



Kraton Polymers: High Performance Modifiers for Asphalt Paving

Polymer modification of asphalt binder is the solution of choice to enhance the durability of roads exposed to heavy traffic or harsh climates. The added performance asphalt binder achieves through polymer modification is required to meet the evolving expectations of drivers, road authorities and the wider community.

As pioneers in asphalt modification, Kraton Polymers leads the paving industry by offering new and innovative polymers that deliver greater performance and processability. With a global supply network and service second to none, Kraton Polymers offers its platform of higher performing polymers to an evermore challenging range of paving applications.



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Driving Innovation with Kraton Polymers High Performance Modifiers for Asphalt Paving





Kraton Polymers is the leading supplier of Styrenic Block Copolymers (SBC's)

- ▶ Market leader for asphalt modification
- ▶ Global manufacturing capability in US, Europe, Asia and South America
- ▶ Technology and innovation leader
- ▶ Service second to none
- ▶ Customers in over 70 countries
- ▶ Reliable supplier and trusted partner
- ▶ Track record of dedication to the industry

Unique SBS properties for asphalt modification

- ▶ Soluble and highly efficient with low processing viscosity
- ▶ Bitumen extended polymer network in the binder
- ▶ Thermal crack resistance through toughness at low temperature
- ▶ Permanent deformation resistance with higher elasticity and modulus
- ▶ Fatigue resistance through toughness and enhanced crack healing

Meeting today's challenges for asphalt pavements

- ▶ Increasing traffic densities, axle loads and tire pressures
- ▶ Improved smoothness through durability over a roads lifetime
- ▶ Reduces maintenance costs and the associated construction delays to traffic and noise emissions in built-up areas
- ▶ Full recyclability and minimum life cycle carbon footprint
- ▶ Consistent binder and speedy construction

SBS asphalt modification: an outstanding performance record

- ▶ Modifier of choice around the globe
- ▶ Addresses both rutting and cracking
- ▶ The best modifier for both hot and cold climates
- ▶ Proven track record with decades of outstanding performance

SBS block copolymers are the leading modifier for asphalt modification as it meets all these requirements.

SBS modified asphalt: the ecological choice that makes economic sense

- ▶ Modification for durability and life cycle eco - and cost- performance
- ▶ Upfront savings through thinner pavement designs
- ▶ Proven to be fully recyclable
- ▶ Can be combined with selected warm mix solutions without impacting performance
- ▶ Safe handling and no added emissions in processing



Applications of Kraton polymers in asphalt

- ▶ Wearing courses for high traffic or harsh climate roads
- ▶ Pavement preservation overlays
- ▶ Cement concrete overlays
- ▶ High performance base courses
- ▶ Waterproofing bridge deck asphalt
- ▶ Stripping resistant porous asphalt
- ▶ Racetrack and airport pavements
- ▶ Asphalt emulsions for chip seals with superior stone retention

Kraton Polymers Innovation - a heritage carried forward:

- ▶ Patented enhanced compatibility polymers
- ▶ Highly modified binders for exceptional fatigue and rut resistance
- ▶ Modified base course binders with step change in toughness
- ▶ Polymers for superior emulsion properties and ease of production

Working with Kraton Polymer towards asphalt solutions

- ▶ Knowledgeable and industry focused sales force
- ▶ Technical service and formulation expertise
- ▶ Polymer, binder, asphalt mix and application development
- ▶ Formulation, processing and equipment advice to produce modified binders

Kraton polymers applications beyond asphalt paving

- ▶ Modified bitumen felts for roof and bridge deck waterproofing
- ▶ Enhanced toughness, resilience and processing of sealants and coatings
- ▶ Road marking paint with superior retro-reflective glass bead retention
- ▶ Hot melt adhesives for use in high speed manufacturing of consumables
- ▶ Pressure sensitive adhesives such as tapes and labels
- ▶ In compounds for enhanced feel, grip, toughness and appearance of products ranging from toys to packaging
- ▶ Replaces natural rubber latex with superior synthetic Kraton IR Latex in various applications

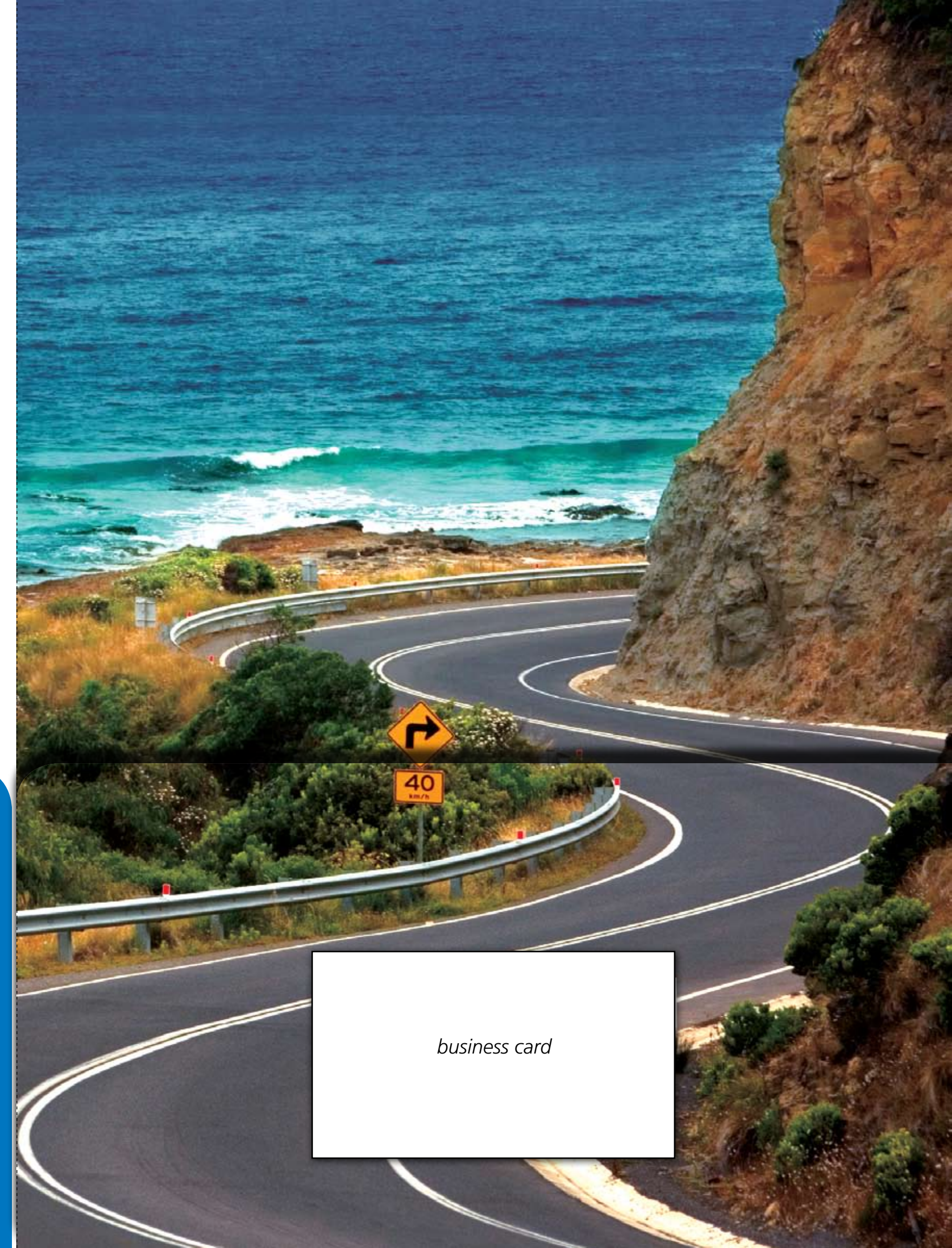
What is SBS?

SBS (polyStyrene-polyButadiene-polyStyrene) polymer is a thermoplastic synthetic rubber granulate characterized by a molecule with a rubbery polybutadiene midblock, either linear or multi-arm, with hard polystyrene end blocks at each tip. Polystyrene and polybutadiene, when mixed together, will not form a single-phase blend. Like water and oil they separate. But as the polystyrene and polybutadiene are chemically attached in SBS, the phase separation can only take place on a micro-scale, without segregation on macro scale. This allows the polystyrene end-blocks to associate with the polystyrene end-blocks of other SBS molecules to form polystyrene domains, linking all molecules together to form a three dimensional elastic network. As the links are physical and not chemical, the network dissociates when heated and reforms upon cooling.

The use of anionic polymerization ensures exact nano-engineered molecular weights of each of the blocks and controlled structures of the molecules. Variations in molecular weight, arm structure and polymerization conditions produce a wide grade range for targeted applications.

In asphalt modification, SBS polymers are able to absorb oily components from the asphalt to as much as 10 times the polymers volume. The volume of the network formed by the linked styrene domains is thereby increased extending throughout the binder.

This gives the asphalt elastic properties over a much wider temperature range, reducing the viscous behavior at high temperature and the brittle behavior at low temperature.



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