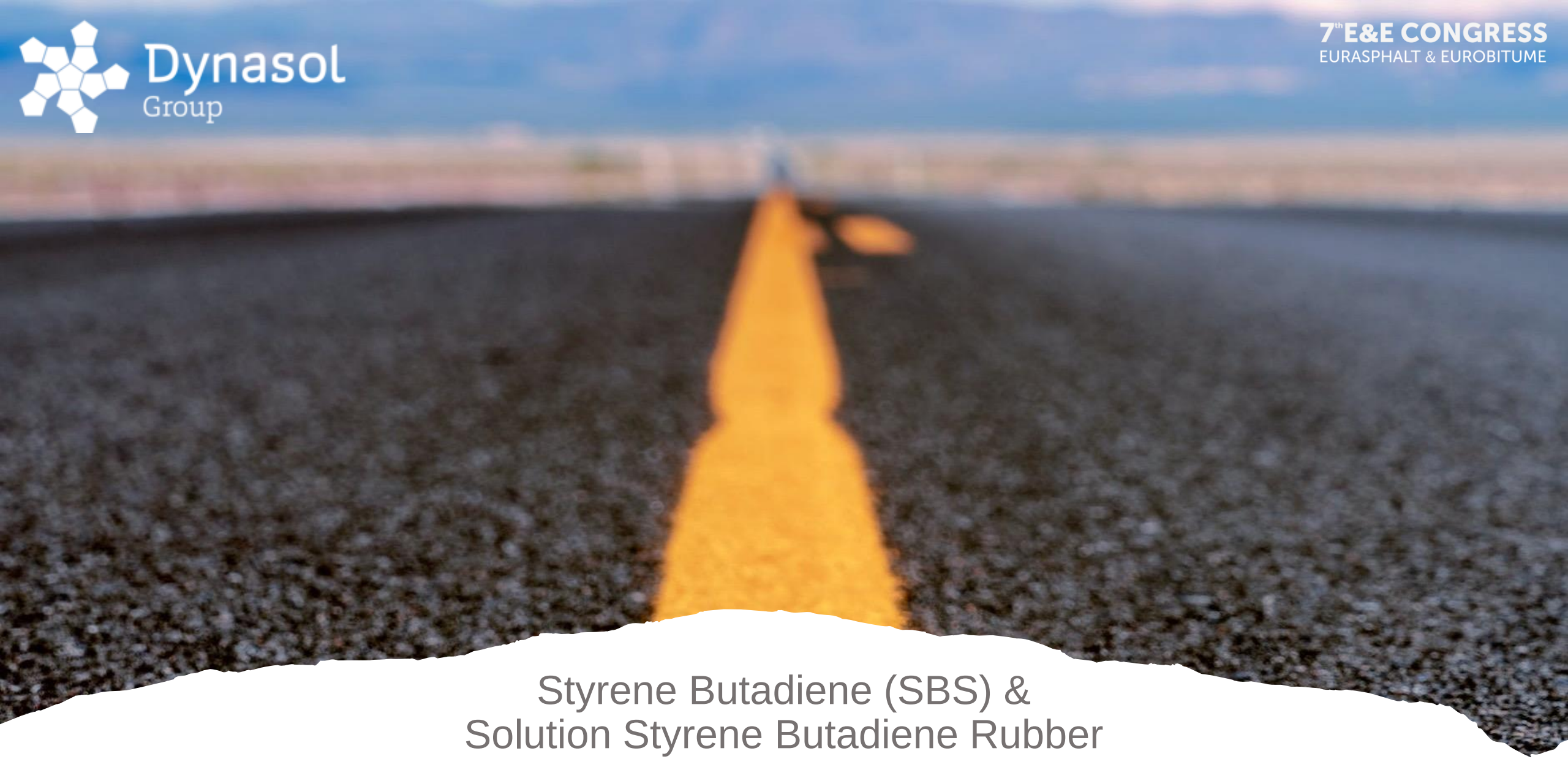

Dynasol Group

7th E&E CONGRESS
EURASPHALT & EUROBITUME

Styrene Butadiene (SBS) & Solution Styrene Butadiene Rubber (SSBR) for **Paving Applications**

Who we are

- One of the biggest industrial groups in México
- Subsidiary of DESC, created in 2007.
- Multicultural team of more than 17,000 employees.
- Presence in over 70 countries in five continents.

- One of the 10 largest oil companies worldwide.
- More than 24,000 employees worldwide.
- Industry innovator with large investments in R&D.
- Presence in more than 50 countries.

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Production sites & office's locations

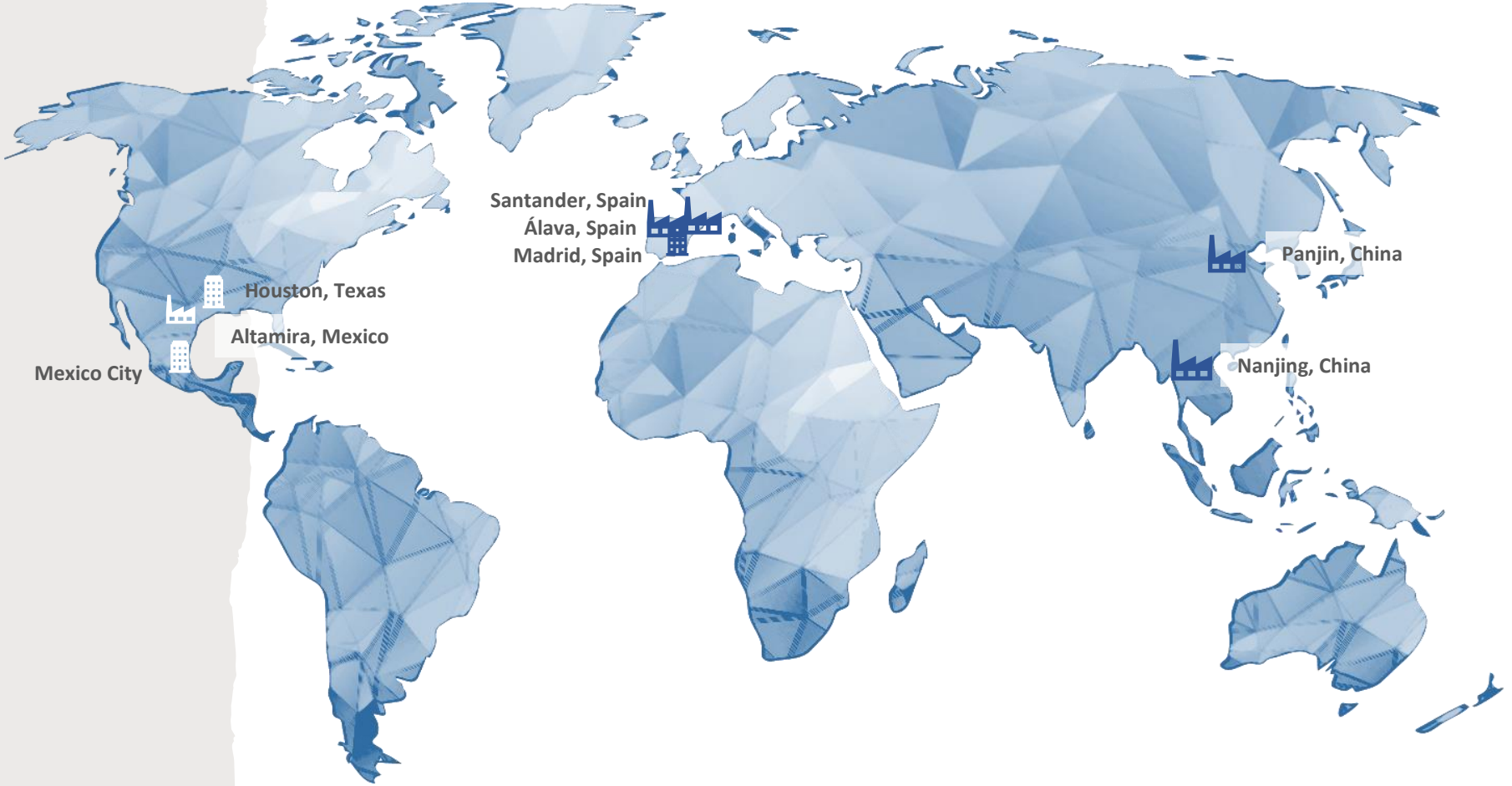
ESBR, NBR, SBC & SSBR
Altamira, Mexico
240 KTA

SBC
Santander, Spain
120 KTA

Rubber Chemicals
Alava, Spain 30 KT

SBC & SSBR
Panjin, China
110 KTA

NBR
Nanjing, China
30 KTA



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Benefits of SB copolymers for PmB

- Reduction on maintenance cost and durability.
- High elastic recovery improving the rutting deformation.
- Better fatigue and cracking resistance.
- Pavement waterproofing.
- High adhesive and cohesive strength in the covering of bitumen with petrous aggregate.
- Reduction of aggregate shelling on the pavement and the formation of holes.
- Better traction between pneumatic and road. Safety driving. Rolling noise reduction.

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Polystyrene

+

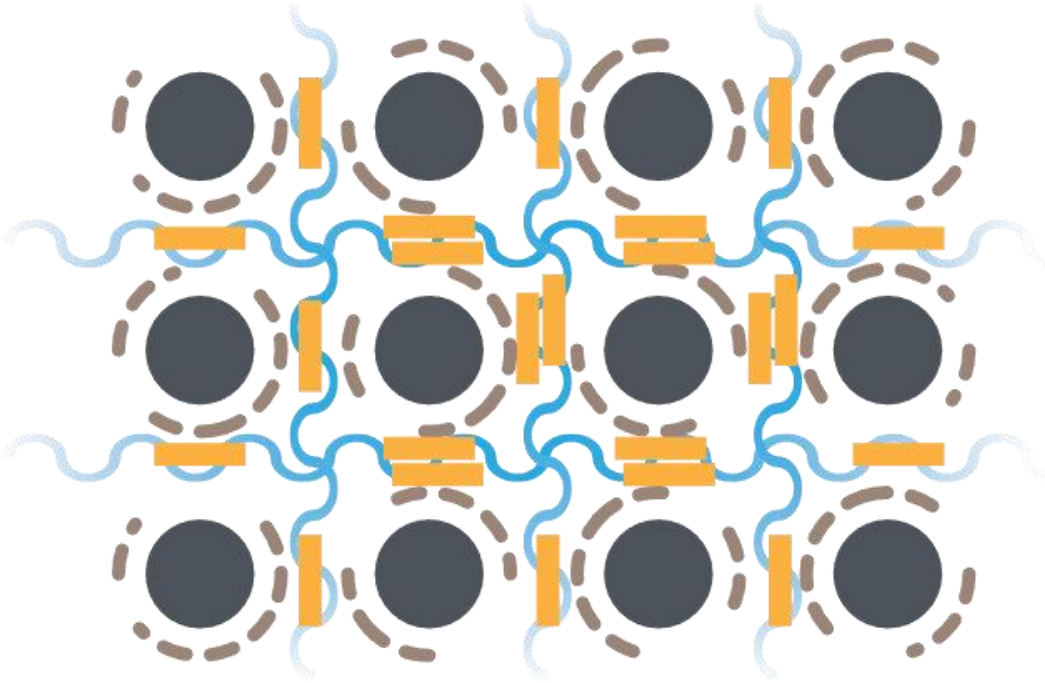
Polybutadiene

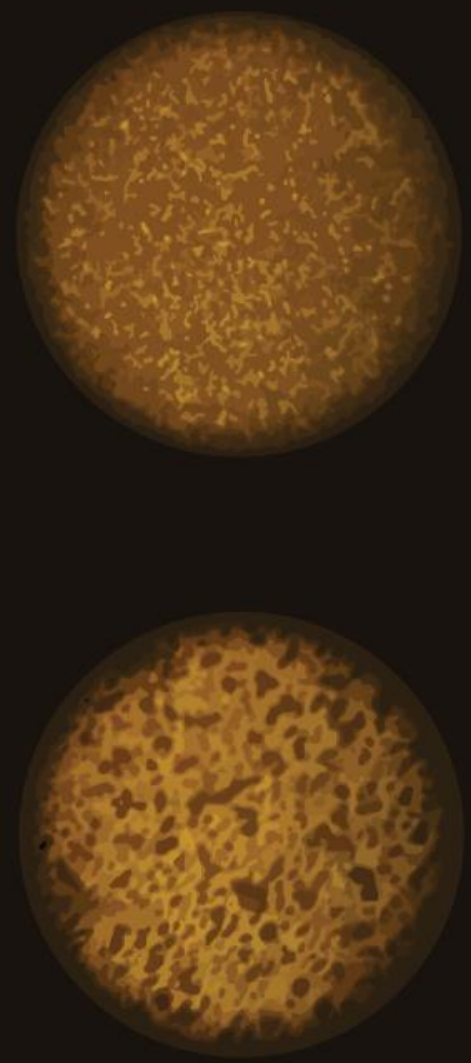
+

Asphaltenes

+

Maltenes





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Dynasol´s product portfolio for Paving Bitumen

PMA properties depending on polymer type.

Brand Grade	Structure	Styrene Content, %	TSV, cP	Tª R&B	Pen	Fraass	Viscosity	Elastic Recovery	Ductility	Force Ductility	Aging	Storage stability
Calprene 411	Radial SBS	30	20	●	●	●	●	●	●	●	●	●
Calprene 401	Radial SBS	20	20	●	●	●	●	●	●	●	●	●
Calprene 501	Linear SBS	31	13	●	●	●	●	●	●	●	●	●
Solprene 4301	Linear SBS/SB	33	11	●	●	●	●	●	●	●	●	●
Calprene 580	Linear	31	9,5	●	●	●	●	●	●	●	●	●
Calprene 4302	Linear	31	7	●	●	●	●	●	●	●	●	●
Solprene 4318	Linear SBS/SB	32	6,3	●	●	●	●	●	●	●	●	●
Solprene 1205	Linear SBR	25	47*	●	●	●	●	●	●	●	●	●
Solprene 1110	Linear SBR	15	147*	●	●	●	●	●	●	●	●	●

Requirement performance ● Excellent ● Good ● Adequate

Condition test: 2 hr mixing, 180ºC, 4000 rpm high shear mixer, bitumen 70/100, 4% polymer.

*Mooney viscosity, ML1-4. Cross-linking agent is required in SBR products.

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High Vinyl SBS in Paving Applications

High Vinyl SBS family permits high polymer concentration in PmB increasing the stiffness, elastic recovery and rutting resistance.

High Vinyl SBS gives superior compatibility than other typical SBS keeping low viscosity despite of the high polymer concentration that is possible to handle.

Calprene 580 and Dyne 149 / Solprene 5375 were developed by Dynasol to be used in highly concentrated SBS in bitumen and polymer modify bitumen emulsions for Paving application and rehabilitation of roads. In some cases, avoid the use of crosslinking agents in final PmB.

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New SBS in Paving Applications

	Calprene 580	Dyne 149
Polymer structure	Linear	Hybrid SB
Styrene content, %	30	37
Vinyl content, %	Medium	High
Insoluble in toluene @ 325,% max	**0.1**	**0.1**
Toluene solution viscosity 5.23% Cst	9.5	5.0
Ashes,% max	0.35	0.35

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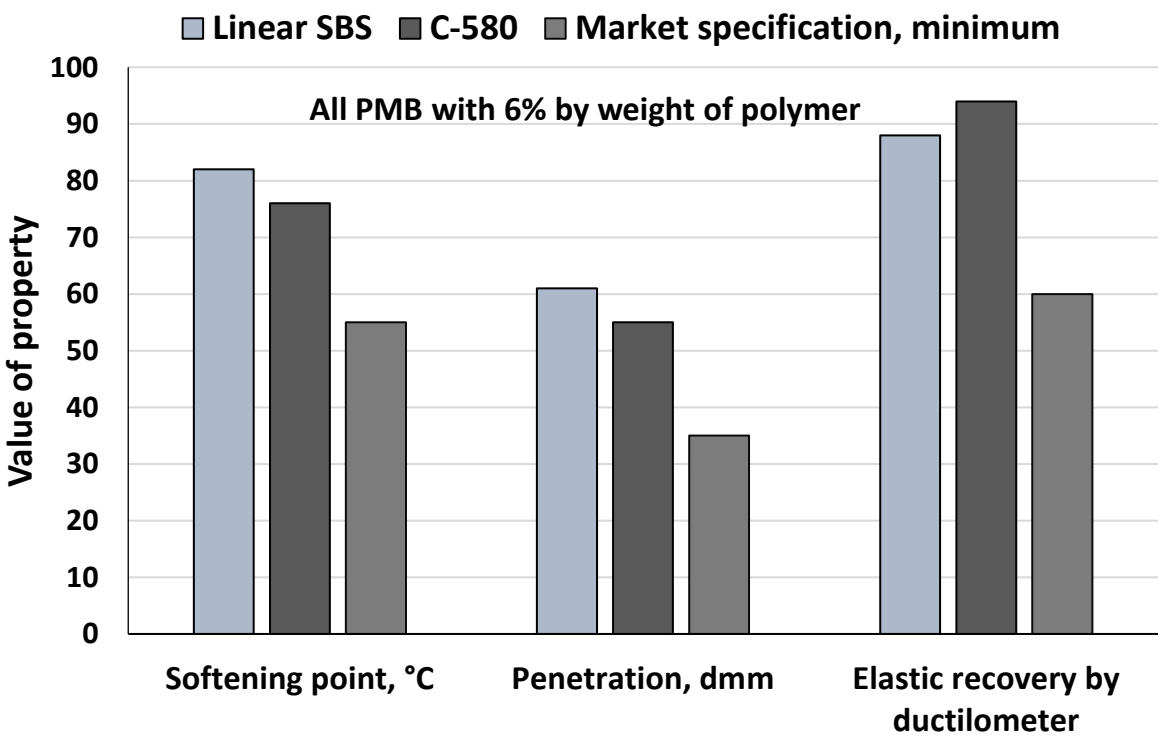
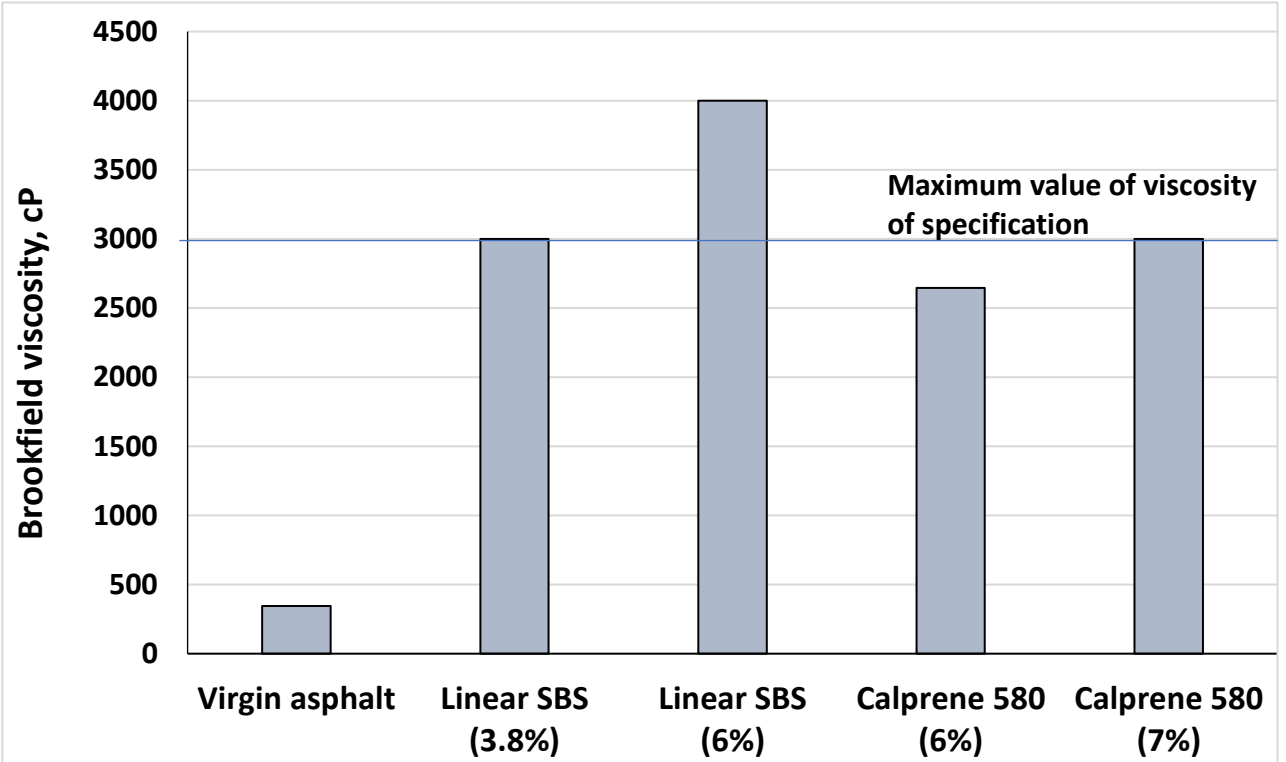
Mechanical Calprene 580 Properties

Structural design of Calprene 580 permit to handle low levels of viscosity comparing other polymers. This is an advantage for pumping, processing and prepare high polymer concentrated bitumen. The polymer modified bitumen keeps good thermal-mechanical properties compared with other SBS and market references.





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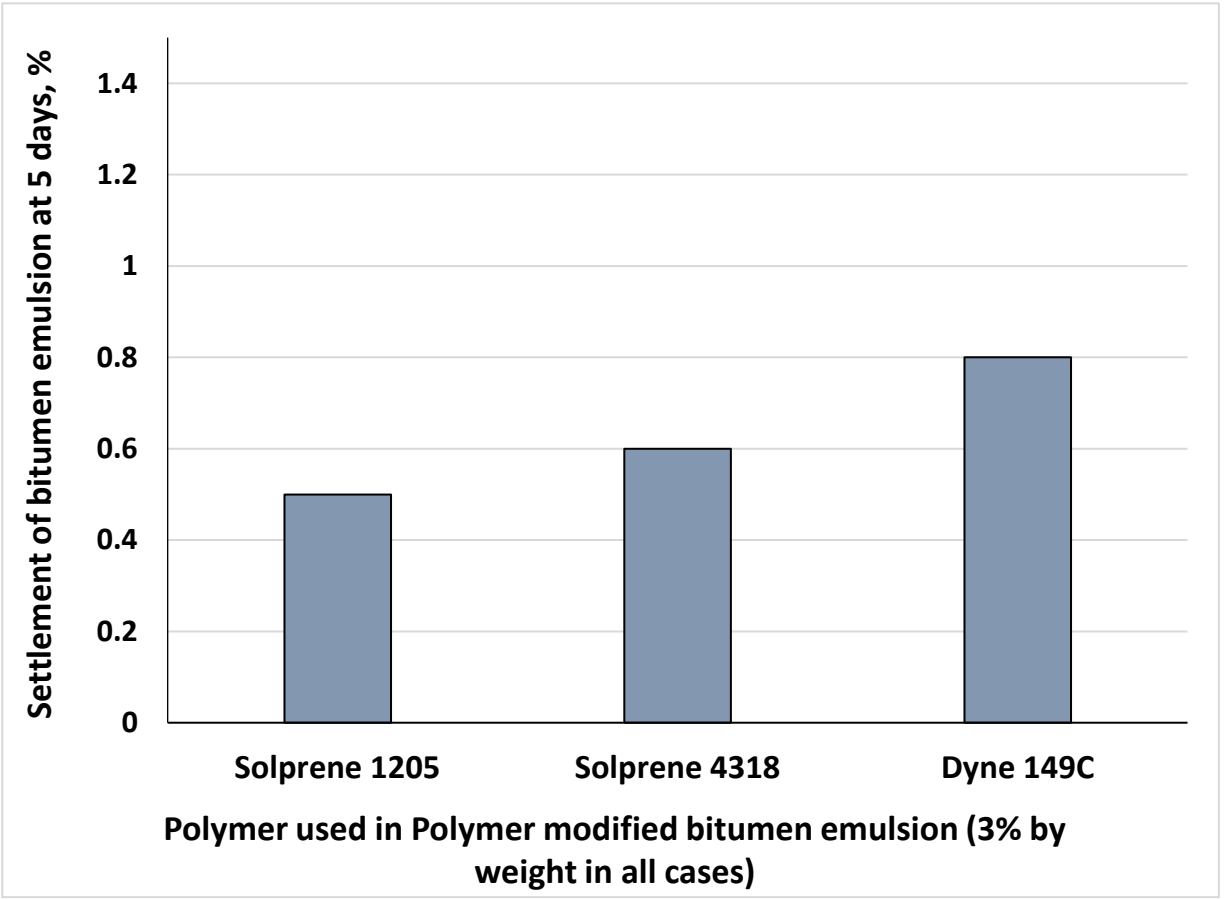
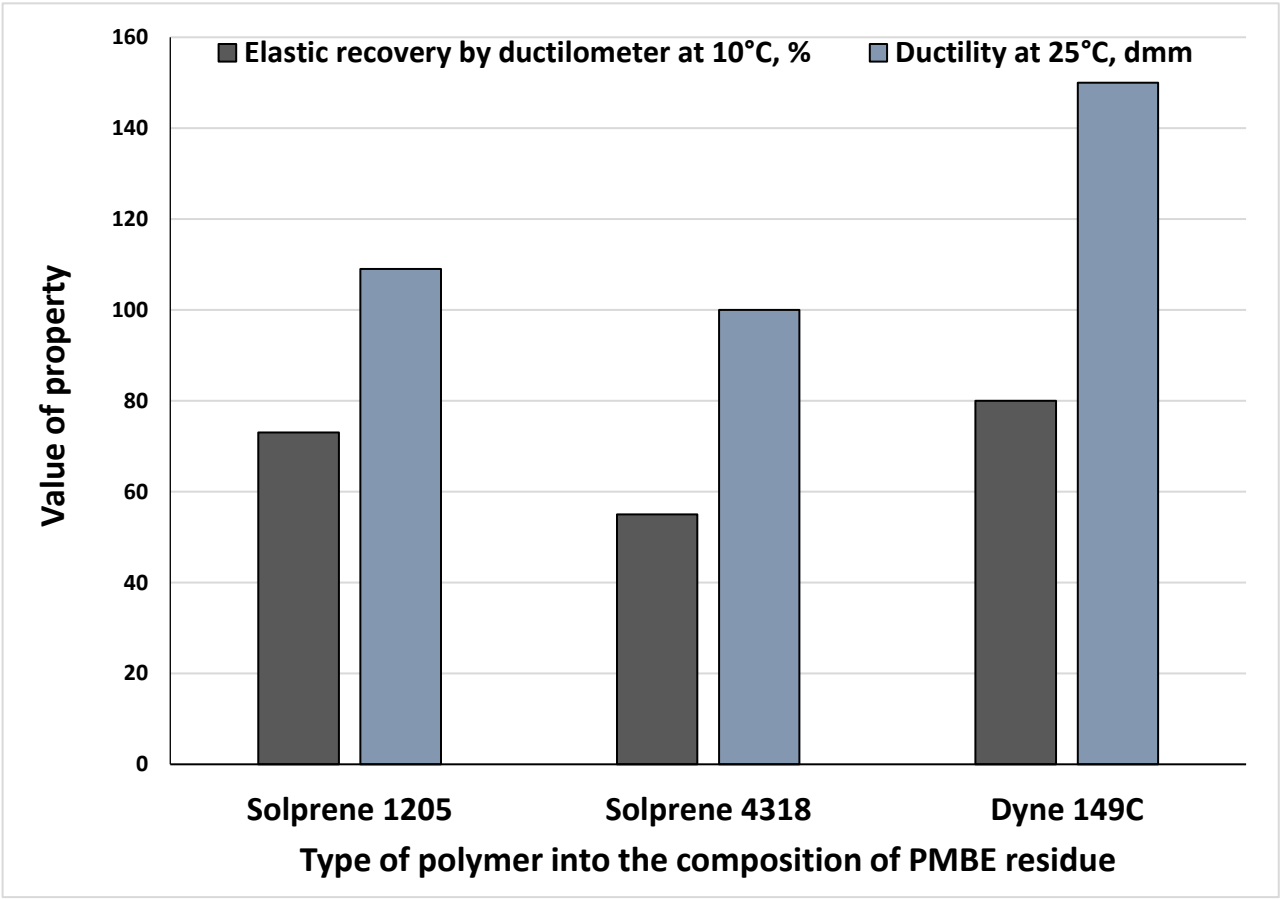
Polymer modified bitumen emulsion (PMBE)





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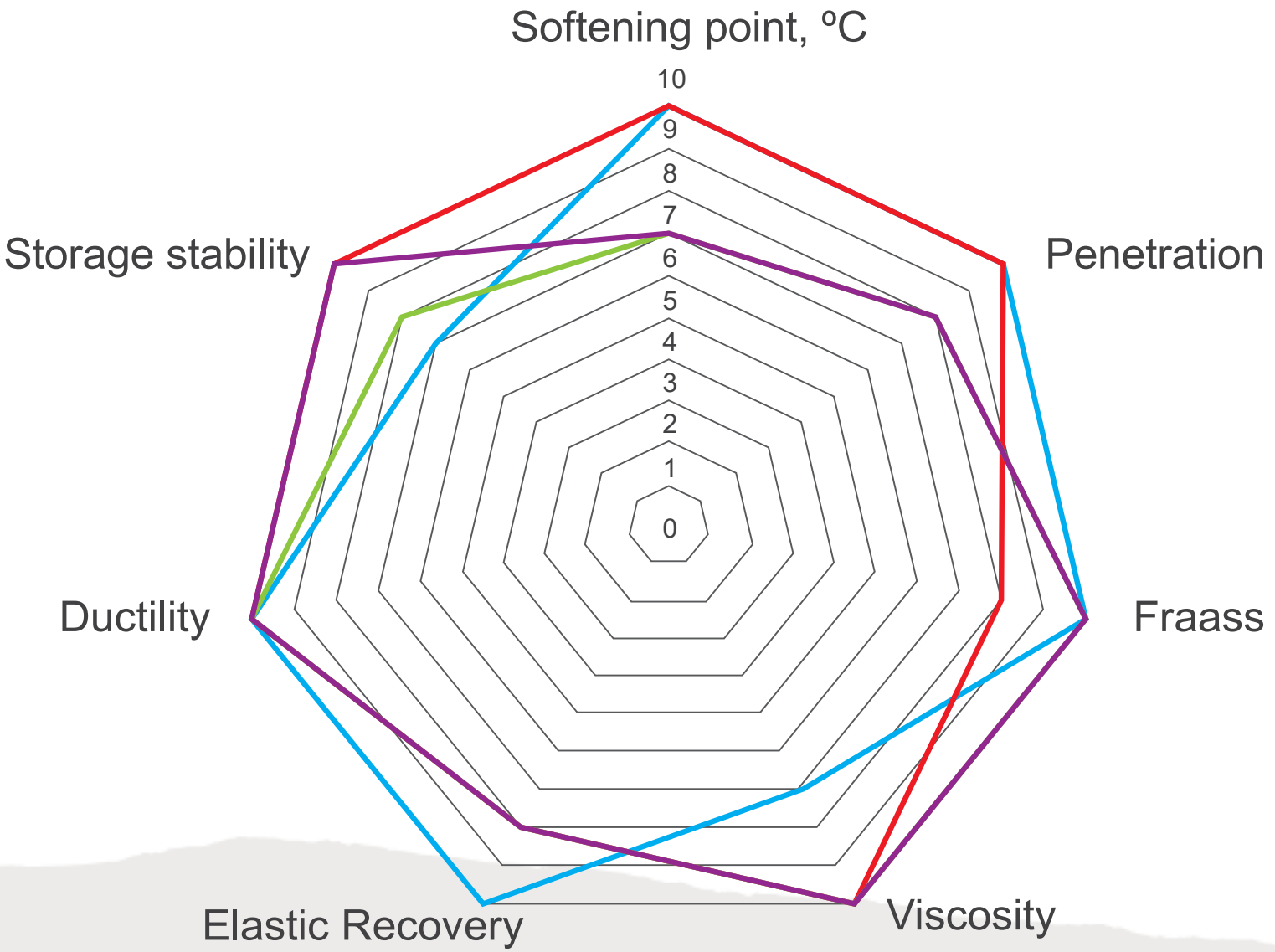
Radial SBS | High vinyl-linear SBS | Linear SBS | S-SBR



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Summary

- Safety roads with better interaction of pneumatics and pavement.
- Better fatigue and cracking resistance.
- **Dyne 149, S4318, S1205, S4302,** Improvements in “chipping” resistance.
- Avoid rutting deformation.
- Good elasticity and tensile strenght.
- Adhesive and cohesive strenght in synergism with petrous agregate.
- Reduction on maitenance cost.
- Less noisy roads.
- **Calprene 580 and Dyne 149 (S5375X)** New vinyl styrene-butadiene copolymers optimize or avoid the use of crosslinking agents in PmB preparation.

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Q & A

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Thank you!

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