Kraton polymers boost functional life of thermoplastic road marking paints

Outline

- Why modify with thermoplastic road marking paints?
- Other requirements from the market
- Kraton polymers introduction
- Improved road marking erosion resistance and retro-reflection performance
- Conclusions

Why modifying thermoplastic road marking paints?

- Typical thermoplastic road marking paint composition:

	Weight %	Material
Binder (15-25%w)	8 - 15	Hydrocarbon Resin
	1 - 5	Plasticiser
	0 - 5	Thermoplastic elastomer
Fillers (75-85%w)	5 - 10	Pigment (e.g. TiO2, ZnO)
	20 - 40	Extender (e.g. CaCO3)
	15 - 20	Glass Beads
	20 - 40	Aggregates

- Binder without elastomer consists mainly of low Mw ingredients, leading to relatively low abrasion resistance
- Addition of Kraton polymers improves the mechanical properties and hence the paint performance life time

Technical needs of RMP-market

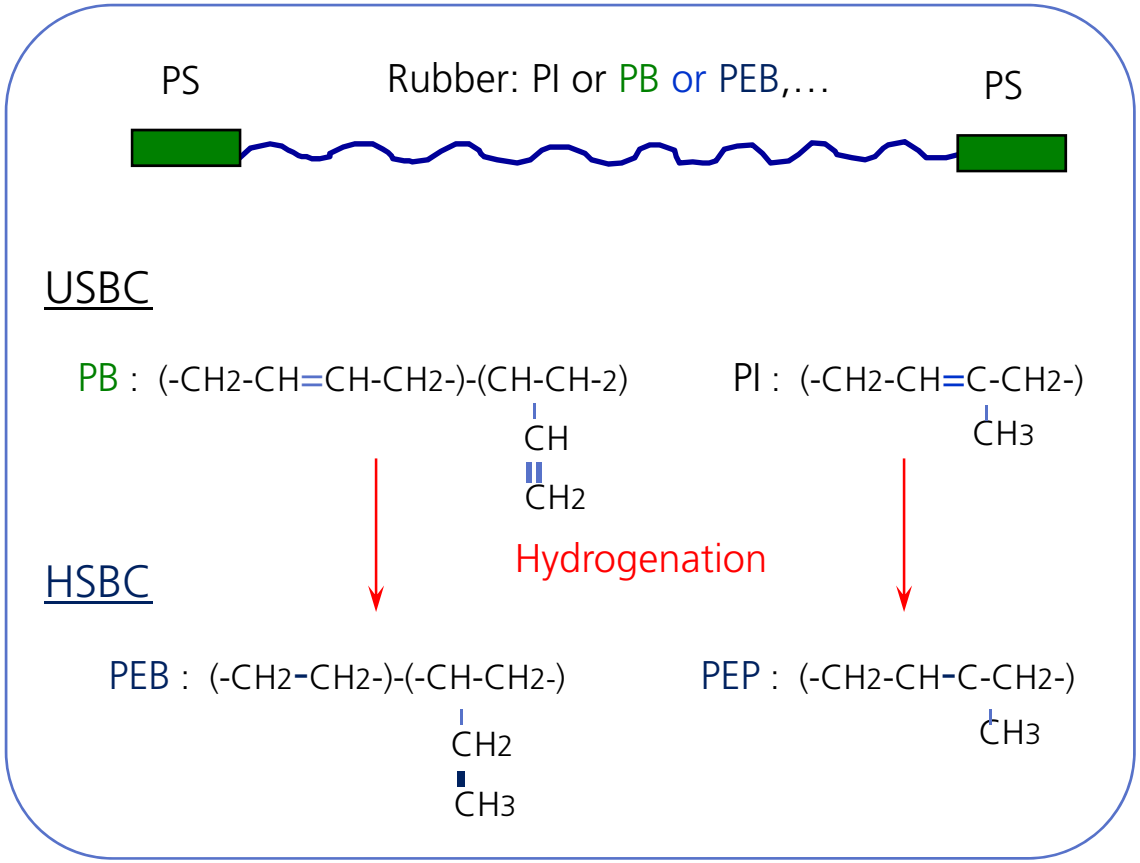
- Sprayability (equipment)
- Elasticity
- Abrasion (Troger, Skid resistance)
- Rheology/viscosity (precipitation glass beads)
- Adhesion (bitumen, old paint, glass beads)
- Whiteness (UV-stability, retro-reflectance)

What are Kraton SBC polymers?

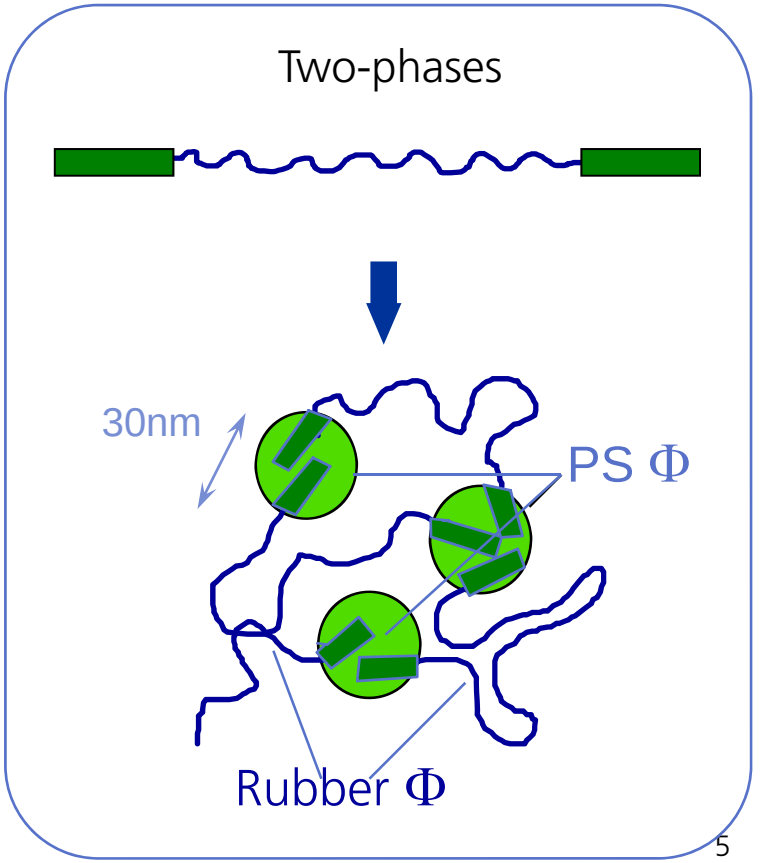
SBC are styrenic block copolymers having rigid blocks (i.e. PS) and soft rubbery block of various possible elastomeric nature. Rigid and soft segments while chemically linked together separate in different nano-scale phases.

Most SBC behave like reinforced cross-linked rubbers at ambient temperature but can be processed and recycled as traditional plastics at higher temperature.

Styrenic Block Copolymer



Thermoplastic Elastomer



Kraton polymers in road marking paint

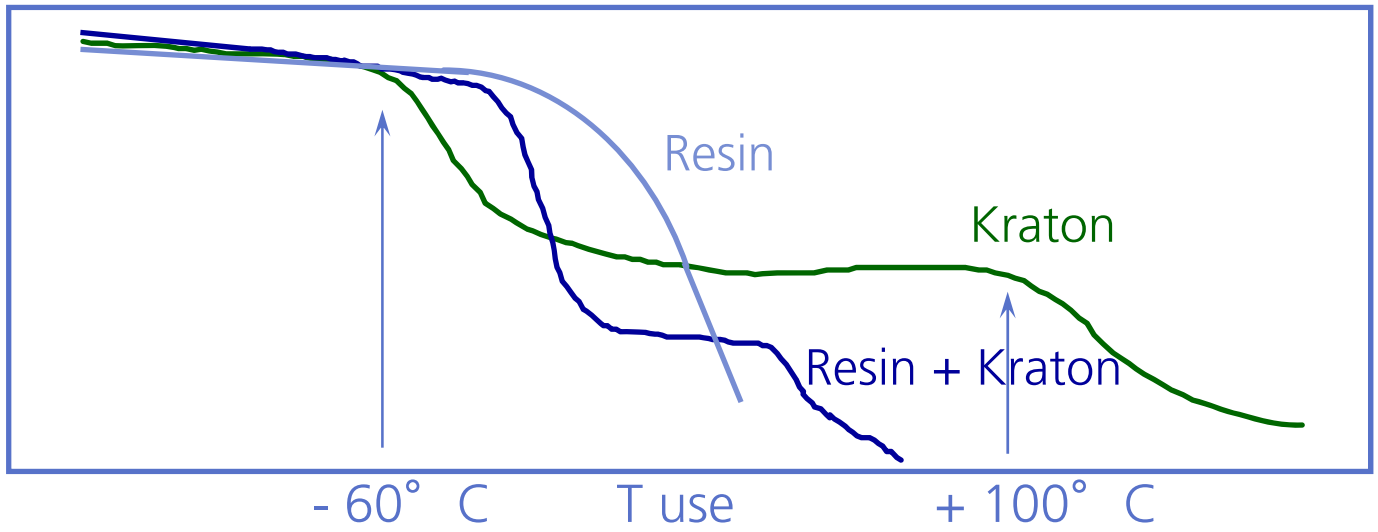
Norm EN 1436

performance	Kraton contribution
retro-reflection	glass bead adhesion rheology modification
colour	no change
skid resistance	flexibility friction
functional life	abrasion resistance

Possible conflict : Abrasion resistance <--> Reflection
Optimal balance attainable with Kraton polymers ?

Kraton benefits

Elastic modulus G'



- Hot melt processable
- High durability
- Elastic above room temperature
- Flexible at low temperatures
- Binder compatibility

Road marking processing

- Kraton polymers are fit for RMP processing techniques:
  - Blended (hot or cold) with all ingredients:
    - Physical form (milled) and nature of Kraton polymer
    - Oil absorption, resin compatibility
  - Molten at 200° C and further homogenised at application area:
    - thermoplastic elastomer character of Kraton polymers
  - Hot melt sprayed or extrusion coated applied:
    - Narrow MWD, controlled molecular parameters, consistent viscosity

HSBC polymers in RMP

- SIS (Kraton D 1161 polymer) is traditionally used to modify thermoplastic road marking paints. HSBC have however interesting features to offer:

Feature :	Result :
• Better phase separation	=> Higher tensile strength more diluted formulations
• Hydrogenation	=> Excellent UV Resistance Good Thermal Stability Good Ozone Resistance Clear Polymers
• Functionalisation	=> Reactive Polar Group Improved Adhesion, Crosslinkable
• Low solubility parameter	=> Better oil absorption

HSBC have higher viscosities than USBC and might be more suitable for extrudable than for sprayable RMP

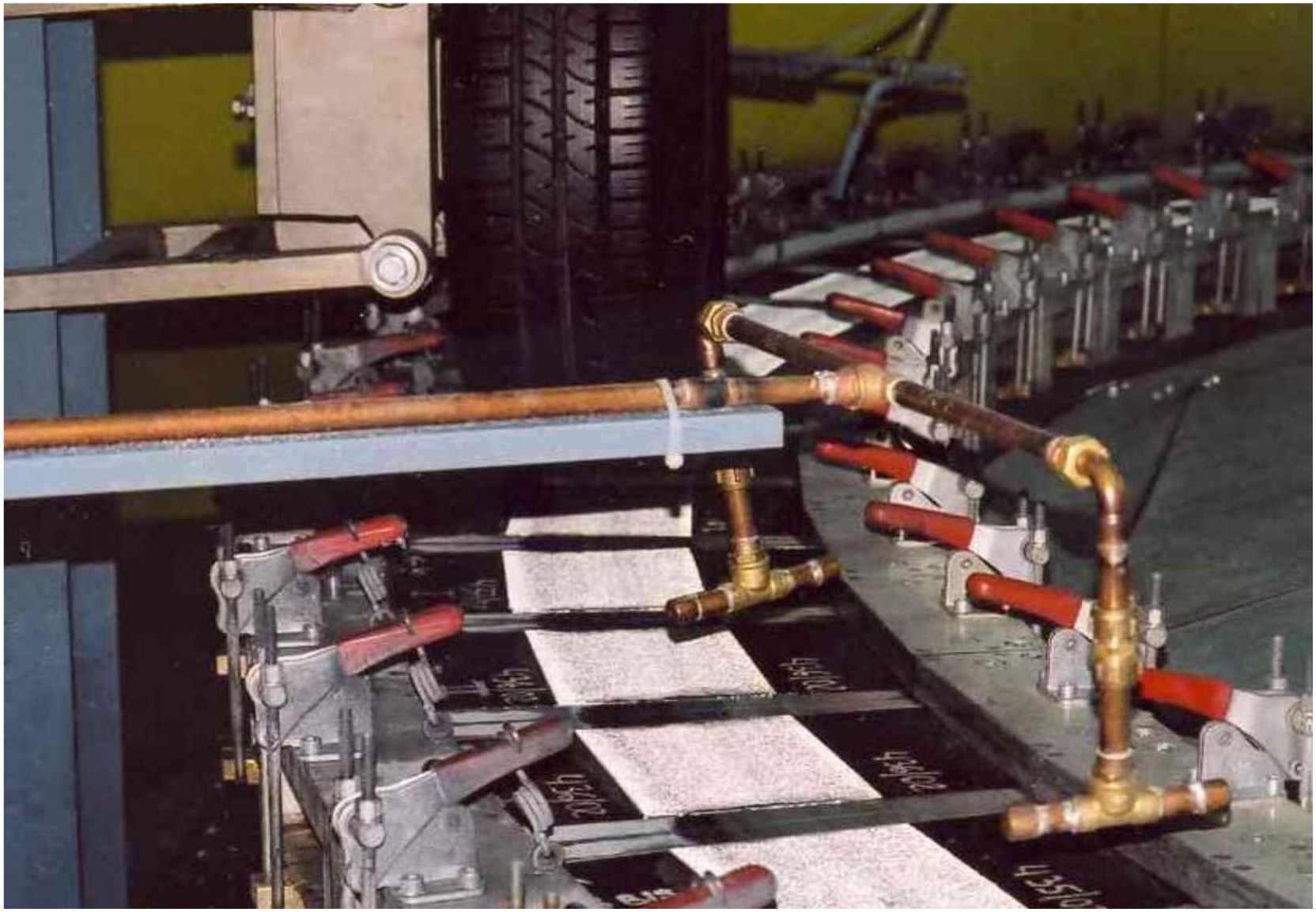
Wear simulator

- 2 Kraton polymers were chosen:
  - SIS polymer: Kraton D 1161 polymer
  - SEBS polymer: Kraton G 1652 polymer

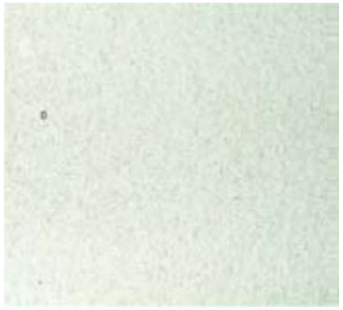
- Paint composition

formulation composition (%)	ref	KD1161	KG1652
C5 resin	15	15	15
oil	2	2	2
rosin resin	1	-	-
PE wax	2	2	2
Kraton polymer		2	2
TiO2	10	10	10
fillers	30	29	29
premix glass bead, 1000-125 µm	40	40	40
g/m² applied paint	3300	3000	3000
drop on beads, g/m², 3F coated, 600-125 µm	300	300	300

AETEC turntable for road markings

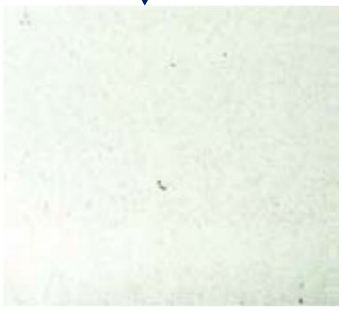


Superior erosion resistance



Reference, initial

1.5 MM wheel passages

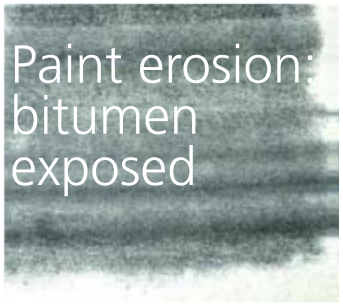


Kraton D 1161, initial

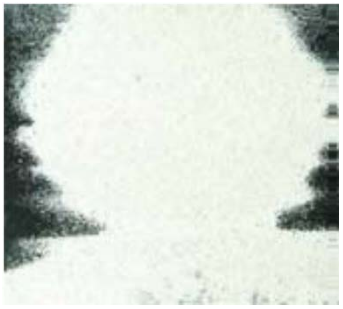
4 MM wheel passages

Kraton G 1652, initial

4 MM wheel passages



Reference

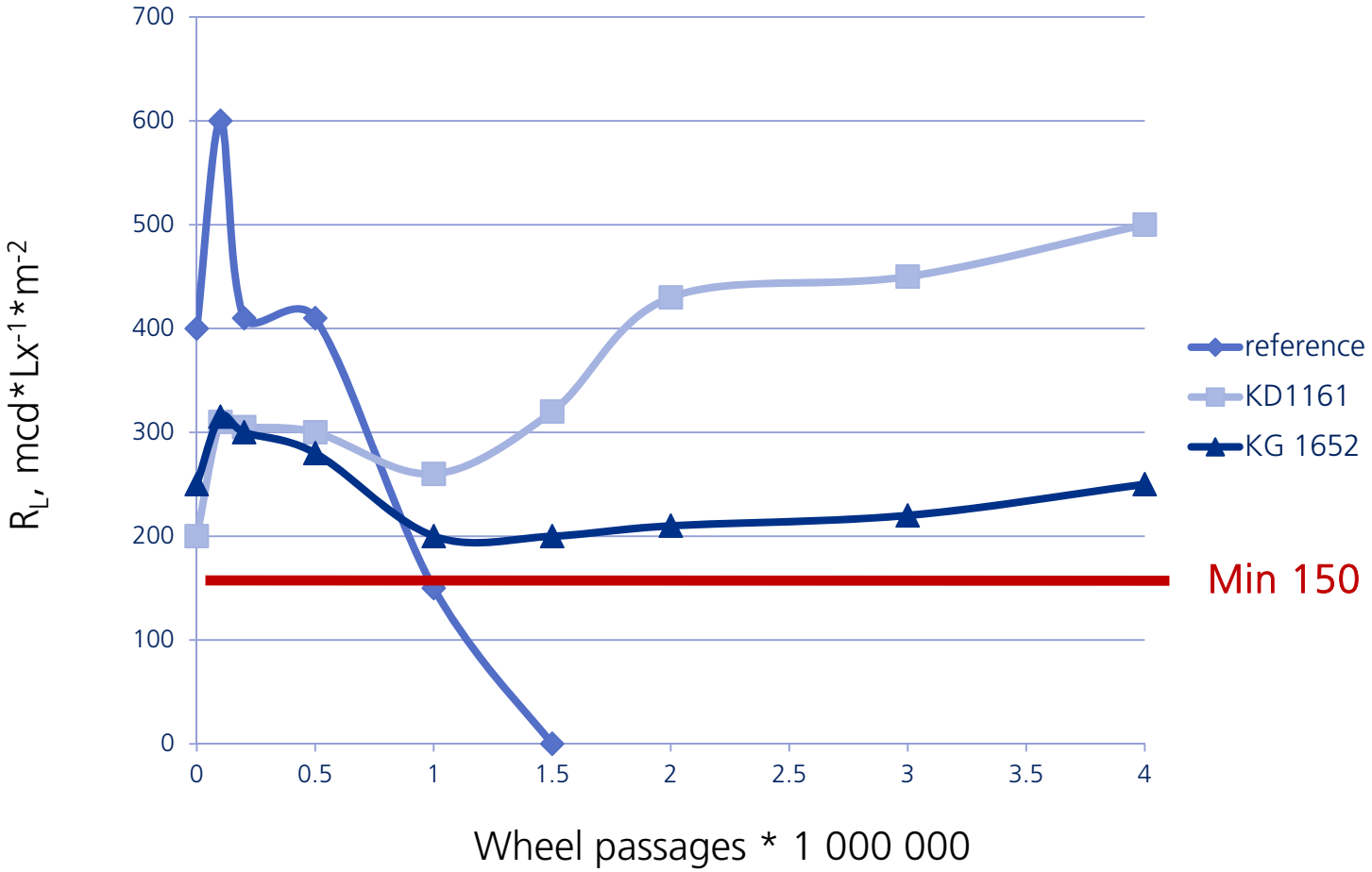


Kraton D 1161

Kraton G 1652

Glass Bead Adhesion

Superior retro-reflection



- Kraton D 1161 exhibits excellent R_L. Because of its SIS nature and polymer structure, it shows an excellent combination of flexibility and cohesion.
- Kraton G 1652 has lower R_L values because of higher cohesion and lower erosion, resulting in dirt pick up.

Conclusions

- Kraton polymers are:
  - hot melt processable thermoplastic elastomers
  - with controlled molecular parameters

- Attributes to hot melt road markings are:
  - flexibility, also at low temperature
  - balanced cohesion / adhesion
  - creep resistance
  - oil retention
  - Improved glass bead retention

Conclusions

- Kraton D 1161 is the polymer of choice for sprayable thermoplastic road marking paints with increased flexiblity and functional life

- Kraton G 1652 is recommended for extrudable thermoplastic road markings with long functional life requirements in low traffic density areas

- Optimal balance of abrasion resistance <-> reflection can be obtained with thermoplastic road marking paints modified with Kraton polymers

Publication Disclaimer:

We believe the information set forth above to be true and accurate, but any findings, recommendations or suggestions that may be made in the foregoing text are without any warranty or guarantee whatsoever, and shall establish no legal duty or responsibility on the part of the authors or any Kraton Polymers entity. Furthermore, nothing set forth above shall be construed as a recommendation to use any product in conflict with any existing patent rights. All Kraton Polymers entities expressly disclaim any and all liability for any damages or injuries arising out of any activities relating in any way to this publication or the information set forth herein.