

ELASTOMERS

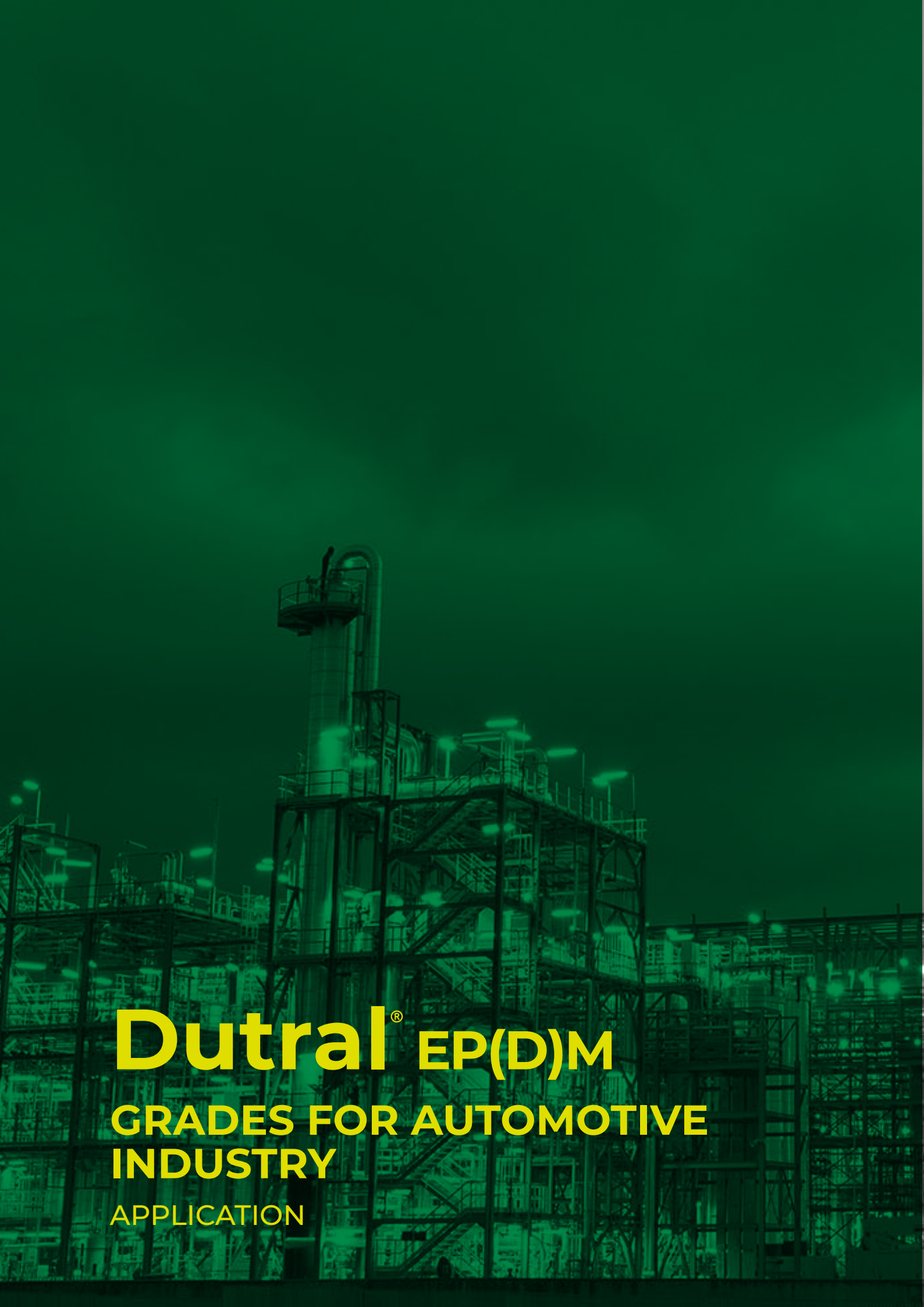
Dutral[®] EP(D)M

GRADES FOR AUTOMOTIVE
INDUSTRY

APPLICATION



versalis



Dutral[®] EP(D)M

GRADES FOR AUTOMOTIVE INDUSTRY

APPLICATION

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 130 KTPY of NPC in order to support market demand.

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®: DEVELOPMENT OF A NEW CATALYST SYSTEM

After years of internal development Versalis is ready to scale up an improved Z-N catalyst. Traditional Catalyst System is very versatile, able to produce from very low to very high Molecular Weight, from low to high Ethylene and ENB content.

The New Catalyst System keeps the versatility of the traditional one, significantly increases the polymerization yield, improves comonomers addition to obtain better distribution inside the polymer chain, reduces undesired side reactions.

Thanks to the new catalyst system Versalis is now in the position to offer a new Branched Terpolymer family characterized by a new polymer structure to improve processability and increase fillerability.

Dutral®: new Catalyst System benefits

Higher polymerization yield	Cleaner products
Better monomer distribution and side reactions control	Better consistency
	Better curing efficiency
	Gel content: low to none
Widening the polymer design	New polymer structures
	Improved processability



GRADE LIST

GRADES	PROPYLENE CONTENT %WT	MOONEY VISCOSITY ML (1+4) 125°C	UNSATURATION LEVEL %WT	OIL CONTENT %WT	PHYSICAL FORM	PACK. N°	MAIN APPLICATIONS
Dutral® BTR 4049	40	76	4.5	-	B	1	Automotive compact profiles, building, mechanical goods
Dutral® BTR 6049	40	85	6	-	B	1	Automotive compact profiles, building, mechanical goods
Dutral® BTR 8148 WO	39	75	8.5	17	B	1 2	Automotive sponge and solid profiles, building, mechanical goods
Dutral® BTX 9049 (BTR 9049)	39	90	9.5	-	B	3	Automotive sponge and solid profiles, building, mechanical goods

STORAGE AND PACKAGING

PACK. N°	PACKAGING DESCRIPTION	CRATE DIMENSION (mm)	NOMINAL NET WEIGHT	BALE (BAG) WEIGHT (kg)	BALE (BAG) DIMENSION (mm)	BALES (BAGS) TOTAL	BALES (BAGS) X LAYERS
1	Cardboard box	1050x1250x1050	625	25	550x350x170	25	5x5
2	Cardboard box	1130x1210x1050	600	25	550x350x220	24	6x4
3	Cardboard box	1000x1200x1850	875	25	550x350x250	35	5x7

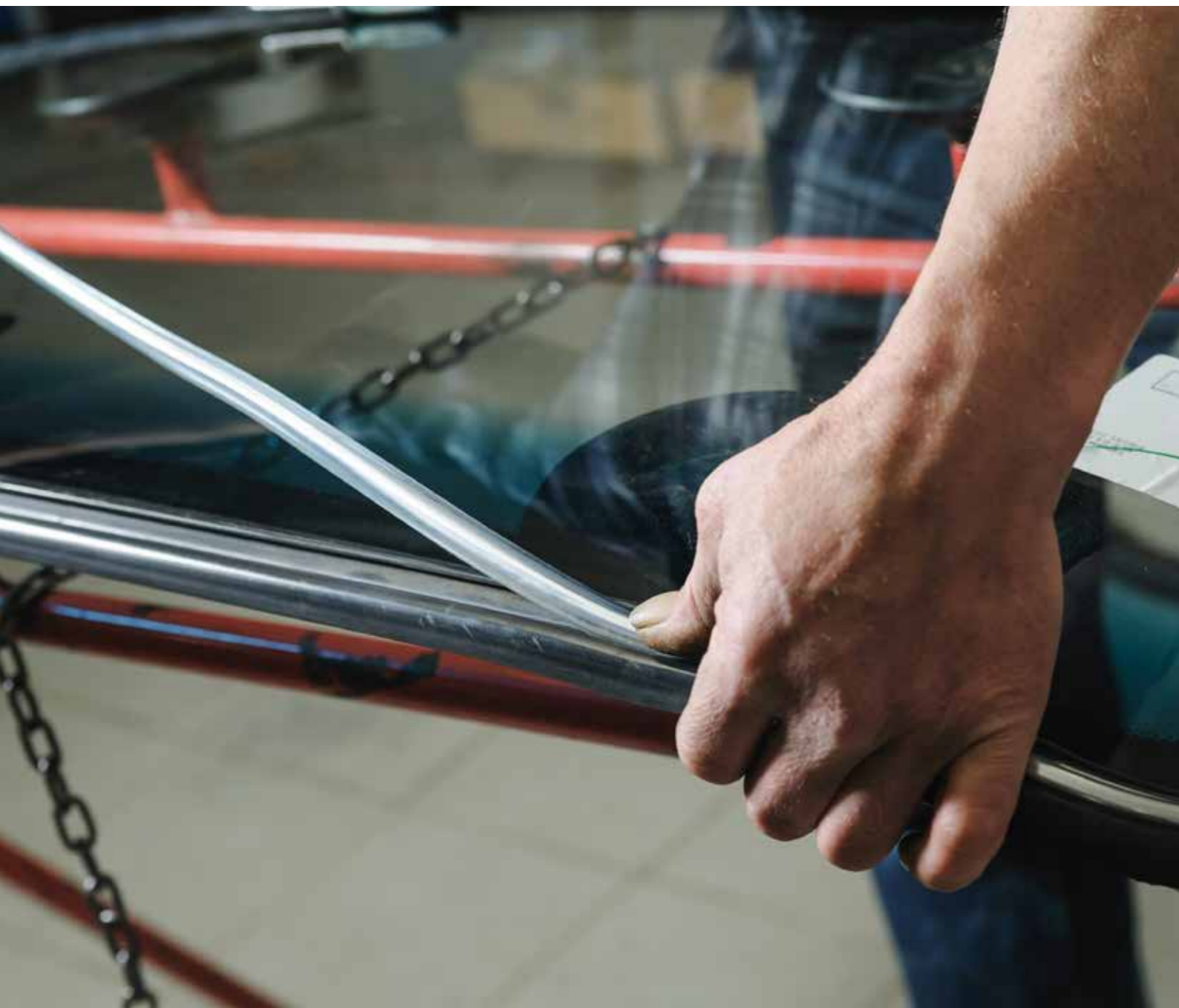
Dutral® grades have to be stored in vented, dry areas at temperature between 20°C and 30°C, avoiding direct sunlight.

Dutral® BTR 4049 and Dutral® BTR 6049: the right choice for compact profiles

KEY FEATURES

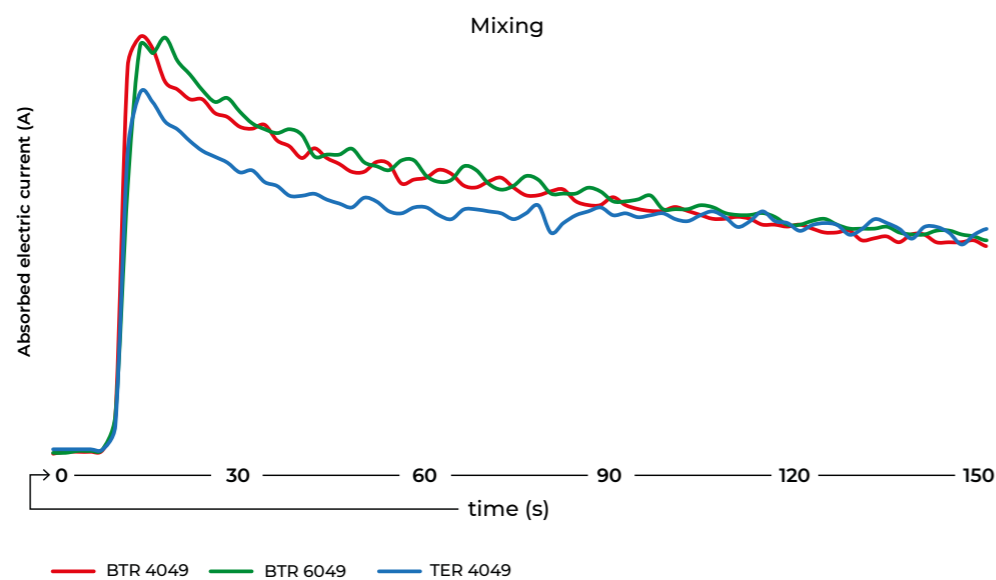
Dutral® BTR 4049 and Dutral® BTR 6049 are high molecular weight terpolymers, characterized by tailored molecular structure to improve mixing ability and to obtain high loading capacity, good mechanical properties and good collapse resistance.

Dutral® BTR 4049 and Dutral® BTR 6049 based compounds exhibit fast extrusion speed, fast curing and high cure state. In particular, Dutral® BTR 6049 vulcanization is boosted by a medium-high diene content.

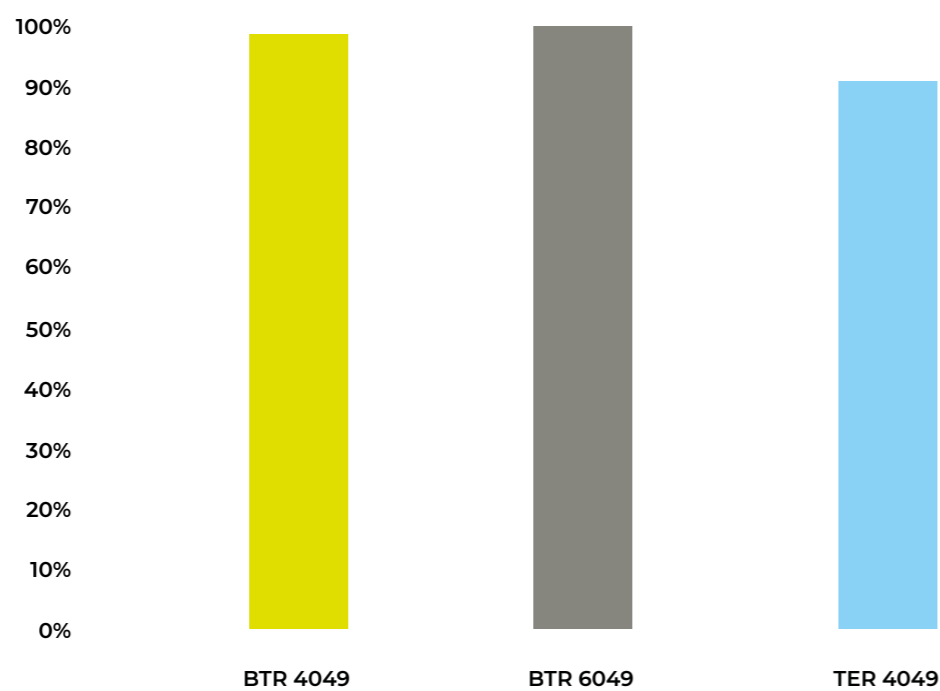


Compact profile formulation

Ingredient (phr)			
Dutral® TER 4049	100		
Dutral® BTR 4049		100	
Dutral® BTR 6049			100
ZnO		5	
Stearic Acid		1	
PEG 4000		5	
CaO		5	
Whiting		25	
FEF N 550		140	
Paraffinic oil		90	
Peroximon F/40		8	
TRIM S		2	
Mooney viscosity			
Polymer ML (1+4) a 125 °C	73	71	85
ML CV (1+4) @ 100 °C	57	50	51
Hardness			
Shore A 3"	55	55	59
Mechanical properties ASTM D412			
M100%	1.2	1.6	2.0
M200%	2.6	3.9	4.8
M300%	4.3	5.9	7.2
T.S. (MPa)	5.9	7.2	9.1
E.B. (%)	460	400	360
Compression set ASTM D395			
24 h 100 °C (%)	13	11	8



Absorbed electric current in the first 150s of the mixing



The tailor made molecular structure of Dutral® BTR 4049 and Dutral® BTR 6049 guarantees a better filler incorporation compared to the linear structure of Dutral® TER 4049.

Dutral® BTR 8148 WO and Dutral® BTX 9049: the best for sponge profiles

Sponge profile is probably the most demanding automotive body sealing application. It requires low Mooney compound and good collapse resistance to allow proper expansion, high cure rate to obtain a perfect skin.

In order to achieve the above-mentioned compound properties, Dutral® BTR 8148 WO and Dutral® BTX 9049 design has been appropriately tuned.





KEY FEATURES

Dutral® BTR 8148 WO and Dutral® BTX 9049 are tailored molecular structure terpolymers of high diene content. They are characterized by high loading capacity, easier dispersion of ingredients during mixing, good dimensional stability and low temperature elasticity; the high ENB content ensures a fast curing. They can be advantageously used in automotive sponge applications.

Dutral® BTR 8148 WO is extended with 17% white paraffinic oil.

The tailor made molecular structure of Dutral® BTR 8148 WO and Dutral® BTX 9049 is below compared with the performance of a linear prototype having the following characteristics:

ML (1+4) @ 125°C 68 MU, propylene content 39%, ENB content 8.5%, oil extended 17.5%.

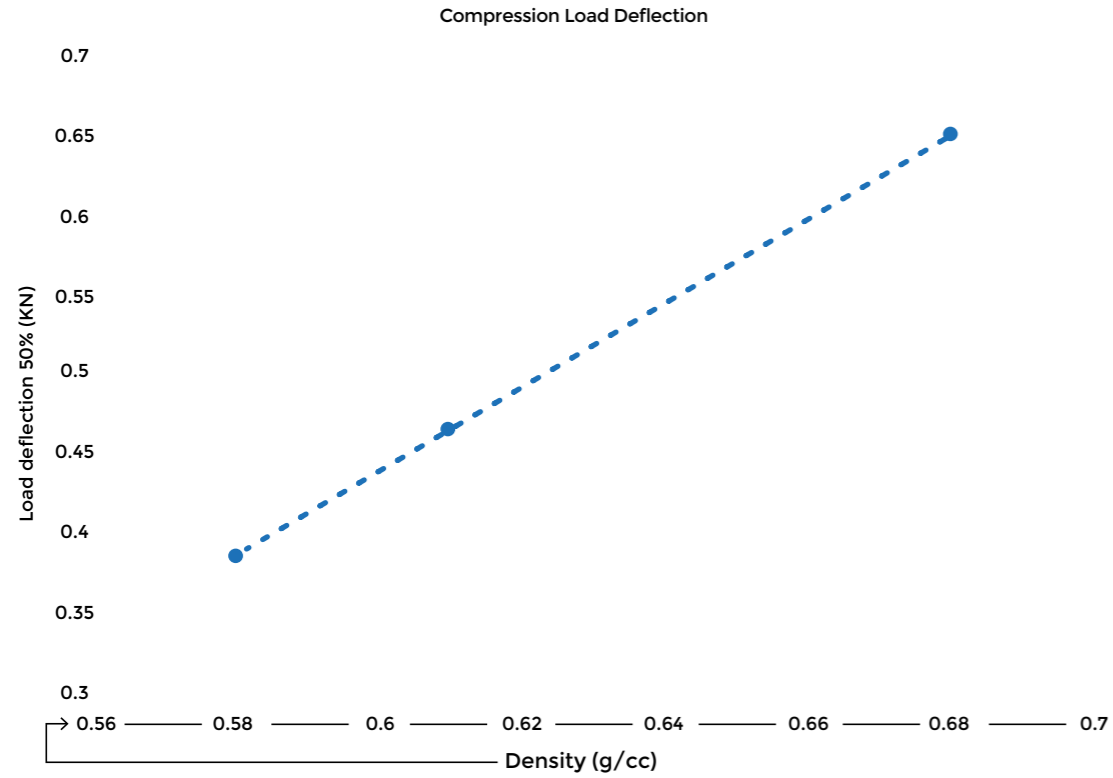


Sponge profile formulation

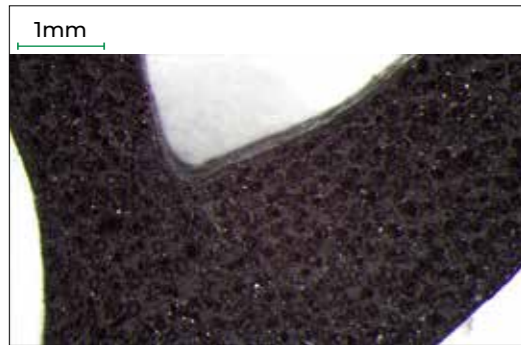
Ingredients (phr)			
Linear prototype	121		
BTR 8148 WO		120.5	
BTX 9049			100
Spheron 6400A		95	
Paraffinic Oil	64	64.5	85
Socal U1S1		40.0	
ZnO		5.0	
Stearic Acid		1.0	
PEG 4000		3.0	
CaO		2.5	
Sulphur		1.5	
MBTS		1.1	
ZBOP/S		1.8	
ZBEC		0.8	
TBBS		0.6	
TBzTD		0.5	
Geniplex 70		1	
ADC 80		1.5	
OBSH		2.5	

Mooney Viscosity and Scorch Time

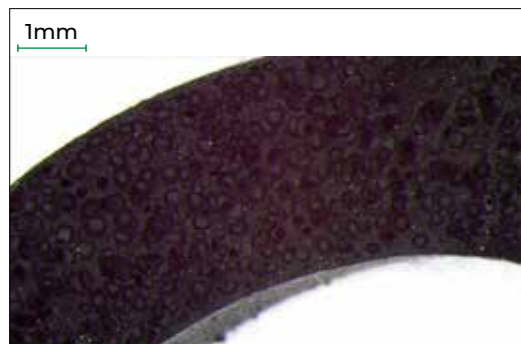
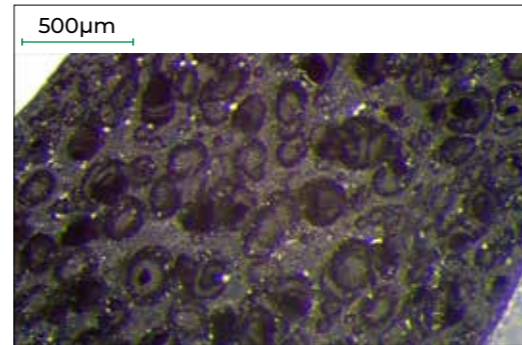
Polymer ML (1+4) @ 125°C	68	75	90
ML CV (1+4) @ 100°C	55.2	44.5	35.1
Scorch 121°C - t 5 (min)	4.3	4.7	4.5
Sponge Sample			
Load Deflection 50% (KN)	0.65	0.46	0.39
Density (g/cc)	0.68	0.61	0.58



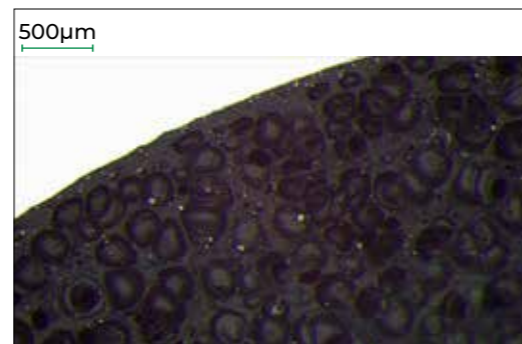
The tailor made molecular structure of Dutral® BTR 8148 WO and Dutral® BTX 9049 effectively reduces the mooney compound and this is beneficial for proper closed cells formation. Indeed the density of sponge samples made with those Dutral® grades is lower than that of the linear prototype, which brings to lower load deflection results.



Sponge profile made with Dutral® BTX 9049



Sponge profile made with Dutral® BTR 8148 WO



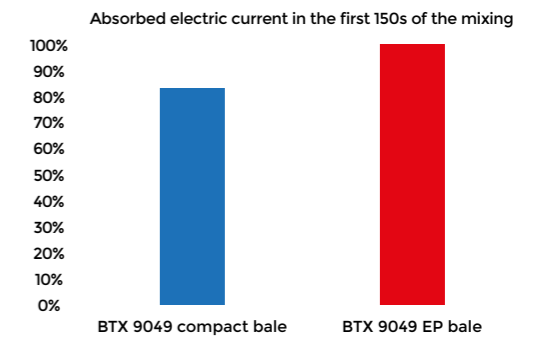
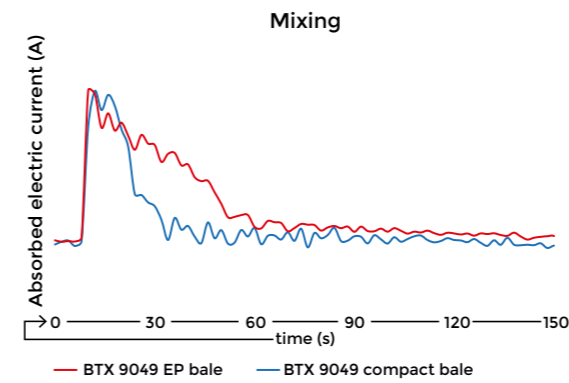
Dutral® BTX 9049: a physical form to help processing

Thanks to our experience in producing the Easy Processing (EP) form for semi-crystalline grades, we applied the same strategy to improve Dutral® BTX 9049 processability.

Mixing cycle

Mixer	Banbury
Capacity	1.6 L
Inizial temperature	70°C
Fill Factor	75%
Rotor speed	55 rpm
Cycle type	UPD 5'

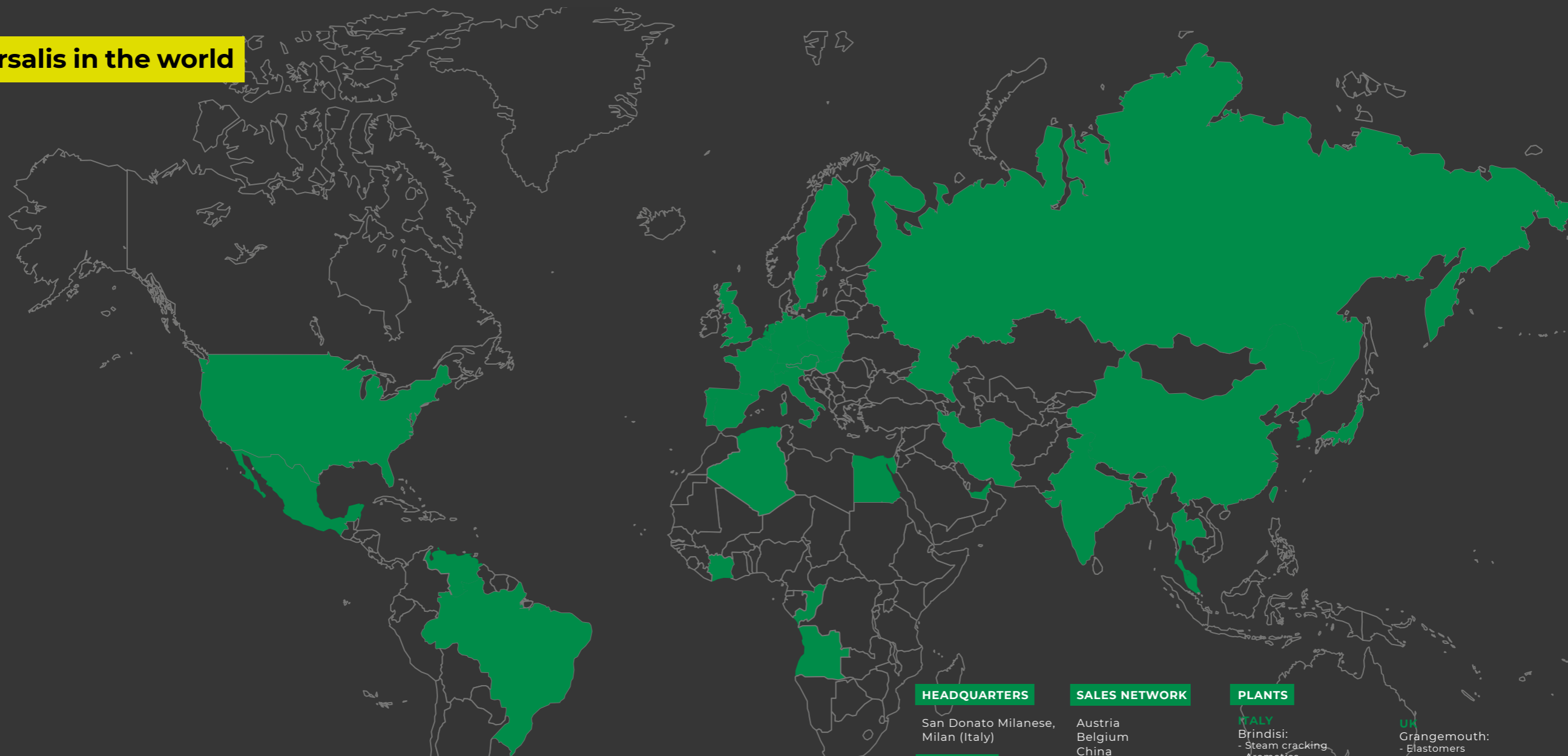
Compound recipe (phr): polymer 100, filler 190, oil 95, processing aids 16, curing agents 8.



BTX 9049 in Easy Processing bale form absorbs almost 20% more than in compact bale form. It means better filler incorporation and the possibility to shorten mixing cycles.



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.



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