



Dynasol
Group

7th E&E CONGRESS
EURASPHALT & EUROBITUME

Turning challenges into solutions through
innovation

Low viscosity **SBS** for Green Asphalt Modification

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

Production sites & office's locations



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



SBC
Santander, Spain
120 KTA



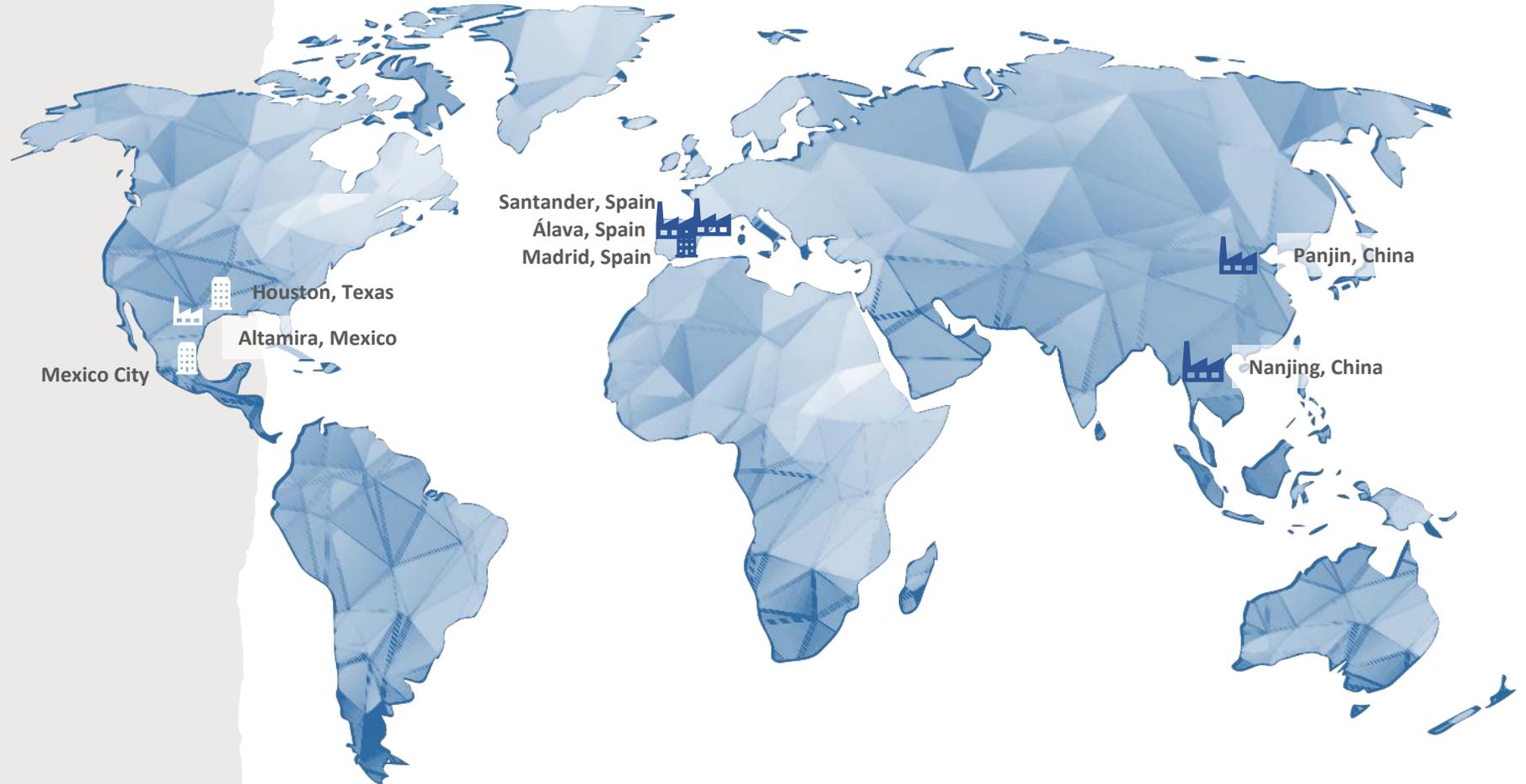
Rubber Chemicals
Alava, Spain 30 KT



SBC & SSBR
Panjin, China
110 KTA



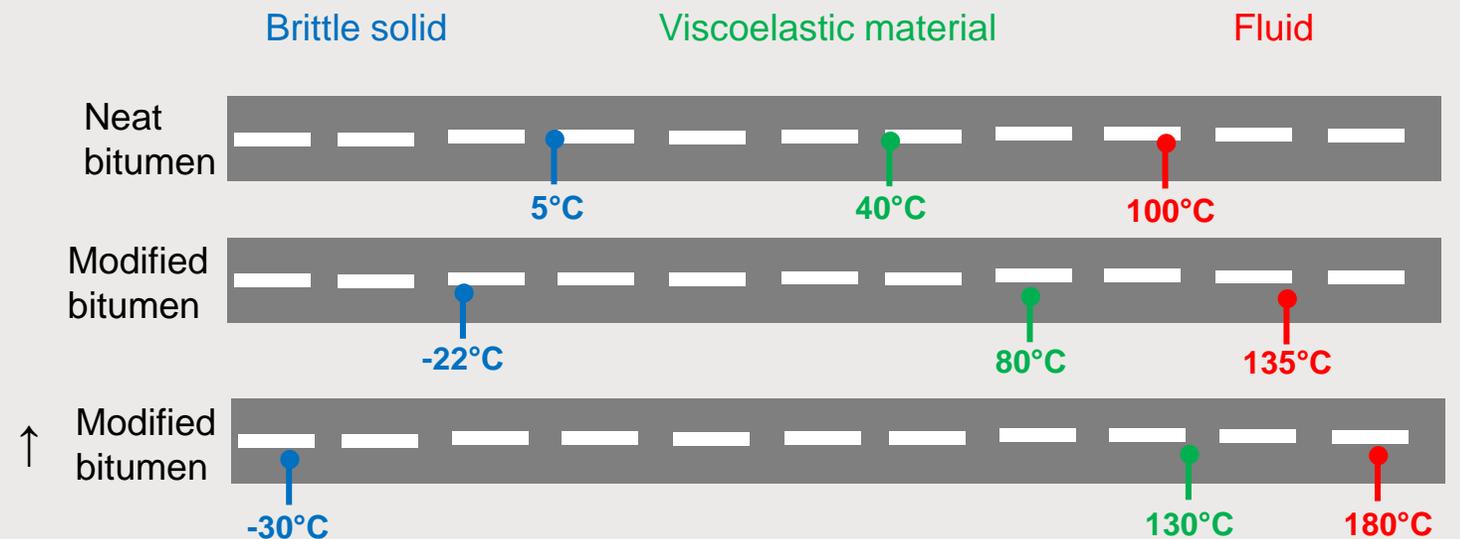
NBR
Nanjing, China
30 KTA





Why modified bitumen?

Bitumen is a viscoelastic material from the refining industry used for waterproofing and pavements. Neat Bitumen is rigid/brittle at low temperatures but soft/fluid at high temperature, deformable and does not recover its original shape.





Polymer Modified Bitumen with SBS

- Elasticity and tensile strength
- Adhesion and cohesion
- High temperature stiffness
- Low temperature flexibility
- Reduced moisture damage
- Noise reduction



Bitumen Quality

- Nowadays **asphalt** is getting more rigid due to the change in composition, with lower aromatic content and important increments in resins (polar compounds) and asphaltenes.
- **SBCs** are strongly compatible with aromatic fraction but less compatible with asphaltenes and resins.
- There is a necessity of increasing the compatibility between SBS and different bitumen sources.

Sustainability

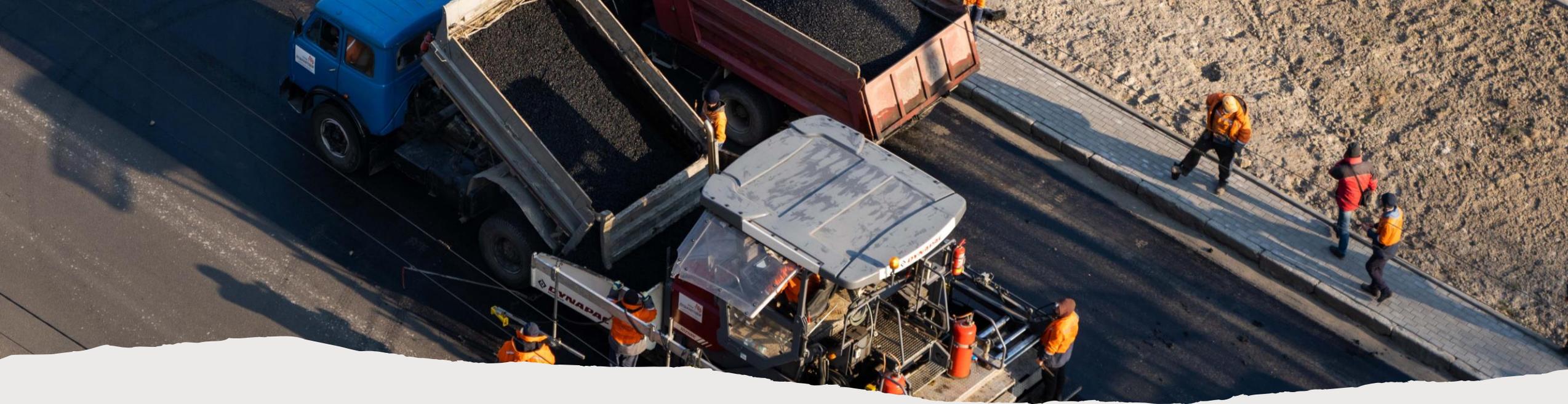


Dynasol Group has established sustainability as one of the pillars for the development of new products across all the segments that we serve including the asphalt industry.



Our low viscosity products help optimize the asphalt modification process, saving mixing energy and reducing emissions with high concentrated blends and warm-mixes.





Concentrated Asphalt Mixes

Low viscosity styrene-butadiene copolymer for highly modified asphalt

Feasibility of working with concentrated blends and subsequent dilution

Excellent fatigue cracking resistance

Permanent deformation resistance

High modification

Durability

Good aging

Warm Mix Asphalt

Warm Mix Asphalt is an asphalt that is produced and applied at a temperature around 20 – 40 °C lower than an equivalent “Hot Mix Asphalt” (HMA)

Advantages

Safety: less emissions and improved working conditions

Environmental: less energy used and lower emissions

Manufacturing: less hardening of the bitumen and full compatibility with the use of RAP

Paving: transport for longer distances and extend the paving season

Solprene 5375X and Dyne 154

Dynasol Group offers low viscosity SBS copolymers for Highly SBS Concentrated Asphalt and Warm-Mixes

Property	Solprene 5375X	Dyne 154
Styrene, %	medium-high	medium
Brookfield, cP	medium-low	low
Coupling degree, %	low	medium-low
1,2-vinyl, %	high	medium-low

Concentrated Asphalt Mixes: Solprene 5375X and Dyne 154

Mixing conditions: EKBE PG 64-22 bitumen at different concentration of SBS (6% and 3% diluted from 6% blend), 190 °C, 3 h, 2500 rpm

High modification with lower viscosity values, particularly Dyne 154

Property	3% diluted		6%	
	S-5375X	Dyne 154	S-5375X	Dyne 154
R&B, °C	61	62	82	81
Pen. 25°C, dmm	44	45	38	40
Brookfield 135°C, cP	950	671	2206	1226
ER torsion, %	33	34	52	76
Ductility 25°C, cm	67	150	50	50
ER duct. RTFOT, 25°C, %	80	53	93	88
PG grade, °C	70-16	70-16	82-16	76-6

PG broader for Solprene 5375X probably due to the higher molecular weight and vinyl content

Dilution at 3% of both mixes have the same PG, proving the feasibility of working with concentrated mixes and subsequent dilution

Warm mixes: Dyne 154

Mixing conditions: 70/100 bitumen, 4% Dyne 154, 4000 rpm, 135 °C, 2h

Property	180°C	135 °C
Fraass, °C	-16	-16
Penetration 25 °C, dmm	48	56
R&B, °C	58,1	58,1
Brookfield 180 °C, Cp, 200 rpm	130	131
Elastic recovery 25°C, %	70,6	47,6
Storage stability, 180 °C, 3 days		
Top: Pen 25°C, dmm	48	50
Top: R&B, °C	60	59
Bottom: Pen 25°C, dmm	49	52
Bottom: R&B, °C	60	59

No undissolved particles were observed after mixing at 135 °C, demonstrating the ease of dispersion of this polymer

Similar performance was obtained at both temperatures confirming the possibility of working at less energy-demanding conditions



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Summary

- More environmentally friendly bitumen modification processes can be accomplished by tailored polymer designs.
- Low viscosity SBS can be dosed at higher concentration in bitumen mixes, achieving good PmB properties and benefits during transportation stage: **Solprene 5375X and Dyne 154**
- Polybutadiene 1,2-vinyl percentage is essential for an outstanding compatibility between SBS and bitumen even in absence of a crosslinking agent: **Solprene-5375X**
- Low viscosity SBS copolymers allow modification at more sustainable conditions: **Dyne 154**



Q & A

Sustainability



Our compass for innovation



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