

ELASTOMERS

Specialty rubbers

FOR LUBRICANT

APPLICATION



versalis

Specialty Rubbers FOR LUBRICANT APPLICATION

Versalis EP(D)M Dutral® OCP

BACKGROUND

The first synthesis ever of an Ethylene Propylene elastomer copolymer was performed in the late '50s by Prof. Natta and his team based in Ferrara. In 1963, the trademarked product Dutral® was scaled-up to a production of 5 KTPY and eventually the capacity increased to 85 KTPY of NPC in order to support market demand. Starting from 2018 a new line in Ferrara has further increased the NPC to 135 KTPY.

PROCESS

The Dutral® EPR is produced by slurry polymerisation process, which allows the production of a wide variety of grades. The process does not require solvent and solvent recovery equipment and, in addition, the low viscosity of the suspension helps temperature control and product handling. Moreover monomers are highly soluble in the reaction bulk, therefore high molecular weight polymers can be produced advantageously. The polymerisation is carried out by proprietary Ziegler-Natta catalyst and the unreacted monomers are recovered in the stripping section. Eventually, the crumbs are stabilised by means of a proper antioxidant and then washed, dried, baled and packaged.

DUTRAL® OLEFIN COPOLYMER PORTFOLIO FOR LUBRICANTS VISCOSITY MODIFICATION

Versalis provides a wide range of grades suitable to be used as thickeners and viscosity index improvers (non-dispersant) in lubricants:

GRADE	PROPYLENE CONTENT %WT	MOONEY VISCOSITY ML (1+4) 100°C	PHYSICAL FORM ⁽³⁾	PACK. N°
Dutral® CO 034	28	44	B	1
Dutral® CO 038	28	60 ⁽¹⁾	B	1
Dutral® CO 043	45	33	B	2
Dutral® CO 058	48	80	B	3

(1) ML (1+4) 125°C (3) B = Bales

GRADE	PROPYLENE CONTENT %WT	MOONEY VISCOSITY ML (1+4) 100°C	MFI (190°C - 2.16 KG) G/10 MIN	PHYSICAL FORM ⁽³⁾	PACK. N°
Dutral® OCP 2530 PL	34	-	8.5 ⁽²⁾	PL*	4
Dutral® OCP 2550	48	-	8.3	B	5
Dutral® OCP 3550	48	-	2.9	B	5
Dutral® OCP 4530	28	-	0.5	B, PL	1,6
Dutral® OCP 5050	48	60	-	B	3

(2) MFI g/10 min at 230°C - 2.16 kg

(3) B = Bales; PL = Pellets;

*PL = Non-free flowing pellets

PACK. N°	PACKAGING DESCRIPTION	CRATE DIMENSION (mm)	NOMINAL NET WEIGHT (kg)	BALE (BAG) WEIGHT (kg)	BALE (BAG) DIMENSION (mm)	BALES (BAGS) TOTAL	BALES (BAGS) X LAYERS
1	Cardboard box	1050x1250x1050	750	25	550x350x170	30	5x6
2	Cardboard box	1050x1250x1050	500	25	550x350x170	20	5x4
3	Cardboard box	1050x1250x1050	625	25	550x350x170	25	5x5
4	PE bags in cardboard box	1000x1200x2090	800	20	-	40	5x8
5	Cardboard box	1050x1250x1050	500	20	-	25	5x5
6	PE bags on wooden pallet	050x1250x1650	1000	20	-	50	5x10

Versalis SEBS Europrene® SOL 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.



EUOPRENE® SOL THX 1050 FOR LUBRICANTS VISCOSITY MODIFICATION

Europrene® SOL THX 1050 is a multi-arm block copolymer obtained by selective hydrogenation of branched styrene-butadiene-styrene block copolymer; it acts viscosity V.I. improver for high quality lubricants.

GRADE	STRUCTURE	STYRENE %	TP CST ⁽¹⁾	SSI % ⁽¹⁾
Europrene® SOL THX 1050	Multi-arm	7	4,5	12

(1) 1% weight in Eni SN 150



STORAGE AND PACKAGING

The product is supplied in bags on pallet and wooden crates, in a compact form, from Ravenna Plant (Italy).
Storage conditions: store in vented, dry area at temperatures between 20°C and 30°C; no direct sunlight.



Application

Friction is reduced by maintaining a film of lubricant between moving surfaces. Temperature variations in different operating conditions modify the lubricant viscosity and consequently the film-forming ability, moving surfaces can come into contact causing surface damages.

Dutral® olefin copolymers and Europrene® SOL TH block copolymer help in reducing lubricant viscosity changes at high and low temperatures (viscosity index improvement, fig. 1). The improvement of the oil viscosity index enable the usage within a wider temperature range (multi-grade lubricants, SAE J300).

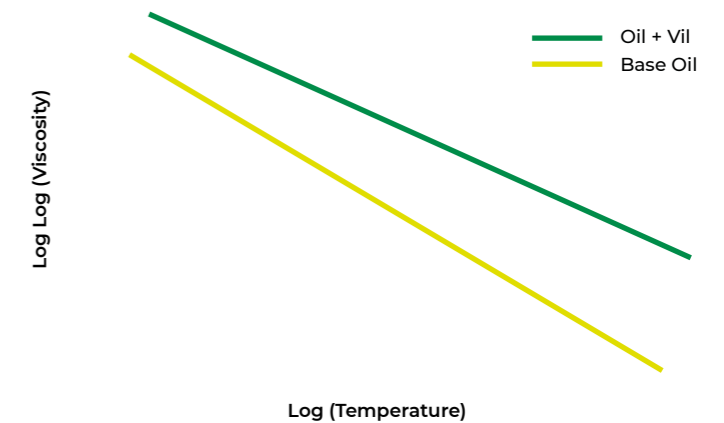
Dutral® CO/OCP and Europrene® SOL TH can be dissolved in mineral and synthetic base oils for producing a liquid VII or a finished lubricant. Two physical forms are available: bales or pellets depending on polymer structure.

The pellets form greatly helps in reducing the dissolution time thanks to a higher contact area in oil.

In case of solid bales it is suggested a grinding/chopping system. For more details about dissolution procedure please contact the Versalis technical service.

Fig. 1

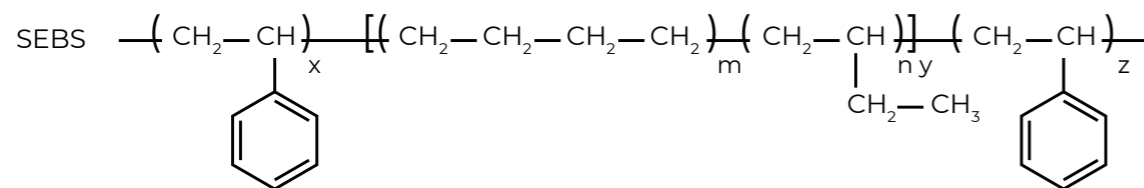
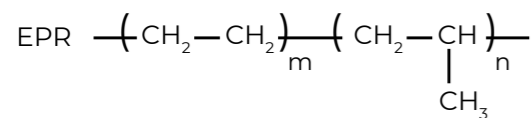
Viscosity index improvement



Dutral® CO/OCP and Europrene® SOL TH are widely used in multi-grade engine oils due to the good thermo-oxidative stability for longer service (single C-C bond, fig. 2), high thickening power with less treat rate,

small amount of Pour Point Depressant (cost reduction). When selecting the proper grade, polymer structure influence on the application performance should be considered (tab. 1).

Fig. 2



Tab. 1

APPLICATION PERFORMANCE	POLIMER STRUCTURE			
	INCREASE IN ETHYLENE CONTENT	INCREASE IN MOLECULAR WEIGHT	NARROWING MWD	MULTI-ARM
PSSI	■	◆	●	●
TP	●	●	■	●
CCS	●	■	■	●

PSSI = Permanent Shear Stability Index; TP = Thickening Power; CCS = Cold Cranking Simulator; MWD = Molecular Weight Distribution

■ No influence ◆ Worse ● Improvement

Grade selection

Thickening Power (TP) grows when Permanent Shear Stability Index (PSSI) increases (see fig. 3).

Blending polymers with low molecular weight and consequently low PSSI (better polymer stability under shear stress) will need higher treat rate (larger quantity) at the same KV target value. The grade selection for targeting a viscosity specification should consider a balance between PSSI and TP. TP is also influenced by copolymer type (OCP/SEBS) structure (linear/multi-arm) and composition (Styrene/Ethylene content), see fig. 3.

A blending study is necessary for determining the proper Dutral® CO/OCP and Europrene® SOL TH treat rate in formulating a lubricant with specific viscosity.

In performing a blend study for the most common SAE J300 multigrade oils the polymer type reported in fig. 4 are suggested as a starting trial.

OCP semi-crystalline grades require a care in the selection of all the other lubricant components to avoid gelation in cold conditions.

In multigrade lubricant applications Europrene® SOL THX 1050 has excellent permanent shear stability, excellent fresh and aged oil low temperature performance, and optimal contribution to high temperature viscosity.

Fig. 3

Thickening Power vs. PSSI

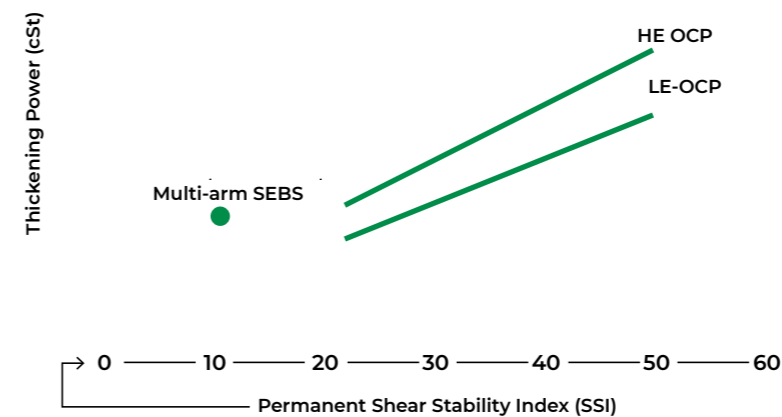
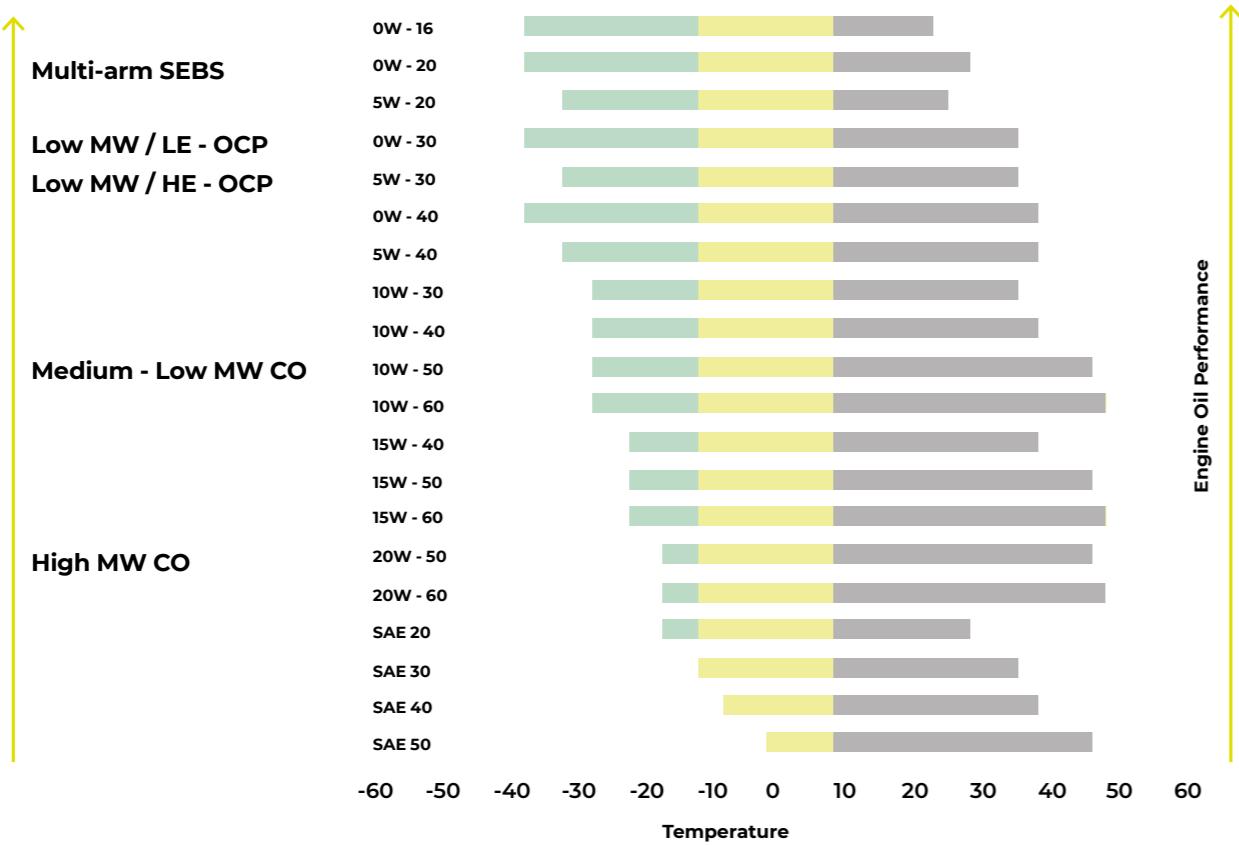
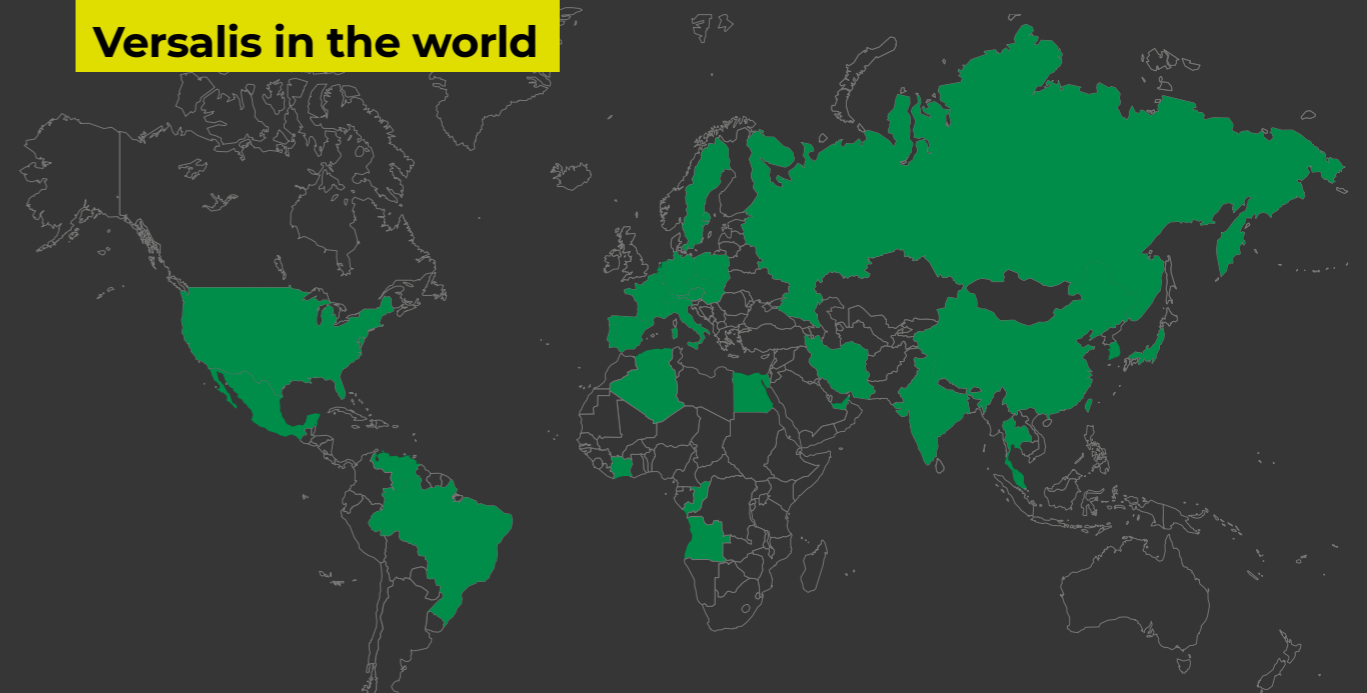


Fig. 4

Automotive Engine Oil-SAE J300 viscosity specification

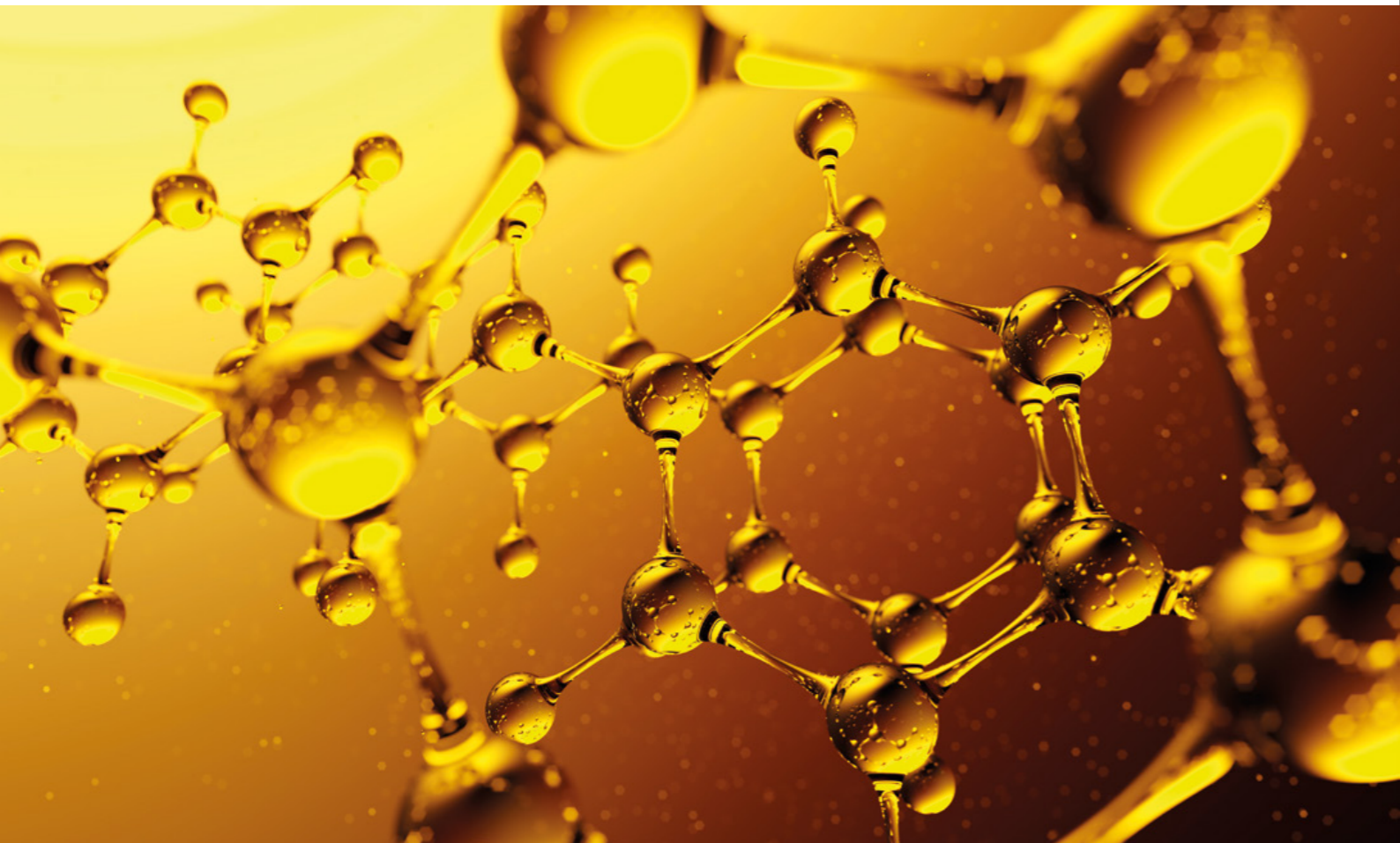


Versalis in the world



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
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Denmark
France
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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)
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

FRANCE

Dunkerque:
- Steam cracking
- Polyethylene EVA

GERMANY

Oberhausen:
- Polyethylene EVA

HUNGARY

Százhalombatta:
- Styrenics

SOUTH KOREA

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



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