

Elastomers

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**EUROPRENE<sup>®</sup> SOLT/TH**

TPR

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The elasticity  
you need

Elastomers

# EUROPRENE<sup>®</sup> SOLT/TH

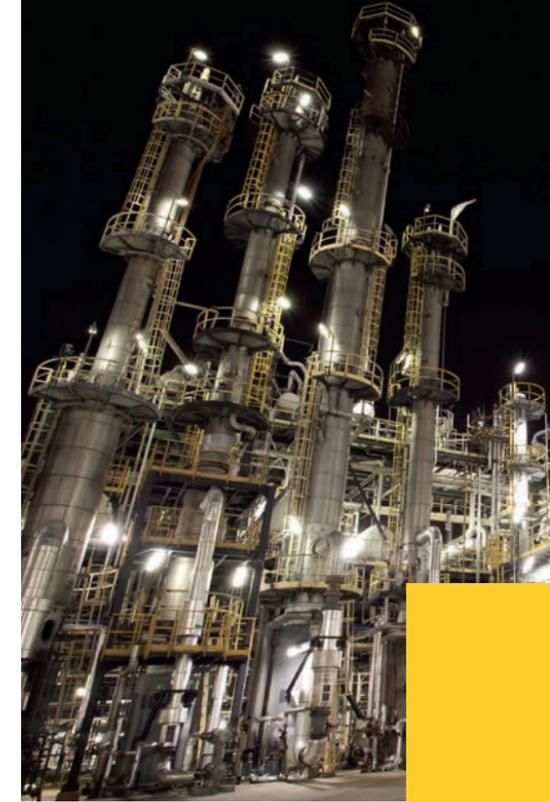
TPR

The elasticity  
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versalis

## Versalis TPR Europrene® SOL T/TH



### Background

The TPR plant, located in Ravenna, Italy, is on stream since 1971 with a current capacity of 90,000 t/y, reached through two revamping steps, in 1991 and 2001. In the latter the hydrogenation section was added to the plant to allow the production of saturated SEBS copolymers. We strive for a continuous improvement in our plant to achieve the highest quality for products and fulfill our customers' needs. Versalis is manufacturing styrenic block copolymers commercialized under the trade names: Europrene® SOL T (SBS and SIS) and Europrene® SOL TH (SEBS).

### Process

Styrenic block copolymers (SBC) are obtained by an anionic polymerization initiated by lithium alkyls in aliphatic solvent. Flexibility is the main feature of this polymerization technique that enables the production of thermoplastic elastomers differentiated by chemical composition, molecular weight and molecular architecture, allowing linear and star copolymers. When the polymerization reaction (and the hydrogenation reaction for SEBS) is completed, the polymer solution is fed to the stripping section where the solvent is removed. The crumb slurry is conveyed to the finishing section where it is dewatered, cooled and finally packed.



**Main properties**

SBCs' material properties are mainly influenced by styrene and butadiene monomers ratio, as well as by the molecular weight of the polymer blocks. Styrenic block copolymers structure is generally of the (S-B) nX type, where S represents the polystyrene end-block, B the polybutadiene or polyisoprene or polyethylene-butylene mid-block and X is the coupling agent. The polystyrene end-blocks are associated in rigid domains (hard phase), dispersed in the rubbery phase (soft phase) to form a three-dimensional network.

The peculiar physical and mechanical properties of styrenic block copolymers are related to this morphological arrangement. At service temperatures, up to 75-80 °C, the hard phase domains act as physical cross-linking points and reinforcing fillers. The rubber phase is determining the elastic properties of these materials, especially for the high resilience and excellent flexibility even at low temperatures. Above the glass transition temperature of the hard phase, the domains soften and the copolymers are therefore processable using traditional thermoplastic equipments.

**Grade selection**

Versalis TPR portfolio includes a wide range of products:

- **Europrene® SOL T Series 6000 and 160:** Dry SBS grades. They differ with respect to the molecular weight (high molecular weight - hmw and low molecular weight - lmw). These polymers are soft, flexible and compatible with Polyethylene (PE) and Polystyrene (PS). They are mainly used for bitumen modification, adhesives and sealants, footwear and technical compounds.
- **Europrene® SOL T series 170:** Oil Extended (OE) SBS grades. These grades are mainly used for footwear and technical compounds thanks to their intrinsic softness and abrasion resistance. The grades are extended with a clear paraffinic oil to optimize color and color stability.

- **Europrene® SOL T series 9000 and 190:** SIS grades. These products, thanks to their excellent tack, are used in adhesives (hot melt and pressure sensitive) and sealants application.
- **Europrene® SOL TH series 2000:** SEBS grades. These saturated styrene block copolymers show an outstanding aging resistance. They offer a wide service temperature range and improved mechanical performances like compression set, keeping the elastic properties typical of rubbery materials. These polymers exhibit an excellent flexibility in the compounding stage allowing the addition of large quantities of plasticizers and fillers.

**Physical form**

Dry SBS hmw	Granules (powder only for selected grades)
Dry SBS lmw, OE SBS, SIS	Dense pellets
SEBS	Porous pellets (powder only for selected grades)

**Handling**

The products must be stored in a covered place, in their sealed packaging, away from direct sunlight and heat sources. The shelf-life of Europrene® SBS and SIS grades is 18 months. The shelf-life of Europrene® SEBS grades is 24 months.





### Applications

#### Compounding

The term 'compounding' covers a wide range of applications, from technical compound to consumer goods, where SEBS are mainly used, to footwear compounds where SBS dry or oil-extended are commonly used.

#### Adhesives

Thermoplastics rubbers and especially SIS grades are commonly used in adhesive production, both hot melt or solvent based. Their main applications are: tapes, labels, nonwoven, industrial assembly.

#### Bitumen modification

SBS and SEBS are used in bitumen modification for roofing and road paving applications. The addition of Europrene® SOL T dramatically improves the bitumen mechanical and elastic properties at both high and low temperatures.

#### Polymer modification

SBS and SEBS are used in polymer modification. The addition of these products to polystyrene, polyethylene and polypropylene greatly improves impact strength, low temperature flexibility and elastic properties.



## Grade list

### Styrene - butadiene - dry SBS

Grade	Bound styrene %wt	Structure	Di-block %wt	Melt flow index <sup>(1)</sup> g/10 min	Physical form <sup>(2)</sup>	Main applications
Europrene® SOL T 161 B	30	Radial	10	< 1	G, P	Bitumen modification for roofing and road paving
Europrene® SOL T 161 C	30	Radial	10	< 1	G	Bitumen modification for roofing and road paving, compounding
Europrene® SOL T 6205	25	Radial	10	< 1	G	Bitumen modification for road paving
Europrene® SOL T 6302	30	Linear	12	< 1	G	Bitumen modification for roofing and road paving, compounding
Europrene® SOL T 6306	37	Radial	10	< 1	G, P	Bitumen modification for roofing
Europrene® SOL T 166	30	Linear	10	6	PL	Moulded and extruded goods, polymer modification, adhesives
Europrene® SOL T 6320	31	Linear	75	11	PL	Bitumen modification, adhesives, polymer modification
Europrene® SOL T 6414	40	Radial	22	11	PL	Adhesives, compounding, polymer modification

(1) ASTM D 1238, (5 kg, 190 °C) (2) PL = Dense pellets; G = Granules; P = Powder

### Styrene - butadiene - oil extended SBS

Grade	Bound styrene %wt	Structure	Oil content phr	Melt flow index <sup>(1)</sup> g/10 min	Physical form <sup>(2)</sup>	Main applications
Europrene® SOL T 172 C	31	Radial	45	9	PL	Footwear, polymer modification and plastic recycling, technical goods
Europrene® SOL T 177 C	50	Radial	40	15	PL	Footwear, high hardness sheets and soles

(1) ASTM D 1238, (5 kg, 190 °C) (2) PL = Dense pellets

## Styrene - isoprene - SIS

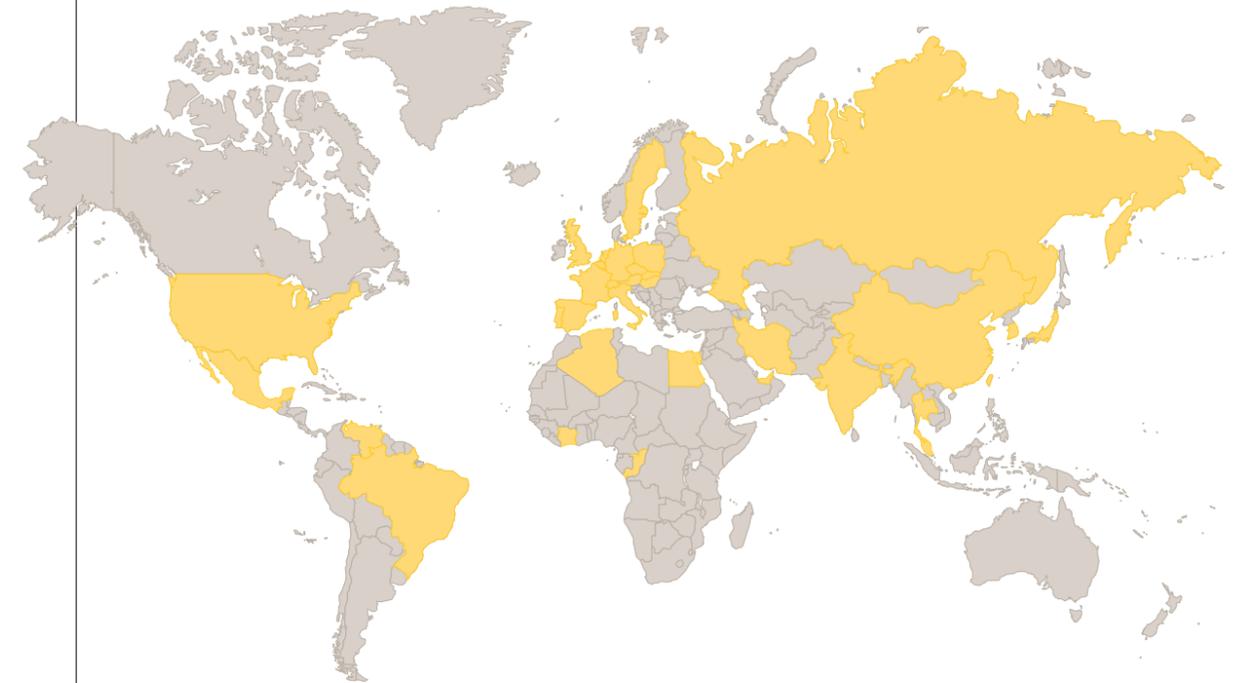
Grade	Bound styrene %wt	Structure	Di-block %wt	Melt flow index <sup>(1)</sup> g/10 min	Physical form <sup>(2)</sup>	Main applications
Europrene® SOL T 190	16	Linear	25	9	PL	General purpose grade for hot melt pressure sensitive adhesives, bitumen modification
Europrene® SOL T 9113	18	Linear	8	12	PL	Hot melt pressure sensitive adhesives for packaging tapes
Europrene® SOL T 9133	16	Linear	55	14	PL	Hot melt pressure sensitive adhesives for labels
Europrene® SOL T 9326	30	Linear	15	8	PL	High cohesion hot melt adhesives, high colour and viscosity stability
Europrene® SOL T 9242	24	Linear	68	20	PL	Hot melt pressure sensitive adhesives for labels

(1) ASTM D 1238, (5 kg, 190 °C) (2) PL = Dense pellets

## Styrene - ethylene - butylene - SEBS

Grade	Bound styrene %wt	Structure	Melt flow index <sup>(3)</sup> g/10 min	Other properties	Physical form <sup>(2)</sup>	Main applications
Europrene® SOL TH 1810	7	Radial	20	-	C	Adhesives, sealants and coatings; as modifier of thermoplastics; in compounding including olefinic polymers and in bitumen modification
Europrene® SOL TH 2311	30	Linear	6	-	F	General purpose grade for hot melt adhesives, sealants and polymer modification
Europrene® SOL TH 2312	30	Linear	<1	-	F	Compounding, adhesives, polymer modification
Europrene® SOL TH 2314	31	Linear	<1	-	F	Compounding
Europrene® SOL TH 2315	32	Linear	<1	-	F, P	Compounding
Europrene® SOL TH 2316	32	Linear	<1	Pharmaceutical oil added	F	High performance compounds
Europrene® SOL TH 3300	30	Linear	12	1 % Maleic Anhydride bonded	PL	Technical compounds (overmolding)
Europrene® SOL THX 1050	7	Multi-arm	-	4,5 (cSt); SSI: 12 (%)	C	Oil viscosity modifier

(2) F = Porous pellets; P = Powder; PL= Dense pellets; C= Compact form  
(3) ASTM D 1238 (5 kg 230°C)



## Versalis in the world

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.

Headquarters	Sales network	Plants	UK
San Donato Milanese, Milan (Italy)	Austria Belgium China Congo Czech Republic Denmark France Germany Ghana Greece Hungary India Italy Mexico Poland Portugal Romania Russian Federation Slovak Republic South Korea Spain Taiwan USA Venezuela	<u>Italy</u>  Brindisi: - Steam cracking - Aromatics - Polyethylene  Crescentino: - Bio-ethanol  Ferrara: - Elastomers - Polyethylene  Mantua: - Intermediates - Styrene - Styrenics  Porto Marghera: - Steam cracking - Aromatics  Porto Torres: - Elastomers - Renewable chemistry  Priolo: - Steam cracking - Aromatics  Ragusa: - Polyethylene EVA - Butadiene  Ravenna: - Elastomers	<u>UK</u> Grangemouth: - Elastomers  <u>France</u> Dunkerque: - Steam cracking - Polyethylene EVA  <u>Germany</u> Oberhausen: - Polyethylene EVA  <u>Hungary</u> Százhalombatta: - Styrenics  <u>South Korea</u> Yeosu (LVE, a joint venture with Lotte Chemical): - Elastomers
<b>Licensing</b> Algeria Brazil China Egypt India Iran Japan Malaysia Portugal Qatar Romania Russian Federation Slovak Republic South Korea Spain Taiwan USA Venezuela	<b>R&amp;D</b> <u>Italy</u> Ferrara Mantua Novara Porto Torres Ravenna Rivalta Scrivia		



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