-ethanol
Ferrara:
- Elastomers
- Polyethylene
Mantua:
- Intermediates
- Styrene
- Styrenics
Porto Marghera:
- Recycled polymers
Porto Torres:
- Elastomers
- Renewable chemistry
Priolo:
- Steam cracking
- Aromatics
Ragusa:
- Polyethylene EVA
- Butadiene
Ravenna:
- Elastomers

UK
Grangemouth:
- Elastomers

FRANCE
Dunkerque:
- Steam cracking
- Polyethylene EVA

GERMANY
Oberhausen:
- Polyethylene EVA

HUNGARY
Százhalombatta:
- Styrenics

SOUTH KOREA
Yeosu (LVE, a joint venture with Lotte Chemical):
- Elastomers

Versalis is focused on establishing itself as a solution provider, offering a range of increasingly market-oriented products at an international level. The company is present in the APAC region through its Shanghai-based subsidiary, Versalis Pacific Trading; in Mumbai, India; in Singapore; and in South Korea through LVE, a joint venture with Lotte Chemical.

Versalis can also count on subsidiaries Versalis Americas – with offices in Houston, Texas – and Versalis Mexico. Furthermore, Versalis serves the oil and gas industry with offices in Ghana and in Congo, with its portfolio of oilfield chemicals. Thanks to a widespread sales network, distributors and sales agents, Versalis can serve all markets worldwide.



versalis

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