

# KURARITY™ / HSBC formulation for overmolding applications

KURARITY business promotion dept.  
Elastomer Division

***kuraray***

# Advantages of KURARITY™ as modifier for overmolding HSBC based compounds



KURARITY™ as “MAM” structure  
-> Made by controlled living anionic polymerization

## Features of “MAM”

High polarity

High Flow-ability

Excellent weatherability

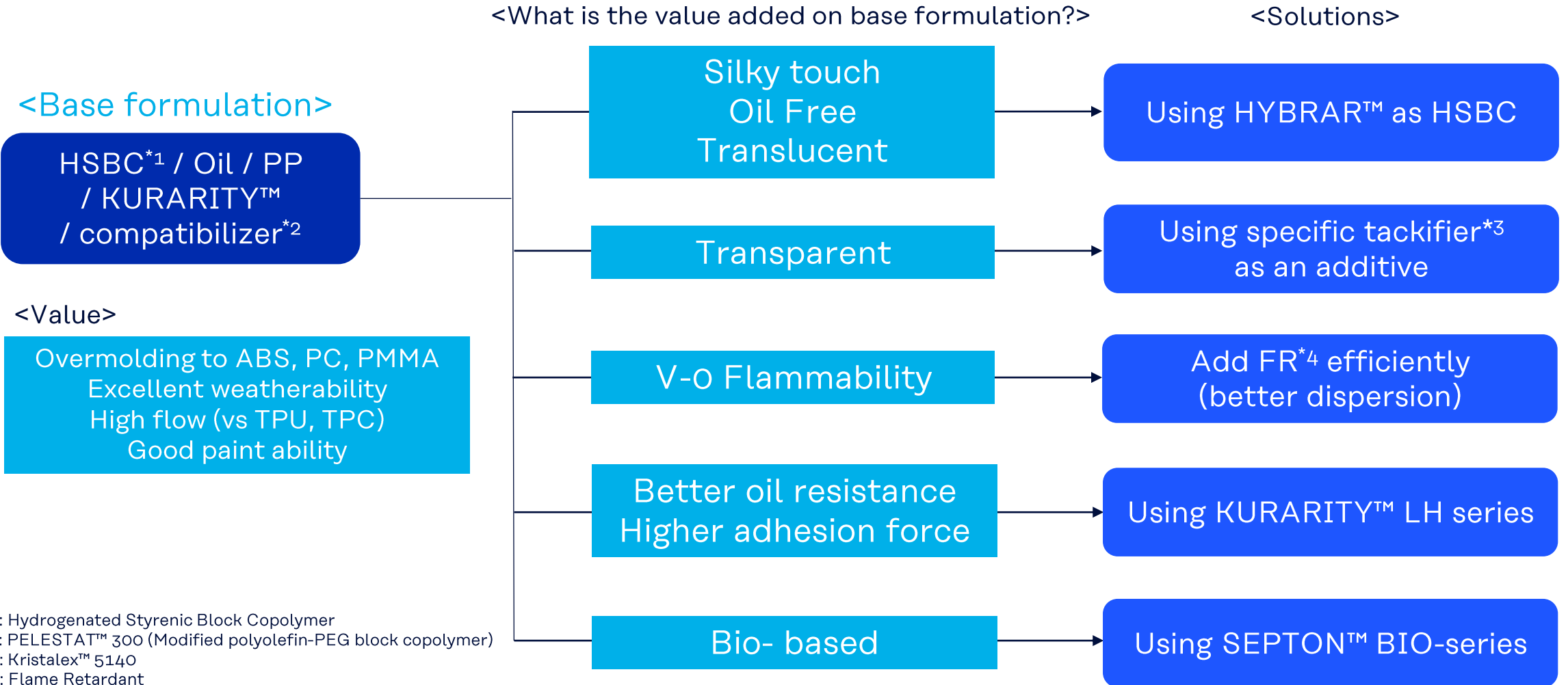
## Advantages as overmolding compound

Good adhesion to polar resin

High flow formulation  
(low temperature molding)

Low yellowing

# Overmolding solutions using Kuraray's Elastomers products



\*1: Hydrogenated Styrenic Block Copolymer

\*2: PELESTAT™ 300 (Modified polyolefin-PEG block copolymer)

\*3: Kristalex™ 5140

\*4: Flame Retardant

\*PELESTAT is a registered trademark of Sanyo Chemical Industries, Ltd.

\*KRISTALEX is a registered trademark of Eastman chemical resins inc..

# Typical properties

				Base formulation	Using HYBRAR™ as HSBC	Using αMSt based copolymer as an additive	Add FR efficiently	Using KURARITY™ LH series	Using SEPTON™ BIO-series
Information of these formulation				HSBC / Oil / PP / KURARITY™ / Compatibilizer* <sup>1</sup>	HYBRAR™ / KURARITY™	HSBC / Oil / KURARITY™ / Additive* <sup>2</sup>	HSBC / Oil / PP / KURARITY™ / Compatibilizer* <sup>1</sup> / Flame retardant	HSBC / Oil / PP / KURARITY™ LH series / Compatibilizer* <sup>1</sup>	SEPTON™ BIO-series / KURARITY™
Value				Overmolding to PC, ABS, PMMA, High flow, Excellent weatherability	Silky touch, Oil free, Translucent	Transparent	Flame retardant (V-O at 6mmt)	Oleic acid resistance, Excellent adhesion	Bio-based
Items	Methods	Conditions	Units						
Hardness (after 15 sec)	ISO 7619-2	after 15 sec	-	49	43	41	65	50	57
MFR	ISO 1133	230 deg.C, 2.16 kgf	g / 10 min	97	64	> 150	3.5	110	17
Tensile strength at break	ISO 37	500 mm / min	MPa	4.5	6.4	4.9	3.4	7.0	8.6
Tensile elongation at break			%	400	920	660	75	640	290
Adhesion to polar resins	In-house method	Injection temp.	deg.C	230	240	230	250	230	230
		to PC		59	63	23	33	73	30
		to ABS	N / 25 mm	59	72	8.2	24	77	34
		to PMMA		59	75	24	31	75	29
Transmittance	ISO 13468-1	1 mmt	%	82	-	92	-	83	84
Haze	ISO 14782	1 mmt	%	98	-	6.0	-	97	95
Oleic acid resistance (Skin oil)	In-house method	Immersed at 23 deg.C, 168 hr	Δwt%	36	61	67	-	29	-

\*1: PELESTAT™ 300 (Modified polyolefin-PEG block copolymer)

\*2: KRISTALEX™ 5140

\*PELESTAT is a registered trademark of Sanyo Chemical Industries, Ltd.

\*KRISTALEX is a registered trademark of Eastman chemical resins inc..

# Formulation detail

		Base formulation	Using HYBRAR™ as HSBC	Using αMSt based copolymer as an additive	Add FR efficiently	Using KURARITY™ LH series	Using SEPTON™ BIO-series
Information of these formulation		HSBC / Oil / PP / KURARITY™ / Compatibilizer*1	HYBRAR™ / KURARITY™	HSBC / Oil / KURARITY™ / Additive*2	HSBC / Oil / PP / KURARITY™ / Compatibilizer*1 / Flame retardant	HSBC / Oil / PP / KURARITY™ LH series / Compatibilizer*1	SEPTON™ BIO-series / KURARITY™
Value		Overmolding to PC, ABS, PMMA, High flow, Excellent weatherability	Silky touch, Oil free, Translucent	Transparent	Flame retardant (V-O at 6mmt)	Oleic acid resistance, Excellent adhesion	Bio-based
<b>Materials</b>							
SEPTON™	4055	100			100	100	
	4033			100			
HYBRAR™	7311F		100				
SEPTON™ BIO-series	SF902						100
Oil	Paraffinic oil (visc. 90 mm <sup>2</sup> / sec at 40 deg.C)	100		100	100	100	
PP	Homo type (MFR = 11 g / 10 min)	30			30	30	
KURARITY™	LA2250	200	100	50	200		50
	LA4285						50
	KL-LH8156					200	
Compatibilizer	PELESTAT™ 300 (Modified polyolefin-PEG block copolymer)	20			20	20	
Additive	KRISTALEX™ 5140			20			
Flame retardant	Phosphorus type				30		
Anti drip agent	PTFE				0.5		

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\*KRISTALEX is a registered trademark of Eastman chemical resins inc..

# Introduction of KURARITY™ as modifier of HSBC based compounds for overmolding applications

KURARITY business promotion dept.  
Elastomer Division

***kuraray***

## Overviewing of our new solution with KURARITY™ (Compare with conventional system)

	Adhesion to polar resin	Flow-ability (Low temp. molding)	Weatherability (Low yellowing)	Paint-ability
HSBC / KURARITY™ compounds (New solution)	+	++	++	++
HSBC / TPU Compounds (Conventional)	++	+-	-	+

Compared with conventional HSBC / TPU compounds for overmolding applications,

Our new solution is;

- ✓ (-) Moderate adhesion force to polar resin
- ✓ (+) Excellent weatherability, flow-ability and paint-ability

# Example formulations

	Ex.1 SEEPS / Oil / PP / KURARITY™ / Compatibilizer	Ex.2 SEEPS / Oil / PP/ KURARITY™ / Compatibilizer	Ex.3 Vinyl bond rich SEEPS / KURARITY™	Ex.4 SEEPS / Oil / PP	Ex.5 SEBS / Oil / Aromatic TPU / Compatibilizer	Ex.6 SEBS / Oil / Aliphatic TPU / Compatibilizer
SEPTON™ 4055	100	100		100		
SEPTON™ 8006					100	100
HYBRAR™ 7311F			100			
Paraffin oil (visc. 90 mm <sup>2</sup> / sec at 40 deg.C)	100	100		100		
Paraffin oil (visc. 380 mm <sup>2</sup> / sec at 40 deg.C)					100	100
Homo PP (MFR = 11)	30	30		30		
<b>KURARITY™ LA2250</b>	<b>100</b>	<b>200</b>	<b>100</b>			
Aromatic TPU (Ester type Hs = 70 A)					200	
Aliphatic TPU (Ester type Hs = 85 A)						200
PELESTAT™ 300 (Modified polyolefin-PEG block copolymer)	10	20				
TU-S5265 (HSBC-TPU block co-polymer)					100	100

\*PELESTAT is a registered trademark of Sanyo Chemical Industries, Ltd.

- ✓ For mixing with low vinyl type HSBC, proper compatibilizer should be selected.
- ✓ High vinyl type HSBC shows good compatibility with KURARITY™.



# Typical properties

	Method	Units	Ex.1 SEEPS / Oil / PP / KURARITY™ / Compatibilizer	Ex.2 SEEPS / Oil / PP/ KURARITY™ / Compatibilizer	Ex.3 Vinyl bond rich SEEPS / KURARITY™	Ex.4 SEEPS / Oil / PP	Ex.5 SEBS / Oil / Aromatic TPU / Compatibilizer	Ex.6 SEBS / Oil / Aliphatic TPU / Compatibilizer
Hardness type A (after 15 sec)	ISO 7619-1	-	49	49	43	49	51	49
MFR (230 deg.C, 2.16 kgf)	ISO 1133	g / 10 min	<b>18</b>	<b>97</b>	<b>64</b>	No flow	6.1	7.2
Tensile strength at break	ISO 37	MPa	4.1	4.5	6.4	3.7	8.2	11
Tensile elongation at break	ISO 37	%	670	400	920	590	760	590
Adhesion to polar resin	Injection temp.	deg.C	230	230	240	230	230	230
	to ABS	N / 25 mm	<b>22</b>	<b>&gt;59</b>	<b>&gt;63</b>	0.17	>70	>81
	to PC		<b>31</b>	<b>&gt;59</b>	<b>&gt;72</b>	0.12	>85	>60
	to PMMA		<b>23</b>	<b>&gt;53</b>	<b>&gt;75</b>	0.12	40	37

- ✓ Ex.1, Ex.2 and Ex.3 show higher flow-ability than conventional HSBC / TPU based compounds (Ex.5 and Ex.6).
- ✓ Adhesion force to polar resin depends on the total amount of KURARITY™.

# Adhesion to polar resin at low temp. molding

	Method	Units	Ex.1 SEEPS / Oil / PP / KURARITY™ / Compatibilizer	Ex.2 SEEPS / Oil / PP/ KURARITY™ / Compatibilizer	Ex.3 Vinyl bond rich SEEPS / KURARITY™	Ex.4 SEEPS / Oil / PP	Ex.5 SEBS / Oil / Aromatic TPU / Compatibilizer	Ex.6 SEBS / Oil / Aliphatic TPU / Compatibilizer
Adhesion to polar resin (Injection temp.: 200 deg.C)	to ABS	N / 25 mm	3.7	> 58	Can't mold (Flow mark)	No data	Can't mold (Flow mark)	Can't mold (Flow mark)
	to PC		2.3	> 31		No data		
	to PMMA		3.3	> 31		No data		
Adhesion to polar resin (Injection temp.: 210 deg.C)	to ABS	N / 25 mm	7.9	> 62	Can't mold (Flow mark)	0.17	Can't mold (Flow mark)	Can't mold (Flow mark)
	to PC		3.8	> 61		0.12		
	to PMMA		5.7	> 58		0.12		

- ✓ Ex.2 shows the highest adhesion to polar resin at 200 - 210 deg.C.
- => Thanks to higher flow ability, HSBC / KURARITY™ compounds enable you to mold at lower temperature.
- ✓ Adhesion force and injection temperature window depend on amount ratio of KURARITY™.

# Weatherability (Yellowing)

	Ex.1	Ex.2	Ex.3	Ex.4	Ex.5	Ex.6
Initial (0hr)	SEEPS / Oil / PP / KURARITY™ / Compatibilizer $b^* = -2.1$	SEEPS / Oil / PP / KURARITY™ / Compatibilizer $b^* = -1.3$	Vinyl bond rich SEEPS / KURARITY™ $b^* = -3.6$	SEEPS / Oil / PP $b^* = -2.5$	SEBS / Oil / Aromatic TPU / Compatibilizer $b^* = -3.6$	SEBS / Oil / Aliphatic TPU / Compatibilizer $b^* = -0.3$
Final (300hr)	$b^* = -3.1$	$b^* = -3.6$	$b^* = -1.7$	$b^* = -2.8$	$b^* = 10.3$	$b^* = 0.6$

✓ HSBC/ KURARITY™ compounds show excellent weatherability.

-> Lower color shift gives wider color options.

ISO4892-4 (SWOM)

Black Panel temp.: 63 deg.C, Exposure intensity: 255 W / m<sup>2</sup> (300-700 nm)  
Exposure time: 300 hr, Injection molding sample: 50 mm x 50 mm x 3 mmt

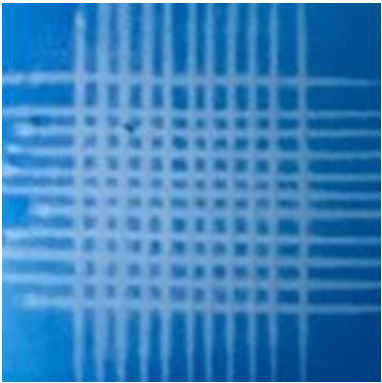
Color measurement

Luminous source : C type, View angle: 2 degrees., Reflection mode

# Paint-ability

## Ex.1

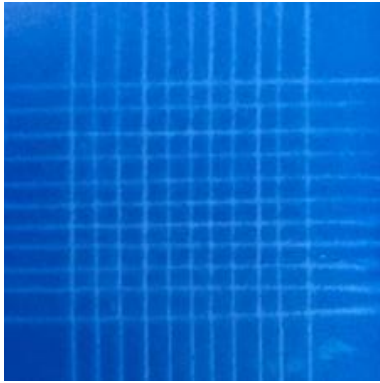
SEEPS / Oil / PP /  
KURARITY™  
/ Compatibilizer



Classification: 2  
(Flaked under 15 %)

## Ex.2

SEEPS / Oil / PP /  
KURARITY™  
/ Compatibilizer



Classification: 1  
(Flaked under 5 %)

## Ex.3

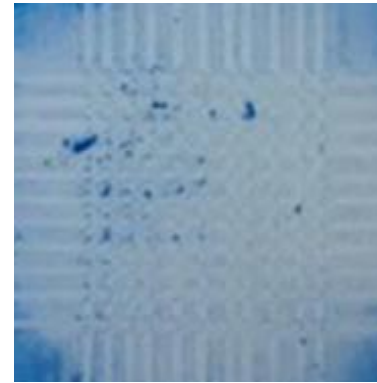
Vinyl bond rich SEEPS  
/ KURARITY™



Classification: 2  
(Flaked under 15 %)

## Ex.4

SEEPS / Oil / PP



Classification: 5  
(Flaked over 65 %)

## Ex.5

SEBS / Oil / Aromatic TPU  
/ Compatibilizer



Classification: 3  
(Flaked over 15 % to 35 %)

## Ex.6

SEBS / Oil / Aliphatic TPU  
/ Compatibilizer



Classification: 2  
(Flaked under 15 %)

- ✓ HSBC/KURARITY™ compounds show better paint-ability.

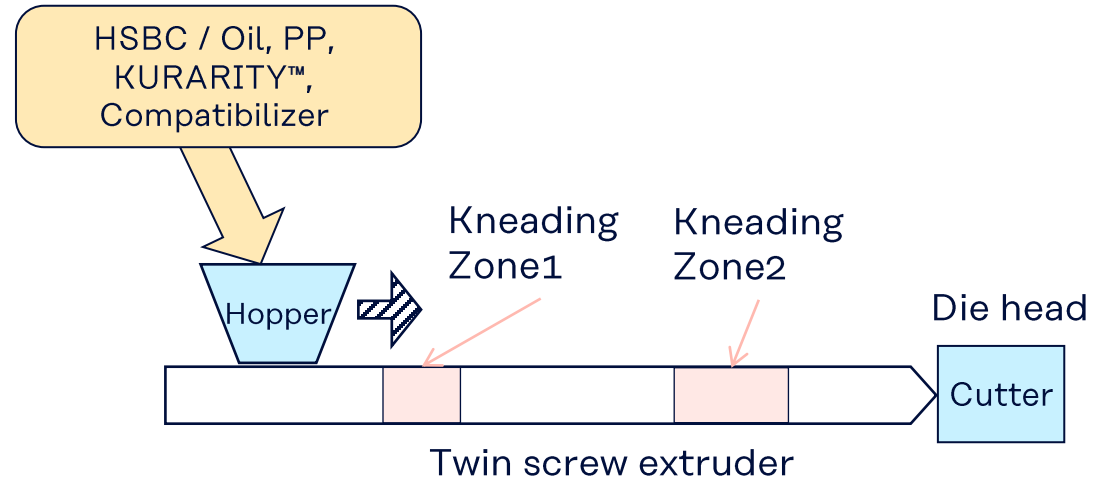
Paint: Pigment (Cyanine Blue b type) / Acrylic resin / Butyl acetate = 3.3 / 6.7 / 90, Sprayed, Thickness: 10 μm  
Adhesion test (Cross-cut test): Number of cuts = 10 x 10 (1 mm) (Kuraray method)  
Classification: 1 (excellent adhesion) - 5 (poor adhesion) (ISO 2409)

# Test compounding conditions (HSBC / KURARITY™ overmolding compound)

## Equipment example

Twin extruder: ZSK 25 (Coperion)

Screw: 25 mmf, L/D= 54



Temperature [deg.C]	C2 (hopper)	C3~C11	C12	Die head
	50	220-240	210-230	200-220
Screw rotation [rpm]	250			
Vent	Pull			
PCW temperature [deg.C]	30-50			



# Transparency control for HSBC / KURARITY™

KURARITY business promotion dept.  
Elastomer Division

***kuraray***

# How to make the formulation transparent

A: HSBC / Paraffin oil / KURARITY™



Add KRISTALEX™ 5140\*

B: HSBC / Paraffin oil / KURARITY™ / KRISTALEX™ 5140



\*KRISTALEX is a registered trademark of Eastman chemical resins inc..

✓ KRISTALEX™ 5140 makes the HSBC / Paraffin oil / KURARITY™ formulation TRANSPARENT.

# Example formulations

				Ref. 1	Ref. 2	Ex.1	Ex.2	Ex.3	Ex.4	Ex.5	Ex.6
SEPTON™ 4033				100	100	100	100	100	100	100	100
Paraffin oil (visc. 90 mm <sup>2</sup> / sec at 40 deg.C)				100	100	100	100	100	100	100	150
KURARITY™ LA2250					50	50	50				
KURARITY™ LA3320								50	50	50	50
KRISTALEX™ 5140						10	20	20	30	40	30
Items	Methods	Conditions	Units								
Transmittance	ISO 13468-1	3 mmt	%	92	62	86	91	82	89	89	91
Haze	ISO 14782	3 mmt	%	1.7	90	33	9.7	44	30	53	9.9
Hardness type A	ISO 7619-1	After 15 sec	-	27	31	35	41	33	36	43	21
Elongation at break	ISO 37	500 mm / min	%	840	660	680	660	680	660	660	720
Strength at break			MPa	5.4	4.5	4.7	4.9	5.1	5.3	6.2	4.8
100% modulus			MPa	0.87	1.0	1.3	1.7	1.3	1.7	2.0	0.90

\*KRISTALEX is a registered trademark of Eastman chemical resins inc..

- ✓ KRISTALEX™ 5140 and paraffin oil content are key points to make transparent formulation.



# Example formulations

				Ref. 1	Ref. 2	Ex.1	Ex.2	Ex.3	Ex.4	Ex.5	Ex.6
SEPTON™ 4033				100	100	100	100	100	100	100	100
Paraffin oil (visc. 90 mm <sup>2</sup> / sec at 40 deg.C)				100	100	100	100	100	100	100	150
KURARITY™ LA2250					50	50	50				
KURARITY™ LA3320								50	50	50	50
KRISTALEX™ 5140						10	20	20	30	40	30
Items	Methods	Conditions	Units								
Adhesion to resin* (Over molding)	Peel test: 100 mm / min	To PC	N / 25 mm	14	13	18	23	20	25	28	23
		To ABS		2.0	6.7	6.3	8.2	9.9	13	17	12
		To PMMA		12	13	20	24	24	28	29	25
		To PP		5.9	14	16	17	15	20	30	9.1

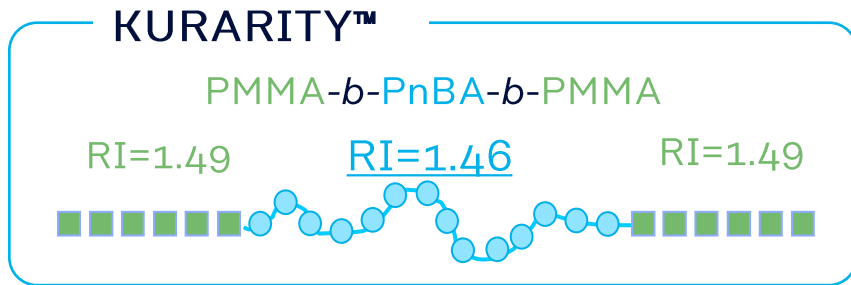
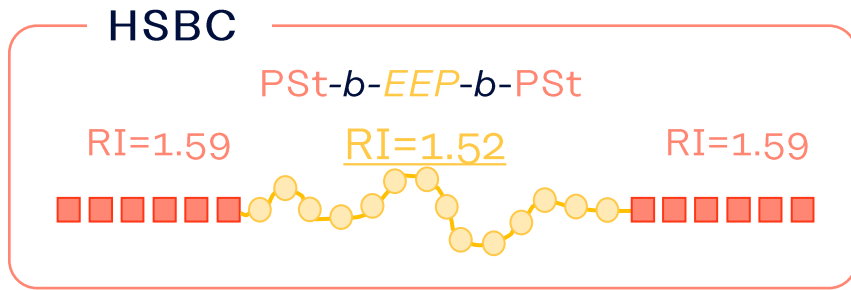
\*KRISTALEX is a registered trademark of Eastman chemical resins inc..

\*Injection conditions

Cylinder temp.: 240 deg.C, Injection rate: 40 mm / sec, Mold temp.: 40 deg.C

✓ HSBC / KURARITY™ / KRISTALEX™ formulation shows better adhesion force to polar / non-polar substrates.

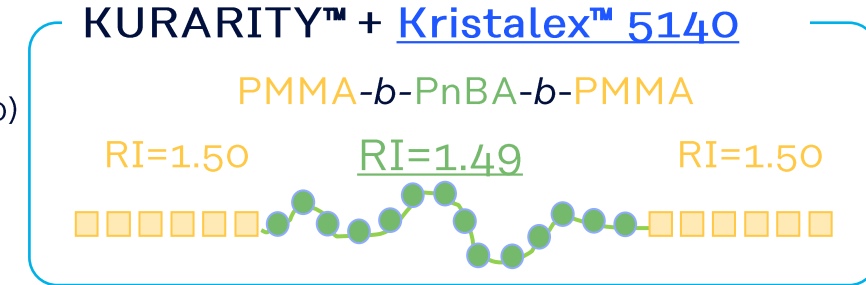
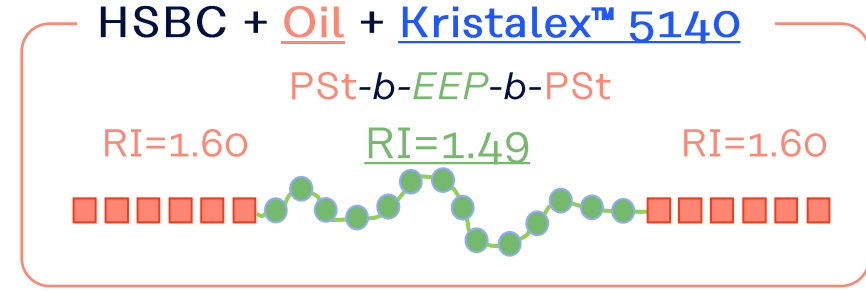
# Assumption mechanism (Refractive Index (RI) control)



	RI
PSt	1.59
EEP	1.52
PMMA	1.49
PnBA	1.46



Adding  
 - KRISTALEX™ 5140 (RI: 1.60)  
 - Oil (RI: 1.48)


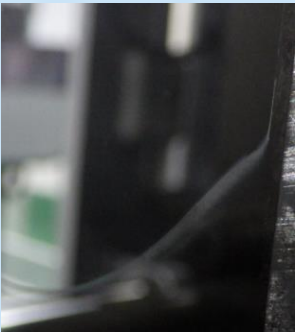




	Estimated RI
PSt + KRISTALEX™ 5140	1.60
EEP + Oil	1.49
PMMA + KRISTALEX™ 5140	1.50
PnBA + KRISTALEX™ 5140	1.49

\*KRISTALEX is a registered trademark of Eastman chemical resins inc..

✓ KRISTALEX™ 5140 and Oil can control RI of each blocks and seem to make the transparent formulation.

# Oil retention, gas contamination on mold

				Ref. 1	Ref. 2	Ex.2	Ex.6
SEPTON™ 4033				100	100	100	100
Paraffin oil (visc. 90 mm <sup>2</sup> / sec at 40 deg.C)				100	100	100	150
KURARITY™ LA2250					50	50	
KURARITY™ LA3320							50
KRISTALEX™ 5140						20	30
Items	Methods	Conditions	Units				
Gas contamination on injection mold	In-house method	Cylinder: 240 deg.C, Mold: 40 deg.C, Photo was taken after 10 shots on injection mold	---				
				Reference	Better	Better	Same level as Ref.1

\*KRISTALEX is a registered trademark of Eastman chemical resins inc..

✓ HSBC / Oil / KURARITY™ / KRISTALEX™ 5140 CPDs show better gas contamination.

# Hardness adjustment

Softer ← → Harder

				Ex.6	Ex.7	Ex.2	Ex.8	Ex.9
SEPTON™ 4033				100	100	100	100	100
Paraffin oil (visc. 90 mm <sup>2</sup> / sec at 40 deg.C)				150	100	100	100	100
KURARITY™ LA2140					50			
KURARITY™ LA2250						50		
KURARITY™ LA3320				50				
KURARITY™ LA4285							50	100
KRISTALEX™ 5140				30	20	20	20	40
Items	Methods	Conditions	Units					
Hardness type A	ISO 7619-1	After 15 sec	-	21	36	41	50	62
Transmittance	ISO 13468-1	3 mmt	%	91	91	91	90	89
Haze	ISO 14782	3 mmt	%	9.9	10	9.7	12	20
Elongation at break	ISO 37	500 mm / min	%	720	720	660	320	180
Strength at break			MPa	4.8	4.8	4.9	4.9	6.0
100% modulus			MPa	0.90	1.4	1.7	3.5	5.2

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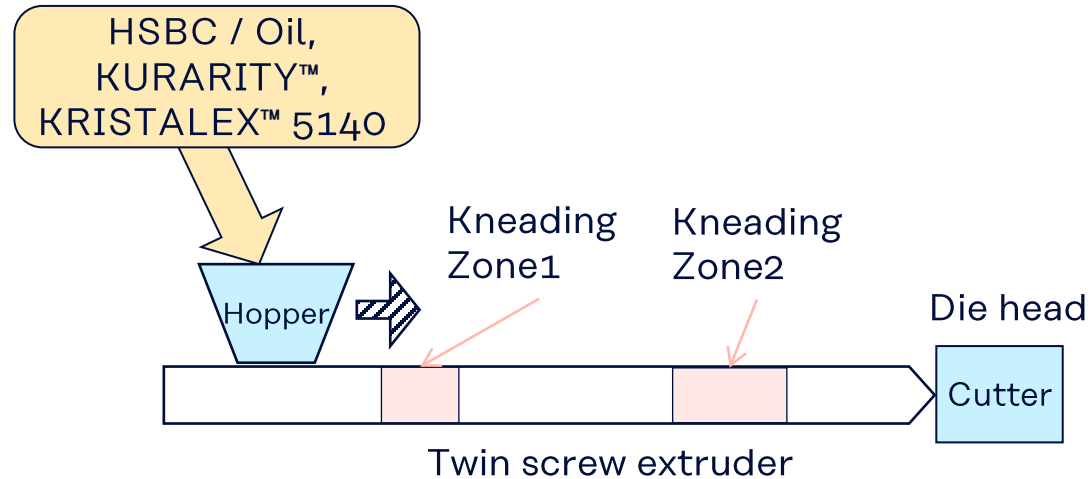
- ✓ Hardness can be adjusted by changing KURARITY™ grade.

# Test compounding conditions (HSBC / KURARITY™ transparent compound)


Equipment example

Twin extruder: ZSK 25 (Coperion)

Screw: 25 mmf, L/D= 54



Temperature [deg.C]	C2 (hopper)	C3~C11	C12	Die head
	50	190-220	180-210	170-200
Screw rotation [rpm]	250			
Vent	Pull			
PCW temperature [deg.C]	30-50			



# Modification of KURARITY™ by adding HSBC / oil as a plasticizer keeping with transparency

KURARITY business promotion dept.  
Elastomer Division

***kuraray***

# What is our new concept?

-KURARITY™ has following characteristics

Pros: Excellent transparency, excellent adhesion to polar resins, excellent weatherability

Cons: Low oleic acid resistance (Similar SP value), Haptic (Low rubber like feeling),  
High cost (Due to limited choice of economical plasticizer)

-HSBC / Oil can serve as a plasticizer in KURARITY™ to improve those cons.

-KRISTALEX™ 5140 contributes to keep this formulation transparent.

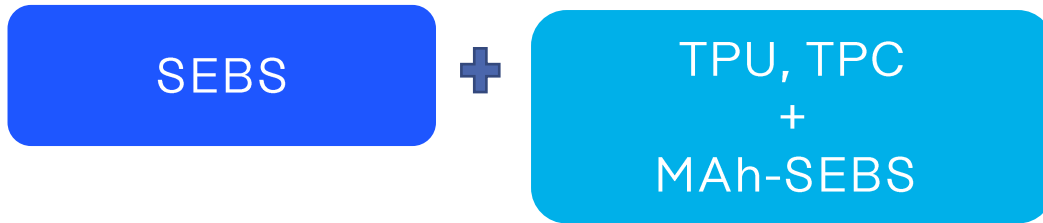


\* Photo:  
Injection molding sample,  
Thickness: 3mm

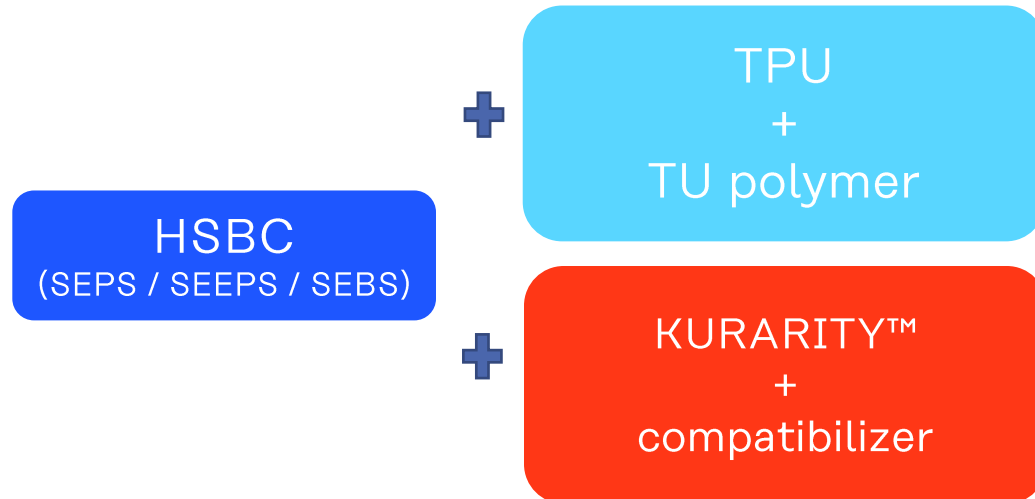
\*KRISTALEX is a registered trademark of Eastman chemical resins inc..

# Illustration of our new concept as overmolding CPD to polar substrate

## -Common technologies



## -KURARAY's solutions



### -Existing HSBC/KURARITY™ formulations:

1. Overmolding formulations: (e.g., HSBC / KURARITY™ / compatibilizer):

Good adhesion to polar resin but **opaque**.

2. Transparent formulations: (e.g., HSBC / KURARITY™ / additive):

Excellent transparency, but **slightly lower adhesion**.



### Our new concept:

Good adhesion and moderate transparency.




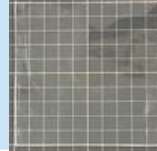






## Overviewing of our new HSBC / KURARITY™ formulation (Compare with conventional system)

	New HSBC / KURARITY™ Formulation	KURARITY™	TPC or TPC / TPS	TPU	HSBC / oil / homo-PP compound
Transparency	+	++	-	+	+-
Haptic (Rubber like)	+	-	-	-	++
Adhesion to polar resin	+	++	++	++	-
Oleic acid resistance	+	-	+-	++	+
Weatherability	+	++	-	-	+
Cost	+	-	++	++	++

- ✓ Comparing to KURARITY™, TPC, TPC / TPS and TPU, new HSBC / KURARITY™ formulation shows;
  - Balanced transparency, haptic, adhesion to polar resin, oleic acid resistance, weatherability and cost.

# Typical properties

				Ex.1	Ex.2	Ex.3	Ref.1	Ref.2	Ref.3	Ref.4	Ref.5
Acrylic polymer	KURARITY™ LA4285			40	40	40		TPC	TPC/TPS	TPU (Ester type)	HSBC / oil / homo-pp compound (100 / 100 / 30)
	KURARITY™ LA2250			50	50	50	100				
	PMMA (MFR = 15, GF1000, KURARAY)			10	10	10					
HSBC	SEPTON™ 4055			20	20	20					
Plasticizer	Paraffin oil (visc. 90 mm <sup>2</sup> / sec at 40 deg.C)			30	30	40					
Additive	KRISTALEX™ 5140			10	10	10					
	PELESTAT™ 300 (Modified polyolefin-PEG block copolymer)				10						
Items	Methods	Conditions	Units								
Transmittance	ISO 13468-1	1 mmt	%	92	91	92	93	61	75	90	89
Haze	ISO 14782	1 mmt	%	75	69	45	1.7	81	42	9.1	76
Hardness type A	ISO 7619-1	After 0 sec	-	73	74	70	69	84	74	73	49
Tensile strength at break	ISO 37	500 mm / min	MPa	7.0	6.0	5.9	8.8	14	10	36	3.7
Tensile elongation at break			%	170	180	150	470	740	640	550	590
Haptics (Rubber like)	In-house method	Touched feeling	-	Good	Good	Good	Poor	Poor	Poor	Poor	Excellent
Appearance (photo)	Injection molding sample	1 mmt	-								

\*KRISTALEX is a registered trademark of Eastman chemical resins inc..

\*PELESTAT is a registered trademark of Sanyo Chemical Industries, Ltd.

✓ Ex.1-3 showed moderate transparency comparing to Ref.1-5, which were shore 70-80A.

# Typical properties

				Ex.1	Ex.2	Ex.3	Ref.1	Ref.2	Ref.3	Ref.4	Ref.5
Acrylic polymer	KURARITY™ LA4285			40	40	40		TPC	TPC/TPS	TPU (Ester type)	HSBC / oil / homo-pp compound (100 / 100 / 30)
	KURARITY™ LA2250			50	50	50	100				
	PMMA (MFR = 15, GF1000, KURARAY)			10	10	10					
HSBC	SEPTON™ 4055			20	20	20					
Plasticizer	Paraffin oil (visc. 90 mm <sup>2</sup> / sec at 40 deg.C)			30	30	40					
Additive	KRISTALEX™ 5140			10	10	10					
	PELESTAT™ 300 (Modified polyolefin-PEG block copolymer)				10						
Items	Methods	Conditions	Units								
Adhesion to resin (Over molded at 230 deg.C)*	To PC	Peel test: 100 mm / sec	N / 25 mm	34 (MB)	55 (MB)	40 (MB)	92 (MB)	200 (MB)	130 (MB)	120 (MB)	0.12 (IF)
	To ABS			45 (MB)	55 (MB)	42 (MB)	92 (MB)	68 (IF)	67 (IF)	110 (MB)	0.17 (IF)
	To PMMA			22 (MB)	57 (MB)	43 (MB)	70 (MB)	81 (IF)	70 (IF)	94 (MB)	0.12 (IF)
Oleic acid resistance	In-house method	Immersed at 23 deg.C 168 hr	Δ wt%	25	22	31	71	38	33	1.3	24
Hand cream resistance				3.5	4.2	4.0	2.6	4.2	5.2	1.5	19
Sunscreen resistance				18	21	24	25	20	20	5.9	17
Oil resistance (IRM903)				11	8.9	14	6.9	12	15	0.6	48
Weatherability	In-house method	-	-	Good	Good	Good	Excellent	Poor	Poor	Poor	Good

\* IF: Interfacial failure, MB: Material break

\*KRISTALEX is a registered trademark of Eastman chemical resins inc..

\*PELESTAT is a registered trademark of Sanyo Chemical Industries, Ltd.

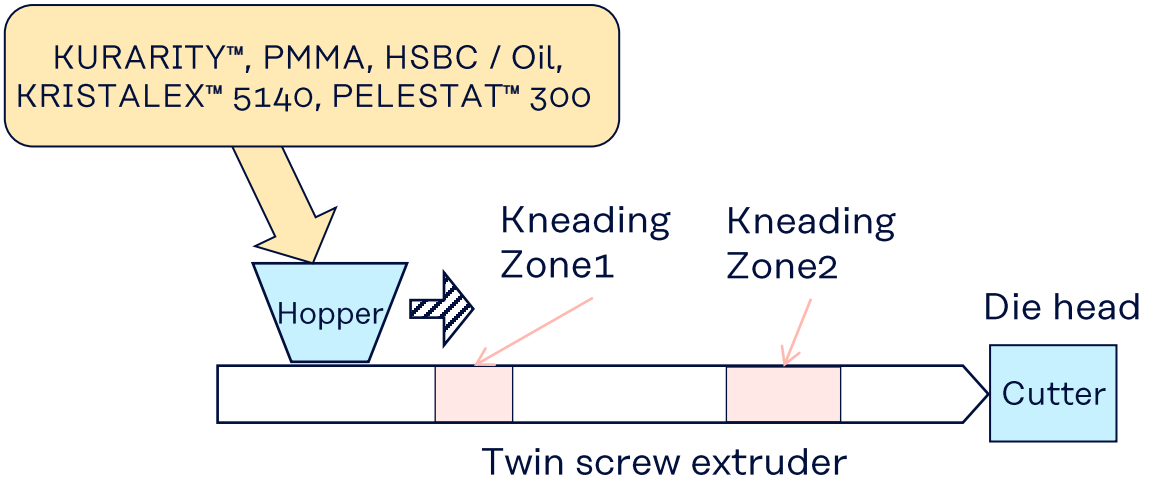
✓ Ex.1-3 showed moderate adhesion, good oleic acid resistance and haptics compared to Ref.1 to 3.

# Test compounding conditions (KURARITY™ base transparent compound)

## Equipment example

Twin extruder: ZSK 25 (Coperion)

Screw: 25 mmf, L/D= 54



Temperature [deg.C]	C2 (hopper)	C3~C11	C12	Die head
	50	220-240	210-230	200-220
Screw rotation [rpm]	250			
Vent	Pull			
PCW temp. [deg.C]	30-50			

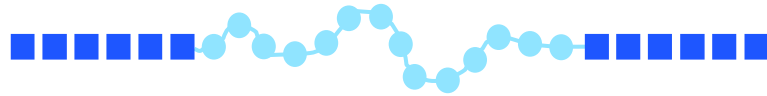
# Flame retardant compounds with KURARITY™ for overmolding application

KURARITY business promotion dept.  
Elastomer Division

***kuraray***

# Advantages of KURARITY™ as modifier for overmolding HSBC based compounds with flame retardant

PMMA-*b*-Acrylate-*b*-PMMA



KURARITY™ as “MAM” structure  
-> Made by controlled living anionic polymerization

## Features of “MAM”

All acrylic elastomer

High polarity

## Advantages as flame retardant compound

Good elongation  
without any plasticizer

Good filler dispersion  
contribute to UL V-0 at 2mmt

Good adhesion to polar resin

# Typical properties (KURARITY™ / Flame retardant)

				Ex.1	Ex.2	Ex.3	Ex.4	Ex.5	Ex.6
KURARITY™	KURARITY™ LA2250			69.5	54.5				
	KURARITY™ LA4285					69.5	54.5		
	KURARITY™ KL-LH8156							69.5	54.5
Flame retardant	Phosphate type			30.0	45.0	30.0	45.0	30.0	45.0
Anti dripping agent	PTFE			0.5	0.5	0.5	0.5	0.5	0.5
Items	Methods	Conditions	Units						
Hardness (shore A)	ISO 7619-1	After 15 sec	-	70	81	95	96	63	74
Tensile strength at break	ISO 37	500 mm / min	MPa	6.5	6.1	16	17	8.6	6.8
Tensile elongation at break			%	330	210	36	22	540	290
MFR	ISO 1133	190 deg.C 2.16 kgf	g / 10 min	6.3	0.28	-	-	9.7	1.1
MFR	ISO 1133	230 deg.C 2.16 kgf	g / 10 min	-	-	4.9	0.25	-	-
Flammability	UL 94	2.0 mmt	-	Out of classification	V-1	Out of classification	V-0	Out of classification	V-0
		3.1 mmt	-	Out of classification	V-0	Out of classification	V-0	V-1	V-0
		6.2 mmt	-	Out of classification	V-0	V-0	V-0	V-0	V-0
Adhesion to polar resins (Molded at 230 deg.C)	In-house method	To PC	N / 25 mm	100	82	36	22	110	85
		To ABS	N / 25 mm	94	75	43	22	120	92
		To PMMA	N / 25 mm	87	72	42	20	120	90

- Ex.2 and 6 achieved V-0 keeping with flexibility and adhesion to polar substrates.
- Ex.6 showed better properties compared to Ex.2 because of higher polarity and flowability of KL-LH8156.

# Typical properties (HSBC / KURARITY™ / Flame retardant)

		Ex.7	Ex.8	Ex.9	Ex.10	Ex.11	Ex.12		
SEPTON™	SEPTON™ 4055	15.4	12.1	15.4	12.1	15.4	12.1		
Oil	Paraffinic oil (visc. 90 mm <sup>2</sup> / sec at 40 deg.C)	15.4	12.1	15.4	12.1	15.4	12.1		
Olefin	Homo PP (MFR = 11)	4.6	3.6	4.6	3.6	4.6	3.6		
KURARITY™	KURARITY™ LA2250	30.9	24.2						
	KURARITY™ LA4285			30.9	24.2				
	KURARITY™ KL-LH8156					30.9	24.2		
Compatibilizer	PELESTAT™ 300 (modified polyolefin-PEG block copolymer)	3.1	2.4	3.1	2.4	3.1	2.4		
Flame retardant	Phosphate type	30.0	45.0	30.0	45.0	30.0	45.0		
Anti dripping agent	PTFE	0.5	0.5	0.5	0.5	0.5	0.5		
Items	Methods	Conditions	Units						
Hardness (shore A)	ISO 7619-1	After 15 sec	-	65	74	85	89	65	76
Tensile strength at break	ISO 37	500 mm / min	MPa	3.6	3.4	5.8	5.9	5.0	4.2
Tensile elongation at break			%	150	150	52	32	420	320
MFR	ISO 1133	230 deg.C 2.16 kgf	g / 10 min	13	1.0	2.3	0.13	22	0.42
Flammability	UL 94	2.0 mmt	-	Out of classification	V-0	Out of classification	V-0	Out of classification	V-0
		3.1 mmt	-	Out of classification	V-0	Out of classification	V-0	Out of classification	V-0
		6.2 mmt	-	V-0	V-0	V-0	V-0	V-0	V-0
Adhesion to polar resins (Molded at 250 deg.C)	In-house method	To PC	N / 25 mm	34	29	43	Brittle*	47	46
		To ABS	N / 25 mm	39	33	51	Brittle*	56	50
		To PMMA	N / 25 mm	37	41	48	Brittle*	47	43

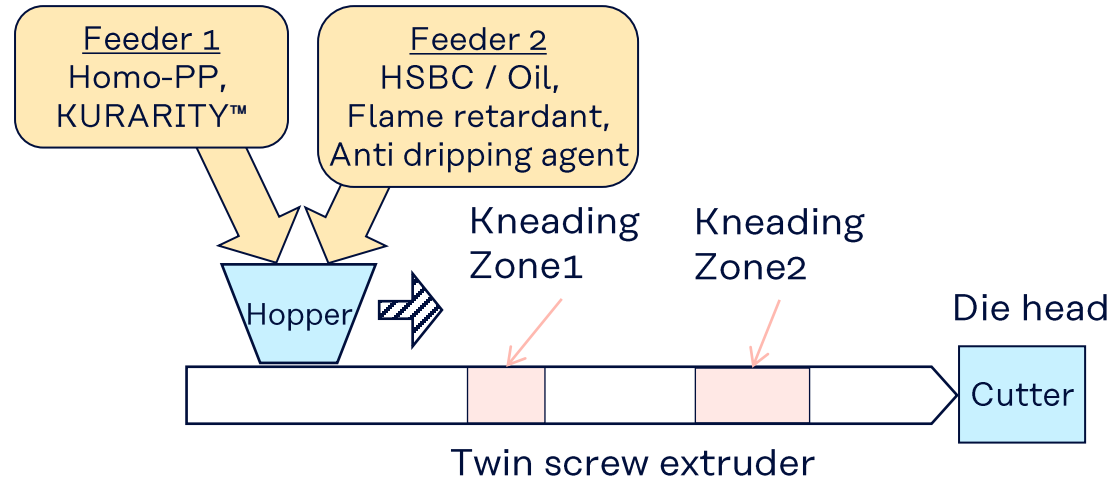
\*Can not measured by peeling test because the test specimens were too much brittle.  
\*PELESTAT is a registered trademark of Sanyo Chemical Industries, Ltd.

- Ex.12 achieved V-0 keeping with flexibility and adhesion to polar substrates.



# Test compounding conditions (Flame retardant compounds)

Equipment example  
 Twin extruder: ZSK 25 (Coperion)  
 Screw: 25 mmf, L/D= 54



Temperature [deg.C]	C2 (hopper)	C3~C11	C12	Die head
		160	240-260	230-240
Screw rotation [rpm]	200			
Vent	Pull			
PCW temperature [deg.C]	30			

**Kuraray Co., Ltd.**  
Elastomer Division  
Tokiwabashi Tower  
2-6-4, Otemachi  
Chiyoda-ku, Tokyo, 100-0004, Japan

✉ [elastomer@kuraray.com](mailto:elastomer@kuraray.com)

→ [www.kuraray.com](http://www.kuraray.com)

→ [www.elastomer.kuraray.com](http://www.elastomer.kuraray.com)

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Precautions should be taken in handling and storage. Please refer to the appropriate Safety Data Sheet for further safety information. In using SEPTON™, HYBRAR™ and KURARITY™, please confirm related laws and regulations, and examine its safety and suitability for the application.

For medical, health care and food contact applications, please contact your Kuraray representative for specific recommendations. Even so, users must conduct their own assessment, revisions, registrations as well rely in their own technical and legal judgment to establish the safety and efficacy of their compound and/or end product with SEPTON™, HYBRAR™ and KURARITY™ for any application. SEPTON™, HYBRAR™ and KURARITY™ should not be used in any devices or materials intended for implantation in the human body. Nothing contained herein constitutes a license to practice under any patent and it should not be construed as an inducement to infringe any patent and the user is advised to take appropriate steps to be sure that any proposed use of the product will not result in patent infringement.

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