kuraray

Meeting consumers' needs with Kuraray's elastomers

Septon™ Hybrar™

SEPTON™ and HYBRAR™

Technical Information

Kuraray manufactures styrenic block copolymers under the trademarks of SEPTON™ and HYBRAR™. These styrenic thermoplastic elastomers (TPE) cover a wide range of applications including:

- Compounds: automotive, consumer products and vulcanized rubber replacement
- Polymer modification: impact modifier and compatibilizer
- Adhesives: hot melts
- Flexible PVC substitutes
- Vibration damping products

The Hydrogenated Styrenic Block Copolymers (HSBCs) consist of styrene based hard blocks and a hydrogenated diene soft block. The combination of the blocks means HSBCs exhibit rubber elasticity. The hard block acts as a crosslinking point below the glass transition temperature of polystyrene while the soft block provides elasticity. In addition, hydrogenation provides excellent heat and weather resistance.

Septon™

SEPTON™ – High-Performance TPE

SEPTON™ is a series of styrenic thermoplastic elastomers used in a great number of TPE compounds and can be processed in various forms. These styrenic TPEs cover a broad range of applications including compounds, polymer modification, adhesives, flexible PVC substitutes and vibration damping products. Specific grades are certified and used in consumer goods, medical, mobility and oil modification applications.

SEPTON™ BIO-series – Bio-based TPE

With SEPTON™ BIO-series, Kuraray offers a unique Hydrogenated Styrene Farnesene Block Copolymer (HSFC) – making us the market's only bio-based HSBC manufacturer. As one of the leading suppliers of TPEs, we are responding to increasing industry demand for more sustainable materials that can significantly improve the environmental footprint.

SEPTON™ Specialty Grades

Using its proprietary polymer synthesis and modification technologies, Kuraray has developed several unique grades of SEPTON™. Those series cover a broad range or product properties including being super soft and having superior heat resistance.

SEPTON™ Q-series is a range of thermoplastic elastomers that combines softness and elasticity.

SEPTON™ V-series is a block copolymer with reactive and cross-linkable hard and soft block.

SEPTON™ J-series is Kuraray's specialty product for high performance gels.

Hybrar™

HYBRAR™ is a truly unique block copolymer consisting of polystyrene end blocks and a vinyl bond rich poly-diene mid-block. Due to its peak tan delta over a broad temperature range, HYBRAR™ exhibits high vibration damping and shock absorption properties.

Unlike PVC and other SBCs, products manufactured using HYBRAR™ do not need a plasticizer. The highly elastic styrenic block copolymer HYBRAR™ can be processed in a wide variety of forms, including films, tubes, foams, and injection molding.

HYBRAR™ products are available as hydrogenated and non-hydrogenated grades. Hydrogenated grades of HYBRAR™ have excellent compatibility with polypropylene resulting in excellent transparency and clarity when blended.

SEPTON™ and HYBRAR™ adding value in our daily life

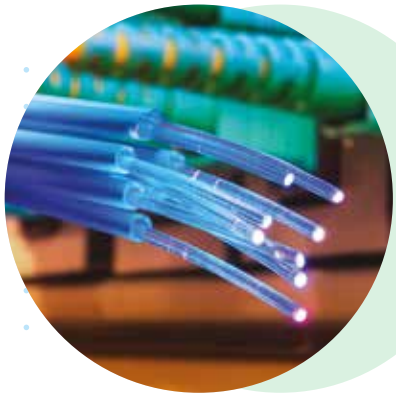
Mobility

Medical

Consumer goods

Oil modification

Personal care



Electronics

What is SEPTON™ BIO-series?

SEPTON™ BIO-series is a unique hydrogenated styrene farnesene block copolymer (HSFC). Derived from sugarcane, this bio-based TPE is a more sustainable alternative to conventional HSBCs.

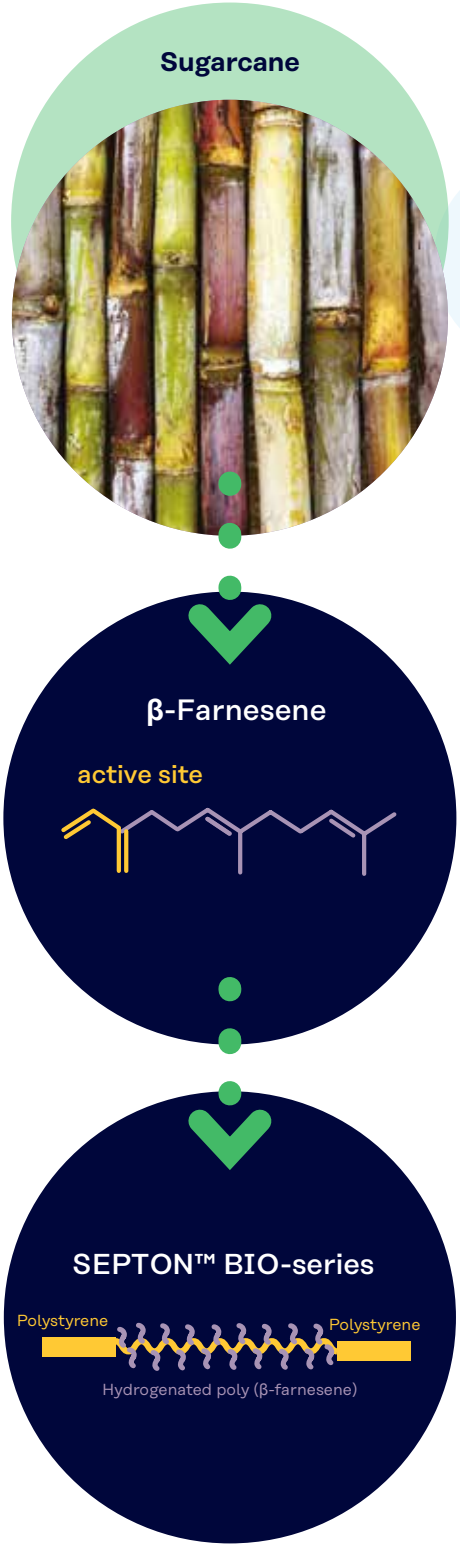
Features and benefits

- Bio-based polymer with up to 80% bio content
- Lower greenhouse gas emissions than conventional HSBC's
- Excellent wet and dry grip performance
- Strong and stable adhesion force across a wide temperature range
- Good processability
- Good damping properties over a wide temperature range
- Low compression set, low permanent set
- Soft without plasticizer
- Enables adhesive applications with excellent removability and no residue

Applications*

- Adhesives, coatings, sealants
- Compounding
- Consumer goods
- Electronics
- Industrial & construction
- Mobility
- Sporting goods & footwear
- 3D printing

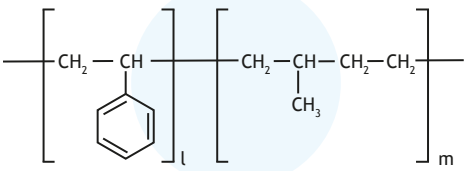
*For certain applications, SEPTON™ BIO-series cannot be introduced due to raw material supply relations. Please contact our sales representatives.



SEPTON™

SEPTON™ 1000-series (SEP)

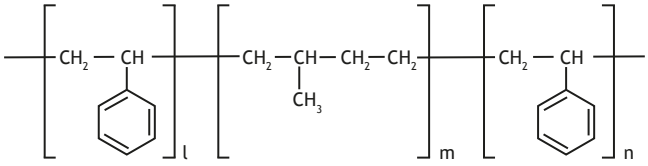
Grade	Styrene content	MFR		Solution viscosity (Toluene solution 30°C)			Physical form	Hardness type A
	wt%	230°C, 2.16 kg (g/10 min)	200°C, 10 kg (g/10 min)	5wt% (mPa·s)	10wt% (mPa·s)	15wt% (mPa·s)		
1020	36	-	1.8	-	40	-	Crumbs	70



Excellent clarity and good flow ability due to its SEP structure. Main areas of applications are adhesives, clear sealants, automotive products, cable/wire insulation, viscosity modifier for lubricant additives, cosmetics, oil and gas, and thixotropic gels and impact modifier for unsaturated polyester. SEPTON™ 1000-series can also be applied as a impact modifier for unsaturated polyester.

SEPTON™ 2000-series (SEPS)

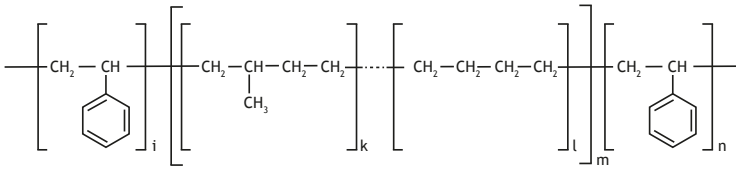
Grade	Styrene content	MFR		Solution viscosity (Toluene solution 30°C)			Physical form	Hardness type A
	wt%	230°C, 2.16 kg (g/10 min)	200°C, 10 kg (g/10 min)	5wt% (mPa·s)	10wt% (mPa·s)	15wt% (mPa·s)		
2002	30	70	100	-	-	25	Pellet	80
2004F	18	5	-	-	-	-	Pellet	67
2005	20	No flow	No flow	40	1700	-	Crumbs	-
2006	35	No flow	No flow	27	1220	-	Crumbs	-
2063	13	7	18	-	29	140	Pellet	36
2104	65	0.4	22	-	-	22	Pellet	98



The SEPS structure generates high elongation properties as well as enhanced low temperature properties without crystallization. With its broad range of hardnesses, it is used in various applications like personal care, medical, automotive, impact modification, film and adhesives.

SEPTON™ 4000-series (SEEPS)

Grade	Styrene content	MFR		Solution viscosity (Toluene solution 30°C)			Physical form	Hardness type A
	wt%	230°C, 2.16 kg (g/10 min)	200°C, 10 kg (g/10 min)	5wt% (mPa·s)	10wt% (mPa·s)	15wt% (mPa·s)		
4033	30	<0.1	<0.1	-	50	390	Crumbs	76
4044	32	No flow	No flow	22	460	-	Crumbs	-
4055	30	No flow	No flow	90	5800	-	Crumbs	-
4077	30	No flow	No flow	300	-	-	Crumbs	-
4099	30	No flow	No flow	670	-	-	Crumbs	-

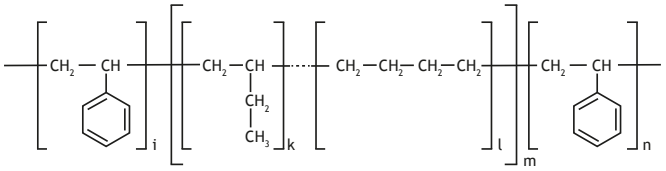


Random copolymer block

Unique SEPTON™ 4000-series shows high tensile strength, moderate elongation with exceptional oil absorbancy with low gels and defects. Kuraray produces SEPTON™ 4000-series with a range of molecular weights and high quality. It is used in several applications like gels and films, automotive, soft touch compounds, PVC replacement and many more.

SEPTON™ 8000-series (SEBS)

Grade	Styrene content	MFR		Solution viscosity (Toluene solution 30°C)			Physical form	Hardness type A
	wt%	230°C, 2.16 kg (g/10 min)	200°C, 10 kg (g/10 min)	5wt% (mPa·s)	10wt% (mPa·s)	15wt% (mPa·s)		
8004	31	<0.1	<0.1	-	40	-	Crumbs	80
8006	33	No flow	No flow	42	-	-	Crumbs	-
8851	33	No flow	No flow	42	-	-	Crumbs	-

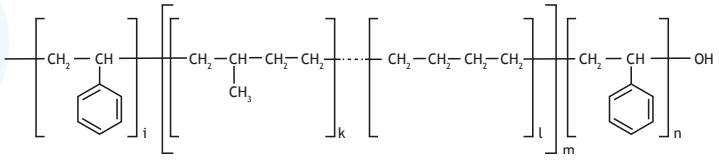


Random copolymer block

With its popular mid-block structure as an industry standard material, SEPTON™ 8000-series is an excellent choice, and Kuraray's customers use SEPTON™ 8000-series in adhesives, automotive, and personal care products.

SEPTON™ OH-terminated (SEEPS-OH)

Grade	Styrene content	MFR		Solution viscosity (Toluene solution 30°C)			Physical form	Hardness type A
	wt%	230°C, 2.16 kg (g/10 min)	200°C, 10 kg (g/10 min)	5wt% (mPa·s)	10wt% (mPa·s)	15wt% (mPa·s)		
HG-252	28	26	-	-	-	70	Pellet	80



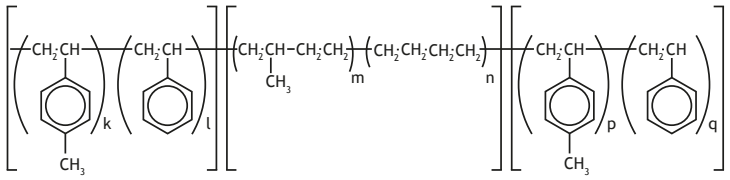
Random copolymer block

The functional group has an end-polymer chain, allowing for the reaction to be controlled. SEPTON™ HG-252 is a hydroxyl terminated styrenic block copolymer used as modifier for polar resins and compatibilizer for polar/ non-polar resins.

SEPTON™ V-series

Grade	Type	Hard Block Content	MFR		Solution viscosity (Toluene solution 30°C)			Physical form	Hardness type A
		wt%	230°C, 2.16 kg (g/10 min)	200°C, 10 kg (g/10 min)	5wt% (mPa·s)	10wt% (mPa·s)	15wt% (mPa·s)		
V9461	S*EEPS*	30	No flow	No flow	90	-	-	Crumbs	-
V9475	S*EEPS*	30	No flow	No flow	190	-	-	Crumbs	-

S*: Poly (p-methylstyrene/styrene) hard block

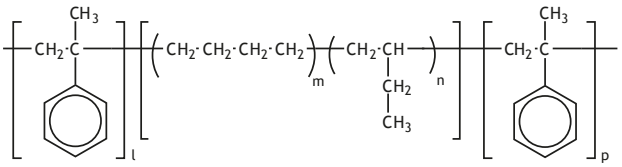


SEPTON™ V-series is a block copolymer that has reactive and cross-linkable hard and soft block. Crosslinked SEPTON™ V-series exhibit excellent heat resistance, long term compression set and oil resistance while keeping its rubber-like properties and good low temperature properties.

SEPTON™ Q-series

Grade	Type	Hard block content	MFR		Solution viscosity (Toluene solution 30°C)			Physical form	Hardness type A
		(wt%)	230°C, 2.16 kg (g/10 min)	200°C, 10 kg (g/10 min)	5wt% (mPa·s)	10wt% (mPa·s)	15wt% (mPa·s)		
Q1250	S*EBS*	29	5.6	-	-	15	-	Pellet	74

S*: Poly (α-methylstyrene) hard block



SEPTON™ Q-series is a range of thermoplastic elastomers that combines softness and elasticity. Compounds with SEPTON™ Q-series as the base polymer have very good mechanical properties and are lighter than conventional TPEs.

SEPTON™ J-series

Grade	Type	Styrene content	MFR		Solution viscosity (Toluene solution 30°C)			Physical form	Hardness type A
		(wt%)	230°C, 2.16 kg (g/10 min)	200°C, 10 kg (g/10 min)	5wt% (mPa·s)	10wt% (mPa·s)	15wt% (mPa·s)		
J3341	Radial	40	No flow	No flow	25	-	-	Crumbs	-

SEPTON J-series is used for high performance gels. Its excellent shock absorbing and damping properties combined with its non-allergenic qualities meet highest industry standards.

SEPTON™ BIO-series

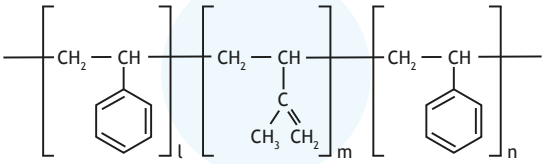
Grade	Styrene content	MFR		Solution viscosity (Toluene solution 30°C)			Physical form	Hardness type A
	wt%	230°C, 2.16 kg (g/10 min)	230°C, 10 kg (g/10 min)	5wt% (mPa·s)	10wt% (mPa·s)	15wt% (mPa·s)		
SF902	18	-	55	-	11	20	Pellet	8
SF904	21	48	>700	-	-	32	Pellet	25

SEPTON™ BIO-series enables new solutions with high bio-based content to meet the emerging demand for more sustainable materials. Main applications are TPE compounds, adhesives, consumer goods, mobility and sport goods & footwear.

HYBRAR™

HYBRAR™ 5000-series (non-hydrogenated)

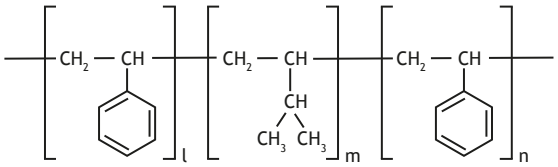
Grade	Type	Styrene content	T_g	MFR		Solution viscosity (Toluene solution 30°C)			Physical form	Hardness type A
		wt%	°C	190°C, 2.16 kg (g/10 min)	230°C, 2.16 kg (g/10 min)	15wt% (mPa·s)	20wt% (mPa·s)	30wt% (mPa·s)		
5125	Vinyl-bond rich SIS	20	-13	3	-	-	100	650	Pellet	60
5127	Vinyl-bond rich SIS	20	8	3	-	-	85	540	Pellet	84

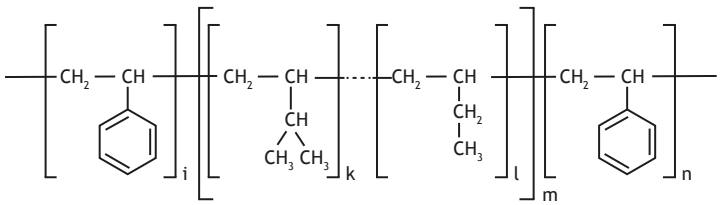


Its damping properties make HYBRAR™ is the product of choice for sports equipment and foamable sound damping sealants. Other applications include adhesives, coatings, sealants, hearing protection, automotive, and housing and construction components.

HYBRAR™ 7000-series (hydrogenated)

Grade	Type	Styrene content	T_g	MFR		Solution viscosity (Toluene solution 30°C)			Physical form	Hardness type A
		wt%	°C	190°C, 2.16 kg (g/10 min)	230°C, 2.16 kg (g/10 min)	15wt% (mPa·s)	20wt% (mPa·s)	30wt% (mPa·s)		
7125F	Vinyl-bond rich SEPS	20	-15	0.7	4	-	60	350	Pellet	64
7311F	Vinyl-bond rich SEEPS	12	-32	0.5	2	95	240	-	Pellet	41

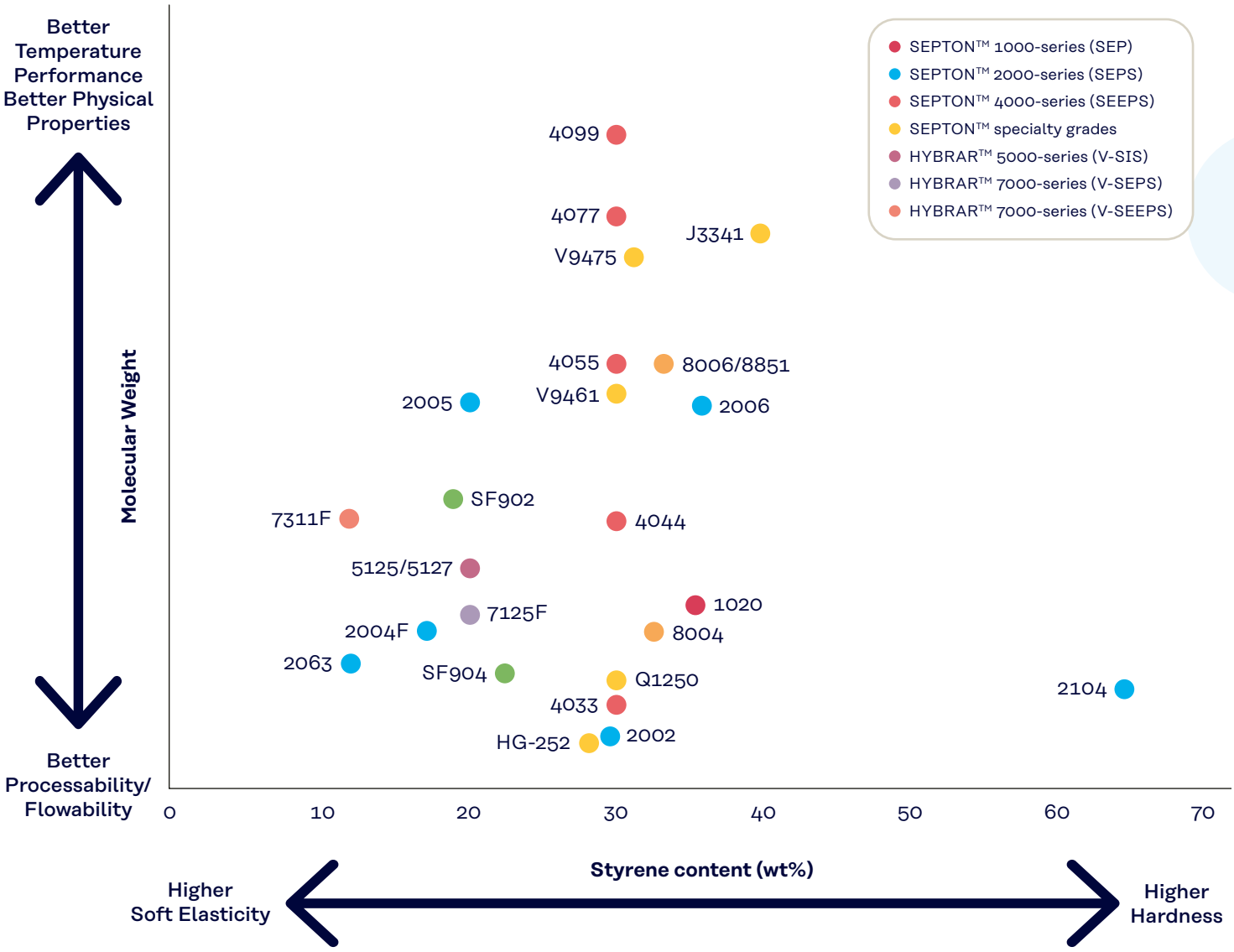




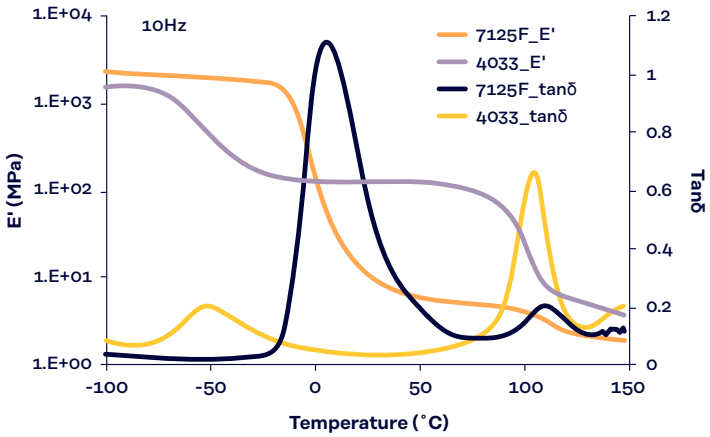
Random copolymer block

Hydrogenated grades show an execllent miscibility with polypropylene. When blended, this results in exceptional transparency and clarity. Medical film and tubing film manufactured using HYBRAR™ is a more environmentally friendly alternative to flexible PVC due to the absence of harmful plasticizers.

SEPTON™ and HYBRAR™ grade map



Dynamic viscoelastic behavior



Solubility data for SEPTON™ and HYBRAR™

Soluble	Partially soluble	Insoluble
▪ Petroleum benzine ▪ Toluene ▪ Hexane ▪ Cyclohexane ▪ Chloroform ▪ Tetrahydrofuran	▪ Ethyl acetate ▪ Methyl ethyl ketone	▪ Methanol ▪ Ethanol ▪ Acetone ▪ Water ▪ Dimethyl formamide

Application

1) Compounds

Effect of PP content						
	Unit	1	2	3	4	5
SEPTON™ 4055	PHR	100	100	100	100	100
Paraffin oil (viscosity 382 mm²/s at 40°C)	PHR	100	100	100	100	100
Homo PP (MFR=10)	PHR	0	20	40	80	100
Antioxidant	Wt%	0.1	0.1	0.1	0.1	0.1
Hardness (Type A)		21	50	72	89	92
Tensile Properties						
100% Modulus	MPa	0.3	0.9	2.1	4	5.1
300% Modulus	MPa	0.4	1.5	2.8	5	6.1
Tensile Strength	MPa	8.4	8.7	15	20	20
Elongation	%	1030	900	870	840	800
Tension Set (100% × 10 min)	%	6	9	12	19	25
Compression Set (70°C × 22 h)	%	–	25	35	47	no data
MFR (230°C, 2.16 kg)	g/10 min	No flow	0.02	0.16	5.2	7.8

Effect of Oil content						
	Unit	1	2	3	4	5
SEPTON™ 4055	PHR	100	100	100	100	100
Homo PP (MFR=11)	PHR	50	50	50	50	50
Paraffin oil viscosity 96 mm²/s at 40°C	PHR	0	60	90	150	180
Hardness (Type A)		94	77	69	54	48
100% modulus	MPa	6.7	3.9	2.7	1.1	0.8
300% modulus	MPa	8.8	5.2	3.7	1.7	1.5
Tensile strength	MPa	36.3	22.5	16.7	9.8	9.3
Elongation	%	740	780	800	910	990

2) SEPTON™ 4000-series for improved performance at high temperatures

		SEPTON™		
		4055	4077	4099
Hardness (Type A)		70	70	70
100% modulus	MPa	1.9	1.8	1.9
Tensile strength	MPa	12.8	13.5	12.2
Elongation	%	820	860	800
Compression set (70˚C)	%	38	36	36
(100˚C)	%	50	44	41
(120˚C)	%	55	50	45
MFR (230˚C, 5 kg)	g/10 min	29	28	16

Formulation: SEPTON™/Paraffin oil/Homo-PP=100/120/45

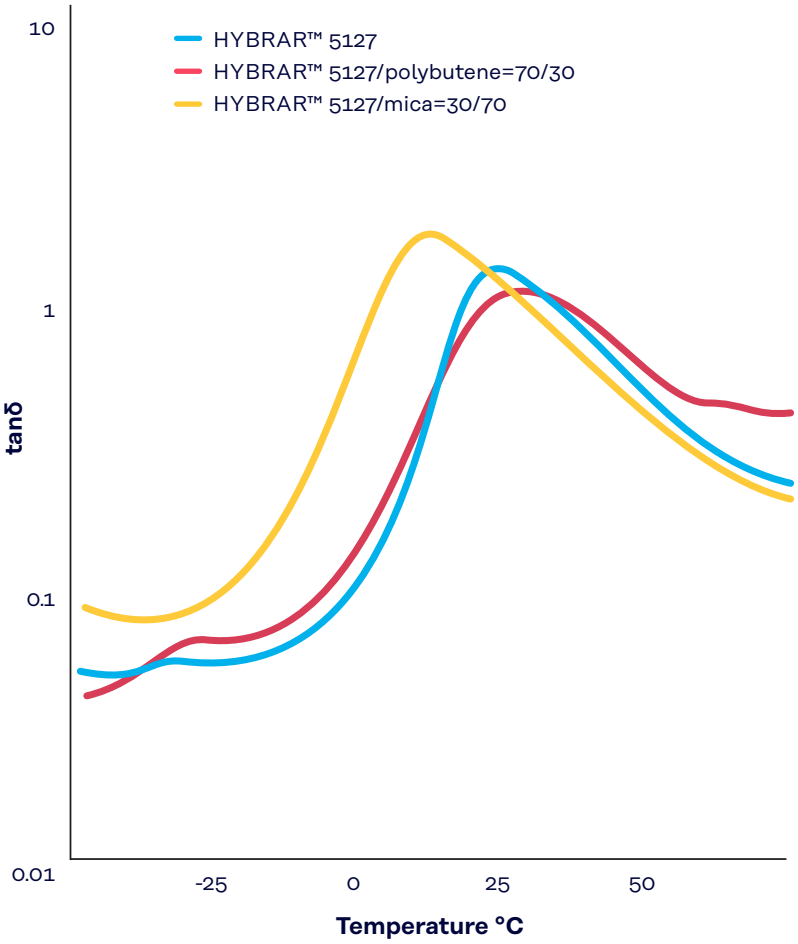
3) SEPTON™ and HYBRAR™ compounds for improved damping performance

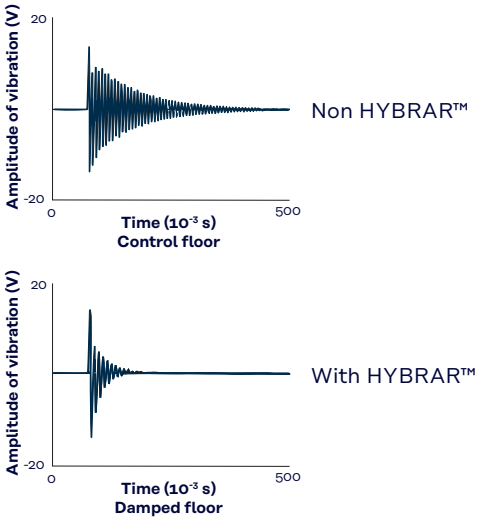
	Unit	1	2
SEPTON™ 4055	PHR	100	100
HYBRAR™ 5127	PHR		100
Paraffin oil	PHR	180	100
Polypropylene	PHR	50	40
Rebound resilience	%	40	17
Hardness (Type A)		48	51
Tensile Modulus	MPa	0.8	1
Tensile Strength	MPa	9.3	10.3
Elongation	%	>500	>500
Compression Set			
25°C,22 h	%		15
70°C,22 h	%	41	
MFR (230°C, 2.16kg)	g/10 min	5	17

4) HYBRAR™ - Polystyrene blends for damping performance

		1	2
HYBRAR™ 5127			20
Polystyrene		100	80
Damping Properties			
Tanδ Loss Factor	0°C	0.033	0.049
	25°C	0.035	0.115
	40°C	0.037	0.094
Loss Factor (Degree of Damping)		0.016	0.068
Hardness (Type D)		83	74
Tensile Modulus	MPa	2600	1900
Tensile Strength	MPa	49	43
Elongation	%	13	17
Flexural Modulus	MPa	2600	1700
Flexural Strength	MPa	74	23

HYBRAR™ Based Filler Compounds





Formulation		Damping Properties		Mechnical Properties	
HYBRAR™ 5127	70	Tanδ at 0 °C	0.54	Tensile Strength (MPa)	3.6
Polybutene	30	25°C	0.73	Elongation (%)	90
EVA	20	40°C	0.51	Hardness (Type A)	89
Mica	150			Specific Gravity	1.83
Light Calcium Carbonate	150				
Calcium Stearate	4				
Carbon Black (GPF)	4				

Test specimen:
Control floor – two layer plywood (thickness = 2.4 mm & 5.3 mm)
Damped floor – three layer plywood (thickness = 2.4 mm & 0.5 mm (Damping compound) & 5.3 mm)

Test Method:
Damped Oscillation Curve was measured by the resonance method with a cantilever beam at 26°C

5) Adhesives

	Unit	1	2	3
SEPTON™ 2063	PHR	100	100	100
Aliphatic Saturated Hydrocarbon Resin (Tackifier)	PHR	100	150	200
Paraffin oil	PHR	50	50	50
Antioxidant	wt%	0.1	0.1	0.1
Tack Rolling Back Tack Test (25°C) *JIS Z0237 as reference: Higher No. => Higher Tack Properties	Ball No.	12	7	<2
Cohesion Creep Test: Holding Power *Sample Size 25 mm*25 mm, Load 1 kg at 40°C	min.	99	51	22
Adhesion 180° Peel Test: To Stainless Steel *Rate of peel 300 mm/min at 25°C	N/25 mm	10	17	29
Melt Viscosity				
160 °C	mPa·s	44200	21700	13400
180 °C *Brookfield Viscometer	mPa·s	16600	10400	6450
Softening Point	°C	118	109	100

Tested by Kuraray Co., Ltd.

Process Oil: Viscosity 95.5 mm²/s at 40°C
Coating Thickness: 30 µm (to 50 µm PET film)

6) SEPTON™ and HYBRAR™ for PP film improvement

Layer	Random PP	HYBRAR™/Random PP	POE/LLDPE	SEPTON™/LLDPE
A Seal or Inner Layer	80% random PP 10 µm	Random PP 20% HYBRAR™ 7311F 10 µm	LLDPE 10 µm	LLDPE 10 µm
B Core Layer	Random PP 40 µm	Random PP 20% HYBRAR™ 7311F 40 µm	80% LLDPE 20% POE 40 µm	90% LLDPE 10% SEPTON™ 2004F 40 µm
C Core Layer	Random PP 10 µm	Random PP 10 µm	LLDPE 10 µm	LLDPE 10 µm
Modulus (MPa)	490	140 (-70%)	N.D.	N.D.
Impact Strength	30 J/m at -20°C	320 J/m (+960%) at -20°C	507 g (Dart) at 21°C	780 g (+50%) (Dart) at 21°C
Heat-Seal Strength (N/25 mm)	1.5 (120°C) 2.1 (125°C) 7.7 (130°C)	6.7 (+350%) (120°C) 16.4 (+680%) (125°C) 17 (+120%) (130°C)	N.D.	N.D.

Tested by Kuraray Co., Ltd.

Impact Strength: Random PP and HYBRAR™/Random PP were measured by notched Izod impact test. POE/LLDPE and SEPTON™/LLDPE were measured by drop dart test at 21°C.

Adding value to your products—worldwide

Kuraray is a world leader in specialty chemicals and functional materials. We are committed to developing products that ensure quality and value while helping our customers differentiate themselves from their competition.

Kuraray's Elastomer Division started in 1972 with the production of polyisoprene rubber and the development of new rubber materials based on Isoprene in the Kashima Plant. From the first production line, the Elastomer Division continuously grew and invented new products such as SEPTON™, HYBRAR™, KURARAY LIQUID RUBBER, and ISOBAM™.

Kuraray strives to develop new and innovative high-performance products for customers around the globe. Learn more about Kuraray's Elastomer products, visit **elastomer.kuraray.com**.

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