

ELASTOMERS

Adhesives

APPLICATION



versalis

Europrene® Styrenic Block Copolymers for adhesive applications

BACKGROUND

Versalis is a European petrochemical company wholly owned by Eni SpA, with a strong position in base chemicals, plastic and synthetic rubbers. Our key strength are the integration and synergies with Eni's gas and refinery sectors. With a global installed capacity of about 700,000 t/y, Versalis is a key player in the elastomers market.

The Europrene® Sol T & TH plant, based in Ravenna, Italy, is on stream since 1970; it has a current nameplate capacity of 90,000 t/y, reached through two plant-revamping steps in 1991 and in 2001, and receives constant renewal. Thanks to these facilities, Versalis is the sole SIS producer in Europe.

The Europrene® SOL plant based in Grangemouth (UK) is on stream since early 1990 with a current capacity of 60,000 t/y, reached through a debottlenecking in 2016.

A further capacity expansion is planned through the start-up of a new production line (JV with Lotte Chemical) in Yeosu, Korea.

Adhesives

APPLICATION

Styrenic block copolymers (SBC) are widely used in adhesive applications thanks to their flexibility and compatibility with oils, resins and other components; moreover, they guarantee cohesion and elasticity to the adhesive formulations.

Versalis' SBCs portfolio includes 4 families:

- **SIS (Europrene® SOL T series 9000 and 190)** the softest and most tacky grades. Thanks to their compositions these products show excellent tack properties, high compatibility with tackifier resins and low viscosity;
- **SBS (Europrene® SOL T series 6000 and 166)** the most cohesive and less tacky. These products show improved performances at low temperature.
- **SEBS (Europrene® SOL TH series 2000);** these saturated styrenic block copolymers show an outstanding aging and chemicals resistance, excellent resistance to heat and aging, wide service temperature range and improved mechanical performances;
- **SB (Europrene® SOL B 1205)** this polymer is a pure di-block suitable for low viscosity, low cohesion and high tack applications.



Products and applications

Chemical composition and molecular structure affect the final properties of the adhesive, both Hot Melt (HMA) and Pressure Sensitive (PSA):

- chemical nature of the rubbery mid-block: I (Isoprene), B (Butadiene), EB (Ethylene/Butylene);
- bound styrene content;
- molecular structure;
- molecular weight;
- di-block content.

Versalis developed a product portfolio covering the three main sectors in adhesive applications: tape, label and non-woven.

Styrene Isoprene Copolymers (SIS)

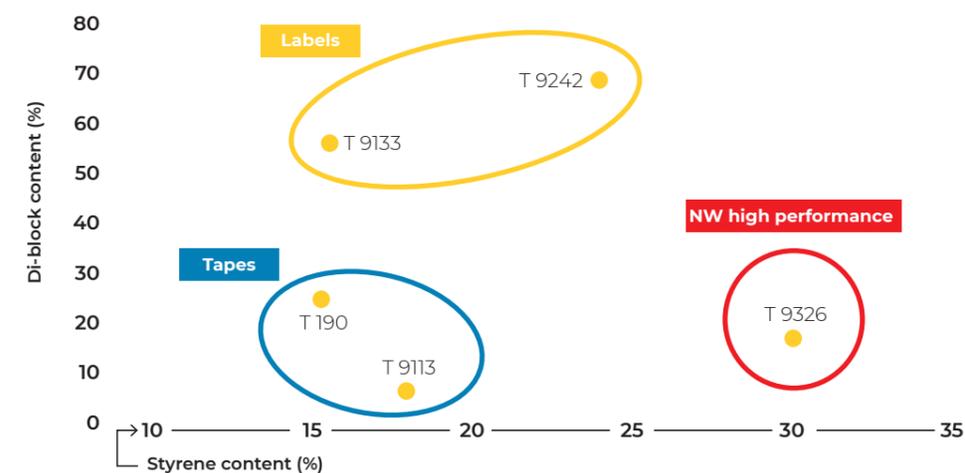
These products are mostly used in the adhesive industry.

The family includes the following grades:

- T 190, T 9113 - Low styrene, low di-block content grades for tapes;
- T 9133 - Low styrene, high di-block content grade for labels;
- T 9326 - High styrene, low di-block content grade for non-woven high performance adhesives;
- T 9242 (the last developed) - Medium styrene, very high di-block content grade for labels.

Fig. 1

SIS Product range



SIS GRADE	STRUCTURE	STYRENE %	MFI* g/10'	DI-BLOCK %	APPLICATION	PROPERTIES
Europrene® SOL T 190	Linear	16	9	25	Hot Melt PSA	General purpose
Europrene® SOL T 9113	Linear	18	12	8	Hot Melt PSA - packaging tapes	Low di-block
Europrene® SOL T 9133	Linear	16	14	55	Hot Melt PSA for labels	Low viscosity, good tack
Europrene® SOL T 9326	Linear	30	8	15	Hot Melt	High cohesion
Europrene® SOL T 9242	Linear	24	20	68	Hot Melt PSA for labels	Low viscosity, good tack

Styrene Butadiene Copolymers (SBS and SB)

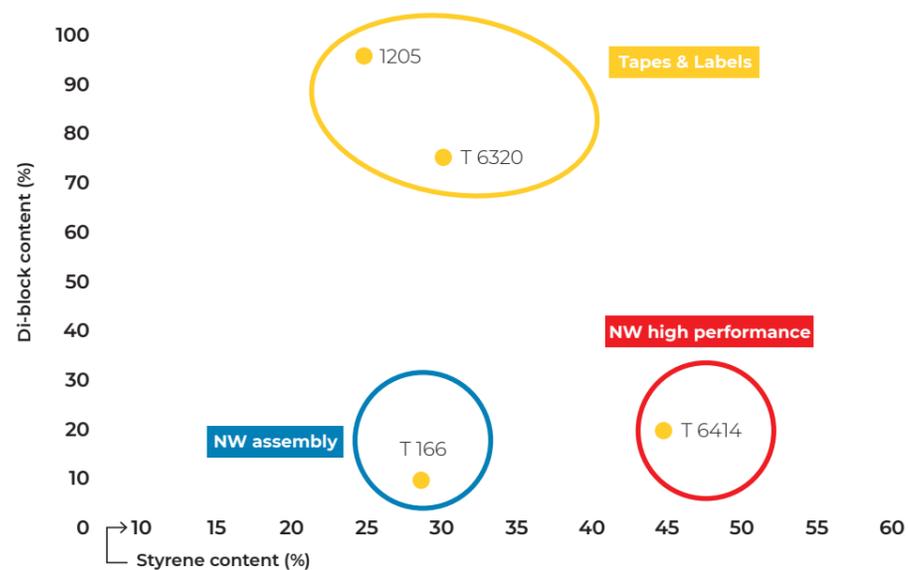
Versalis has a wide range of dry SBS, different for chemical composition, structure and molecular weight.

The low molecular weight grades are particularly suitable for adhesives:

- T 166 - Medium styrene, low di-block content grade for non-woven assembly;
- T 6320 - Medium styrene, high di-block content grade for tapes and labels;
- T 6414 - High styrene, low di-block content grade for non-woven high performance adhesives;
- 1205 - Low styrene, pure di-block grade for labels.

Fig. 2

SBS Product range



SBS GRADE	STRUCTURE	STYRENE %	MFI* g/10'	DI-BLOCK %	APPLICATION	PROPERTIES
Europrene® SOL T 166	Linear	30	6	10	Multipurpose HMA - SBA	Low viscosity
Europrene® SOL T 6320	Linear	31	11	75	Hot Melt PSA - general purpose	Very low viscosity
Europrene® SOL T 6414	Radial	40	11	22	Hot Melt - non-woven	Low viscosity, high cohesion
Europrene® SOL 1205	Linear	25	-	100	Hot Melt PSA for labels	Pure di-block, low viscosity, high tack

* ASTM 1238 190°C, 5 Kg

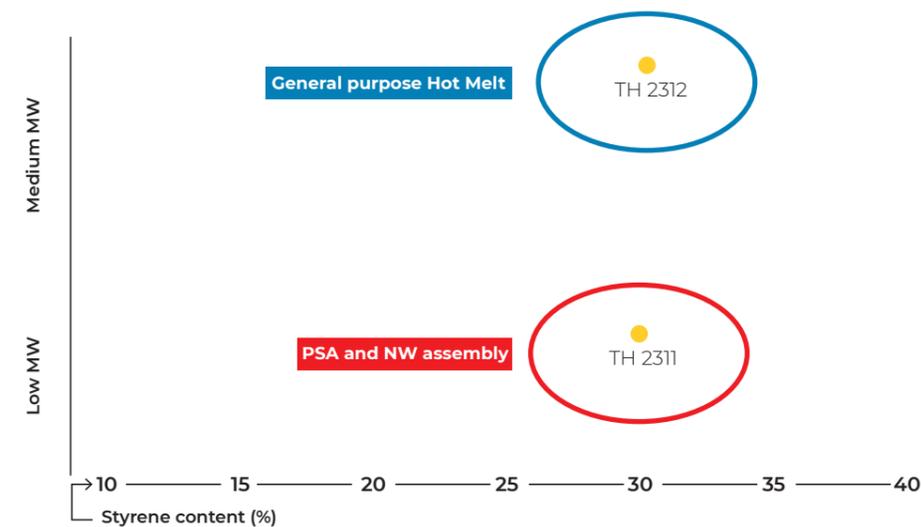
Styrene Ethylene Butylene Copolymers (SEBS)

Two grades of hydrogenated product family are recommended:

- TH 2311 - Low styrene, low molecular weight grade for PSA and non-woven assembly;
- TH 2312 - Low styrene, medium molecular weight grade for general purpose HM.

Fig. 3

SEBS Product range



SEBS GRADE	STRUCTURE	STYRENE %	MFI** g/10'	DI-BLOCK %	APPLICATION	PROPERTIES
Europrene® SOL TH 2311	Linear	30	1	0	Hot Melt, non-woven	High stability, low viscosity
Europrene® SOL TH 2312	Linear	30	<1	0	Hot Melt, non-woven	High stability, low viscosity

** ASTM 1238 200°C, 5 Kg

PHYSICAL FORM AND PACKAGING

	SOURCE	PHYSICAL FORM	ANTIOXIDANT	FDA APPROVAL	PACKAGING	SHELF LIFE (MONTHS)
SIS GRADE						
Europrene® SOL T 190	Ravenna	Dense Pellets	BHT/TNPP free	Yes	Bags on pallet / Big Bag	18
Europrene® SOL T 9113	Ravenna	Dense Pellets	BHT/TNPP free	Yes	Bags on pallet / Big Bag	18
Europrene® SOL T 9133	Ravenna	Dense Pellets	BHT/TNPP free	Yes	Bags on pallet / Big Bag	18
Europrene® SOL T 9326	Ravenna	Dense Pellets	BHT/TNPP free	Yes	Bags on pallet / Big Bag	18
Europrene® SOL T 9242	Ravenna	Dense Pellets	BHT/TNPP free	Yes	Bags on pallet / Big Bag	18

SBS GRADE

Europrene® SOL T 166	Ravenna	Dense Pellets	BHT/TNPP free	Yes	Bags on pallet	18
Europrene® SOL T 6320	Ravenna	Dense Pellets	BHT/TNPP free	Yes	Bags on pallet / Big Bag	18
Europrene® SOL T 6414	Ravenna	Dense Pellets	BHT/TNPP free	Yes	Bags on pallet	18
Europrene® SOL 1205	Grangemouth	Friable Bales	BHT/TNPP free	Yes	Metal and Woden crates	18

SEBS GRADE

Europrene® SOL TH 2311	Ravenna	Porous Pellets	BHT/TNPP free	Yes	Bags on pallet	24
Europrene® SOL TH 2312	Ravenna	Porous Pellets	BHT/TNPP free	Yes	Bags on pallet	24

Storage instructions: store in vented, dry area at temperatures between 20°C and 30°C; no direct sunlight.

Formulations

SBCs play a key role in pressure sensitive adhesives, that are viscoelastic materials with flow properties. SBCs provide flexibility, ease of tackification and desired bond strength when mixed up with tackifier resins, pigments and oil. Compatibility is a key parameter for the components mixing. Elastic and viscous behavior, wisely balanced in formulation, generate suitable characteristics to a broad field of applications.

Europrene® SBCs thermoplastic elastomers are used both in solvent based and Hot Melt adhesives. In particular, Hot Melts have become increasingly popular due to economical, energetic and environmental advantages offered by this technology.

During the manufacturing of Hot Melt adhesives, two separate steps can be distinguished: mixing process and adhesive spread. The mixing process can be carried out using discontinuous mixers or using extruders with high mixing efficiency. Temperatures are in the range of 130-180°C.

Adhesive spread is performed using coaters or jet applicators normally suitable for Hot Melts.

Adhesive formulations are substantially based on a proper combination of three main components to reach requirements desired for the end usage.



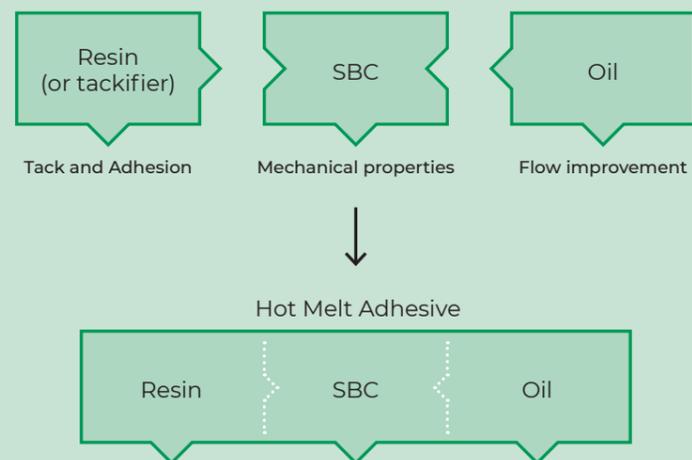


Versalis in the world



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

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

Typical formulations

ADHESIVE TAPE

Components	phr
SBC	100
Resin	120
Oil	20
Antiox	1

LABEL

Components	phr
SBC	100
Resin	120
Oil	60
Antiox	1

NON WOVEN

Components	phr
SBC	100
Resin	250
Oil	80
Antiox	1



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