

*New Hydrogenated Styrenic Block  
Copolymers for Pressure Sensitive  
Adhesives*

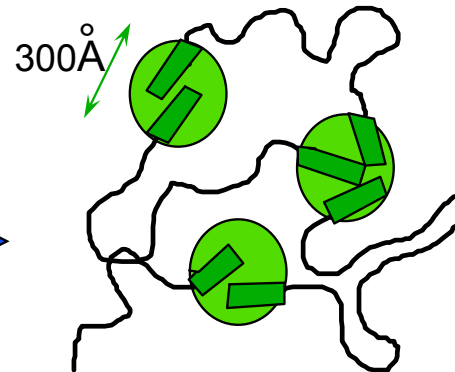
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KRATON Polymers Research S.A.  
Belgium

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# KRATON : Thermoplastic Elastomer

## Two-phase structure

PS and Rubber are incompatible and form a two-phase structure

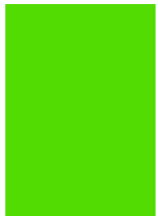


PS  $\Phi$

Rubber  $\Phi$

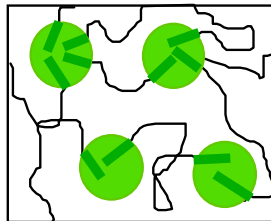
## Temperature induced transitions

Glass



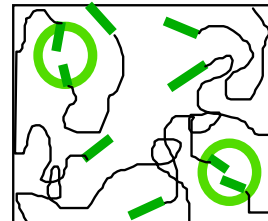
Rubber  
T<sub>g</sub>

Crosslinked reinforced rubber



PS  
T<sub>g</sub>

Viscous liquid



Order-  
disorder  
T

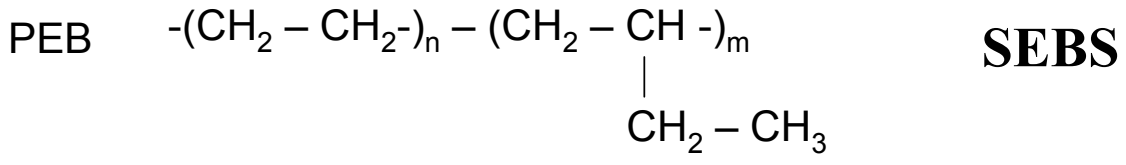
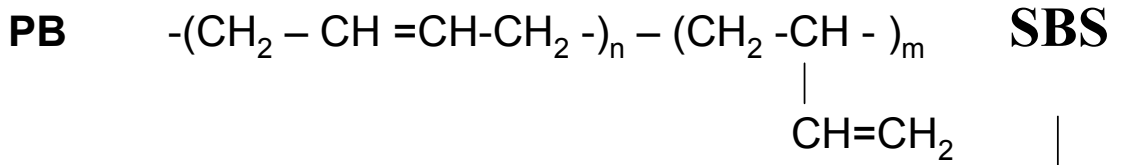
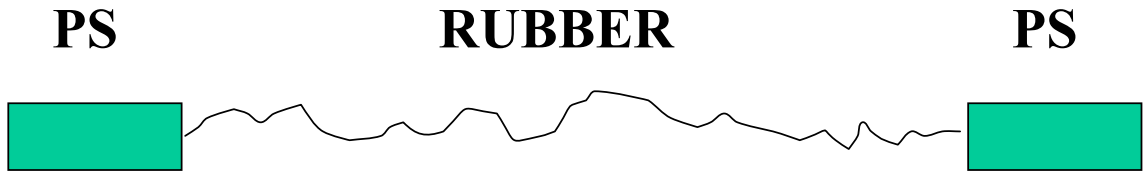
'Homopolymer'



← End-use region →

← Processing region →

# Structure of Hydrogenated Styrenic Block Copolymers



# Features of conventional Kraton G



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## *Hydrogenation of double bonds*

- higher mid-block Tg (-55°C) than SBS (-90°C)
- long term thermal stability and weatherability + UV additives
- lower mid-block solubility parameter ( $\delta = 7.9$ ) than SBS ( $\delta = 8.3$ )  $\rightarrow$  hydrogenated tackifiers, polyolefins, waxes
- enhanced phase separation
  - high cohesion
  - formulation dilution

# Features of new Kraton G



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## *Modifying the EB structure*

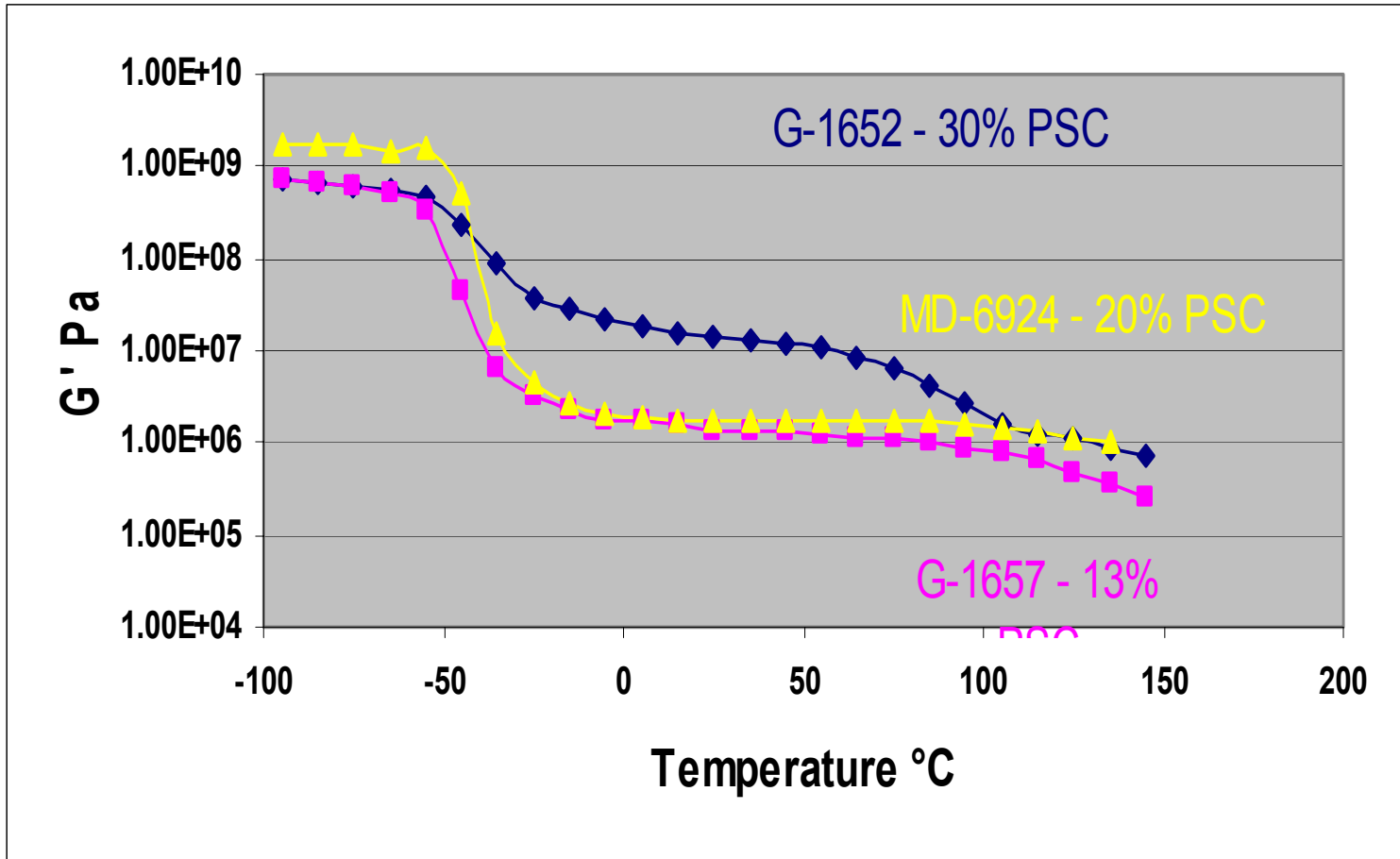
- higher mid-block Tg (-38°C) than SEBS (-55°C)
- higher Me ----→ G' modulus, tack, Hot-melt viscosity
- lower mid-block solubility parameter ( $\delta = 7.8$ ), increased compatibility with PP (clarity) and APAO



# Kraton G Polymer Grades

Polymer	Type	Polystyrene %	Mid-block DMA Tg °C	solution visc, cPs	Melt Flow g/10 min	morphology
<b>MD-6917</b>	SEBS	33	-38	70 at 10%	0	powder
<b>G-1651</b>	SEBS	33	-55	1 800 at 10%	0	powder
<b>MD-6924</b>	SEBS	20	-38	1 300 at 25%	<1 at 230/5	powder
<b>G-1650</b>	SEBS	30	-55	8 000 at 25%	<1 at 230/5	powder
<b>MD-6932</b>	SEBS	20	-35	210 at 25%	80 at 230/5	dense pellets
<b>G-1652</b>	SEBS	30	-55	1 800 at 25%	5 at 230/5	powder
<b>G-1657</b>	(SEB) <sub>2</sub>	13	-55	4 200 at 25%	8 at 200/5	dense pellets

# Example of DMA curves



# Application Domain in function of the Kraton G concentration

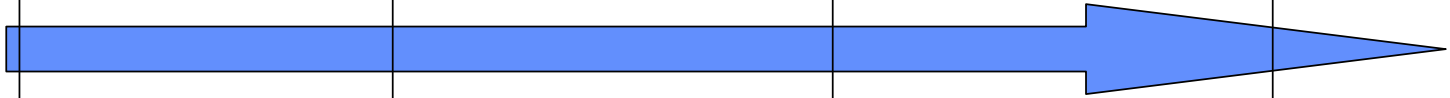


2-15 %

20-25%

30-45%

55-80%



hygiene

Oil gels

Greases

Packaging

Road marking paints

Sealants

Non-wovens

Tapes

Labels

Films

# Compounding, Coating

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- Compounding
    - Z- blade mixing at about 180°C
  - Coating
    - Solvent coating at 22 and 28 g/m<sup>2</sup> on PET
    - Hot-melt coating at 35 g/m<sup>2</sup> on PET
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# Pressure Sensitive Adhesive (PSA) gels with high molecular weight polymers

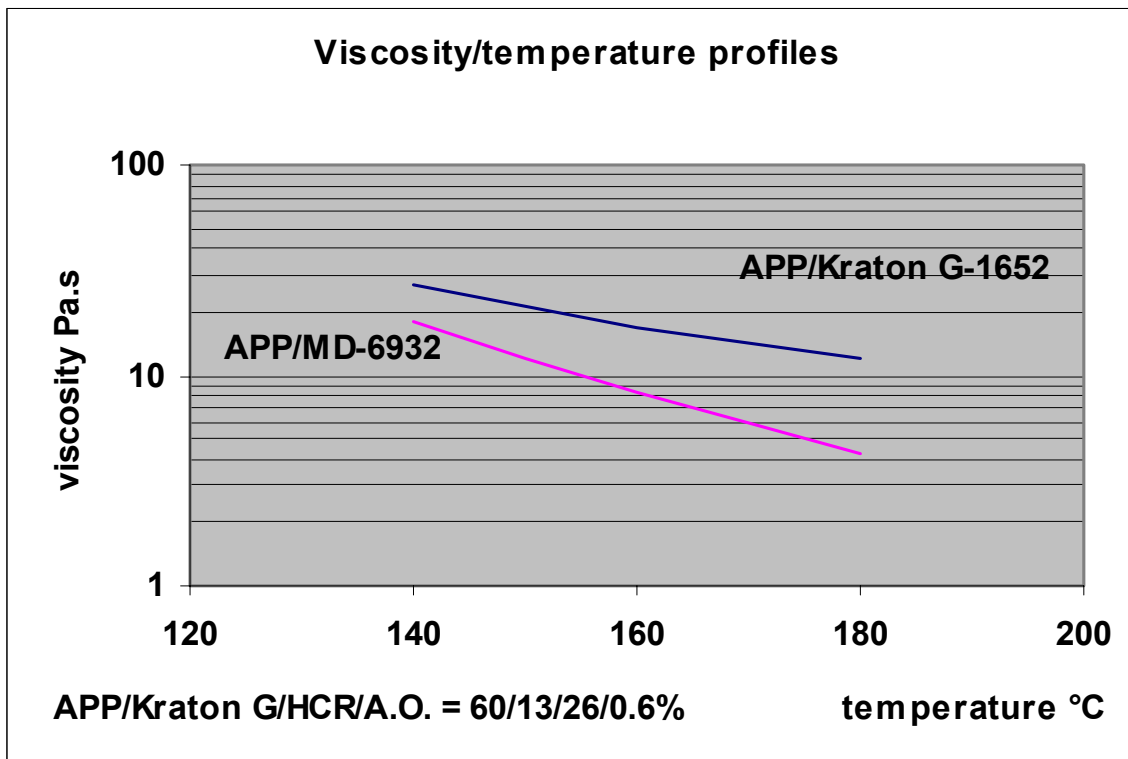


Ingredients	units	F-1	F-2	F-3
Kraton G-1651		12		
Kraton MD-6917			12	10
Hydrocarbon resin	%	55	55	56
White oil		32.7	32.7	33.7
anti-oxidant		0.3	0.3	0.3
HMV 177°C	Pa.s	22.1	4.2	0.7
Loop Tack	N/25 mm	30	28	32
Peel Adhesion	N/25 mm	18	13	18
Shear 1 kg ss	hours	3 A/C failure	400 A/C failure	76 A failure
SAFT Mylar 0.5 kg	°C	51	65	60

# Laminating adhesives

<b>Ingredients</b>	<b>units</b>	<b>F-1</b>	<b>F-2</b>
APP (Eastoflex P-1023)		60	60
Kraton G-1652		13	
MD-6932	%		13
Hydrocarbon Resin		26	26
Antioxidant		0.6	0.6
<b>Properties</b>			
T-Peel PET/PP	N/25 mm	19	14
T-Peel PET/HDPE	N/25 mm	4	16
HMV at 160°C	Pa.s	17	8.3
APP/SEBS		compatible	miscible

# Laminating adhesives— Viscosity /temperature profiles

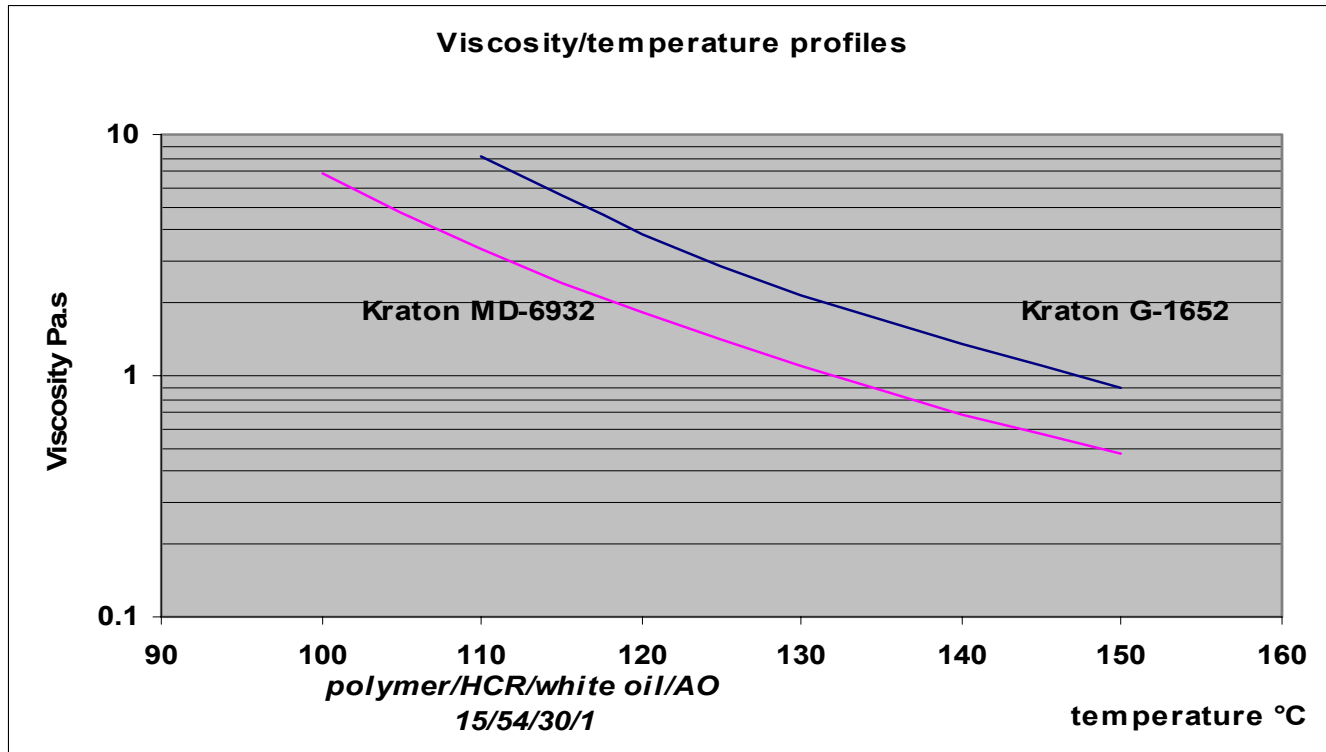


# Packaging Adhesives with Ethylene/Octene copolymers



Ingredients	Units	F-1	F-2	F-3
Kraton MD-6932		10		
Kraton G-1652			10	
Kraton G-1657	%			10
Metallocene E/O			20	
Hydro-Hydrocarbon resin			45	
98°C F-T wax			25	
<b>Properties</b>				
HMV 177°C	Pa.s	0.8	1.1	1.6
PAFT (1x1" - 0.1 kg)	°C	64	63	64
SAFT (1x1" - 0.5 kg)		87	84	87
Fiber Tear on Carton (1/8" HM bead) 1.7°C	%	50	50	50

# Hot-melt viscosity profiles MD-6932 versus Kraton G-1652





## PSA Properties of Formulations based on three different KRATON G grades

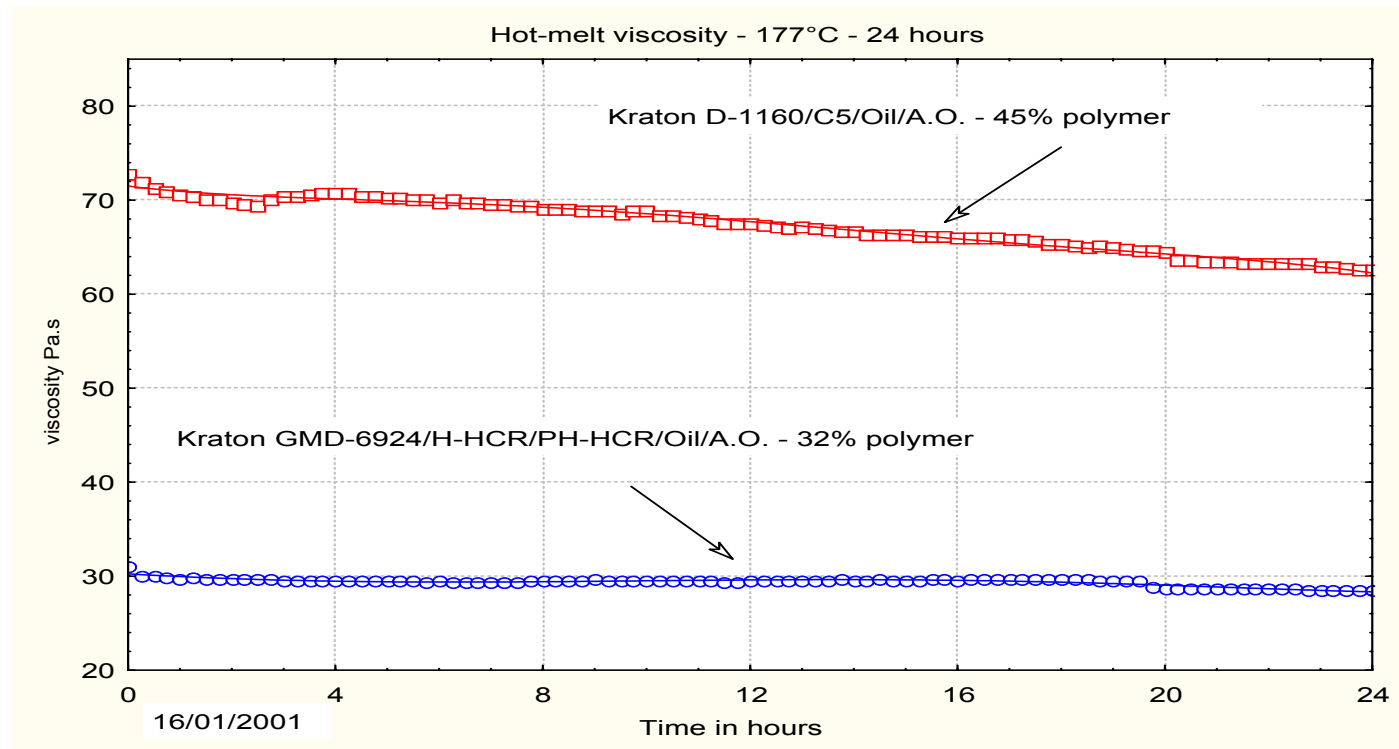
<b>Ingredients - %w</b>	<b>% Polystyrene</b>	<b>F-1</b>	<b>F-2</b>	<b>F-3</b>
Kraton G-1657	13	36		
Kraton MD-6924	21		32	
Kraton G-1650	30			32
H-C9/PH-C9		47	51	
H-C9				51
oil		16	16	16
antioxidant		1	1	1
<b>Properties</b>	<b>units</b>			
RBT	cm	10	>30	10
LT	N/25 mm	6	13	9
PA 180°	N/25 mm	12	18	13
HP ss 2 kg	hours	60 AF	>200	>200
SAFT 0.5 kg	°C	87	112	106
HMV 177 °C	Pa.s	34	30	80

# PSA Properties Comparison between KRATON D and KRATON G formulations



<i>Ingredients - %w</i>	<i>% Polystyrene</i>	<i>F-1</i>	<i>F-2</i>
Kraton D-1160	19	45	
Kraton MD-6924	21		32
C5		49	
H-C9/PH-C9			51
Oil		5	16
Anti-oxidant		1	1
<i>Properties</i>	<i>units</i>		
RBT	cm	>30	>30
LT	N/25 mm	16	13
PA 180°	N/25 mm	19	18
HP ss 2 kg	hours	>140	>200
SAFT 0.5 kg	°C	110	112
HMV 177 °C		73	30
HMV 180 °C	Pa.s	-	-
HMV 190 °C		40	-

# Hot-Melt Viscosity stability between KRATON D and KRATON G formulations



23/02/2005

# Conclusions



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## **Novel Hydrogenated SEBS block copolymers provides to the formulator**

- ✦ low hot-melt viscosity and processing temperatures for the end-user
  - ✦ a good balance of tack , adhesion and cohesion
  - ✦ excellent long term thermal stability
  - ✦ UV stability in combination with UV absorbers
  - ✦ Wide application latitude
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