NO. RRM00-065-E1

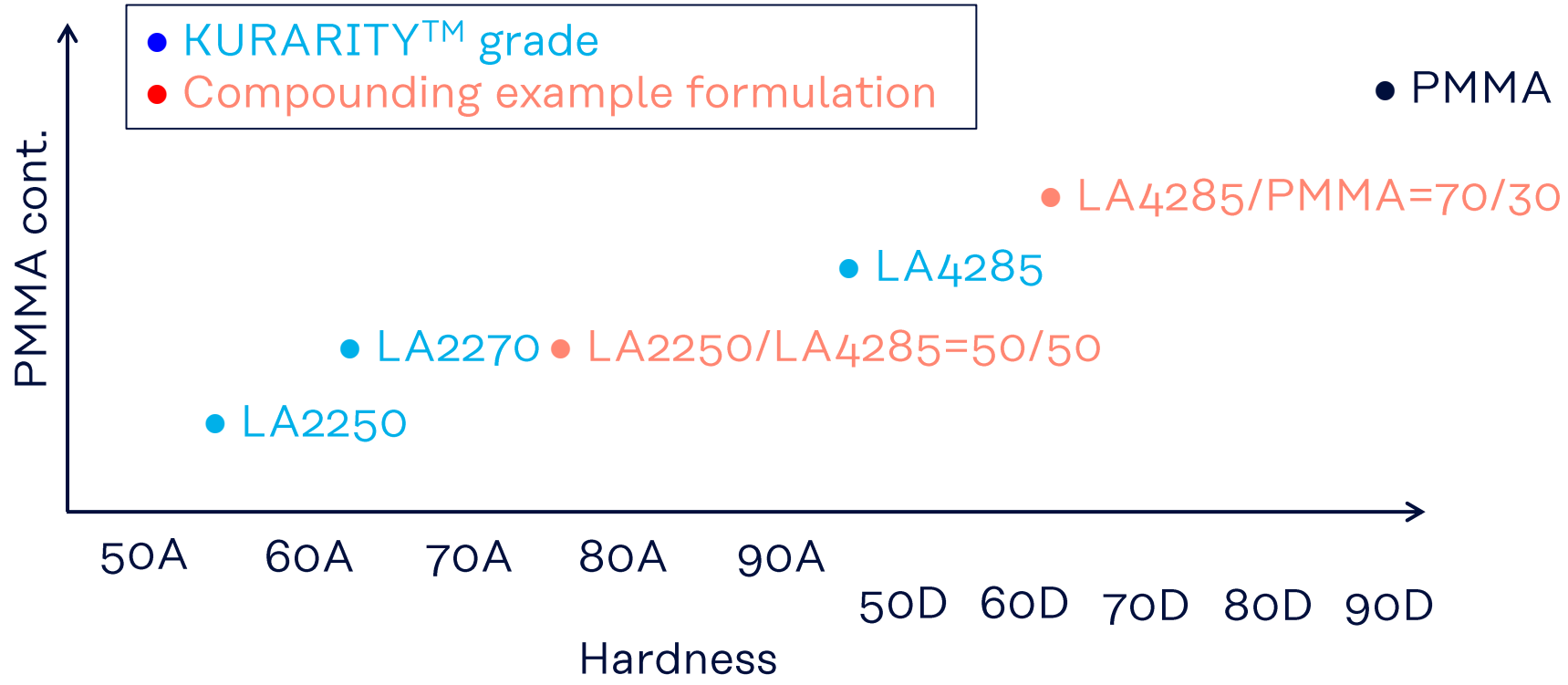
KURARITY™ transparent compounds and recommended additives

KURARITY business promotion dept.
Elastomer Division

kuraray Kurarity™

KURARITY™ transparent compounds

- ✓ We have three grades of KURARITY™ among hardness 50-95A.
- ✓ By compounding different grades of KURARITY™ , the hardness of KURARITY™/PMMA can be adjusted.



KURARITY™ soft & transparent compounds

KURARITY™ LA2250				100	50					
KURARITY™ LA2270						100	70	50	30	
KURARITY™ LA4285					50		30	50	70	100
Items	**Methods**	**Conditions**	**Units**							
Hardness type A	ISO 7619-1	After 15 sec	-	55	78	62	66	73	79	95
Specific gravity	ISO 1183	-	-	1.08	1.10	1.10	1.10	1.10	1.11	1.11
MFR	ISO 1133	190 degC 2.16 kgf	g/10 min	25	3.8	4.4	3.1	2.7	2.1	1.5
		230 deg.C 2.16 kgf		330	68	80	57	49	43	31
Strength at break	ISO 37	500 mm/min	MPa	9.0	12	12	16	17	17	19
Elongation at break			%	380	190	230	300	270	210	140
100% Modulus			MPa	3.7	9.1	9.0	10	11	13	19
Flexural modulus	ISO 178	3 mm/ min	MPa	---	100	180	320	500	620	650
Transmittance	ISO 13468-1	3 mmt	%	92	92	92	92	92	92	92
Haze	ISO 14782	3 mmt	%	2.0-6.0*	2.0-3.5*	1.0	1.0	1.0	1.0	1.0

* The HAZE values are normally worse due to the anti-blocking agent dusted onto LA2250.

✓ By compounding different grades of KURARITY™, mechanical properties can be adjusted

KURARITY™ / PMMA compounds

KURARITY™ LA4285				100	70	70	50		
PARAPET™ GF (High flow grade)					30			100	
PLEXIGLAS® 8N (Standard grade)						30	50		100
Items	**Methods**	**Conditions**	**Units**						
Hardness type D	ISO 7619-1	After 15 sec	-	46	62	61	66	85-90	91
Specific gravity	ISO 1183	-	-	1.11	1.13	1.13	1.15	1.19	1.19
MFR	ISO 1133	230 deg.C, 3.8 kgf	g/10 min	72	37	28	15	15	3
Strength at break	ISO 527-2	50 mm/min	MPa	19	30	28	40	67	89
Elongation at break			%	140	50	41	30	3.0	5.5
Flexural modulus	ISO 178	3 mm/min	MPa	650	1400	1100	1650	3300	3300
Transmittance	ISO 13468-1	3 mmt	%	92	92	91	90	93	93
Haze	ISO 14782	3 mmt	%	1.0	1.0	1.2	2.0	0.3	0.4

*PARAPET is a registered trademark of Kuraray Co., Ltd.
*PLEXIGLAS is a registered trademark of Röhm GmbH

- ✓ By adding PMMA to KURARITY™ LA4285, hardness can be adjusted with good transparency.
- ✓ Using high flow grade can lower haze value.

Standard compounding conditions

1. Preparation

	LA2250	LA2270	LA4285	PMMA
Pre-drying	60 deg.C more than 4hr	60 deg.C more than 6hr	70-80 deg.C more than 6hr	Depends on grade (ex: 80deg.C 6hr)
Pre-blend	Henschel type*1)	Tumbler type or Henschel type		

*1) The granules of LA2250 can be aggregated.
- KURARITY™ should be dried in an air circulation oven dryer or vacuum oven dryer.
- Using vent type extruder, no necessary for drying.

2. Compounding

Equipment:
Twin Screw Extruder (65mmφ, L/D=32)
Cutting : Strand cut
KURARITY™ soft compound needs to use the anti-blocking agent.
Recommendation: EBS (Emulsion aq.)

	KURARITY™ soft compound	KURARITY™ / PMMA compound
C1	50 deg.C	50 deg.C
C2	150 deg.C	170 deg.C
C3 - C5	170 deg.C	190 deg.C
Die head	220 deg.C	230 deg.C
Screw Rotation	200 rpm	200 rpm
Out put	250 kg/hr	250 kg/hr

Standard injection molding conditions

Formulations	LA2250 / LA4285 =50 / 50	LA2270 / LA4285 = 50 / 50	LA4285 =100	LA4285 / PMMA =70 / 30
Pre-drying	60 deg.C more than 4hr	60 deg.C more than 6hr	70-80 deg.C more than 6hr	70-80 deg.C more than 6hr
Cylinder temp. [deg.C]	180-200	190-220	200-230	210-240
Mold temp. [deg.C]	20-40	20-40	20-40	30-60
The bottom of hopper	Water cooling	Water cooling	Water cooling	Water cooling
Screw rotation [rpm]	< 100	< 100	< 100	< 100
Back pressure [kgf/cm^2]	0-10	0-10	0-10	0-10

- KURARITY™ should be dried in an air circulation oven dryer or vacuum oven dryer.

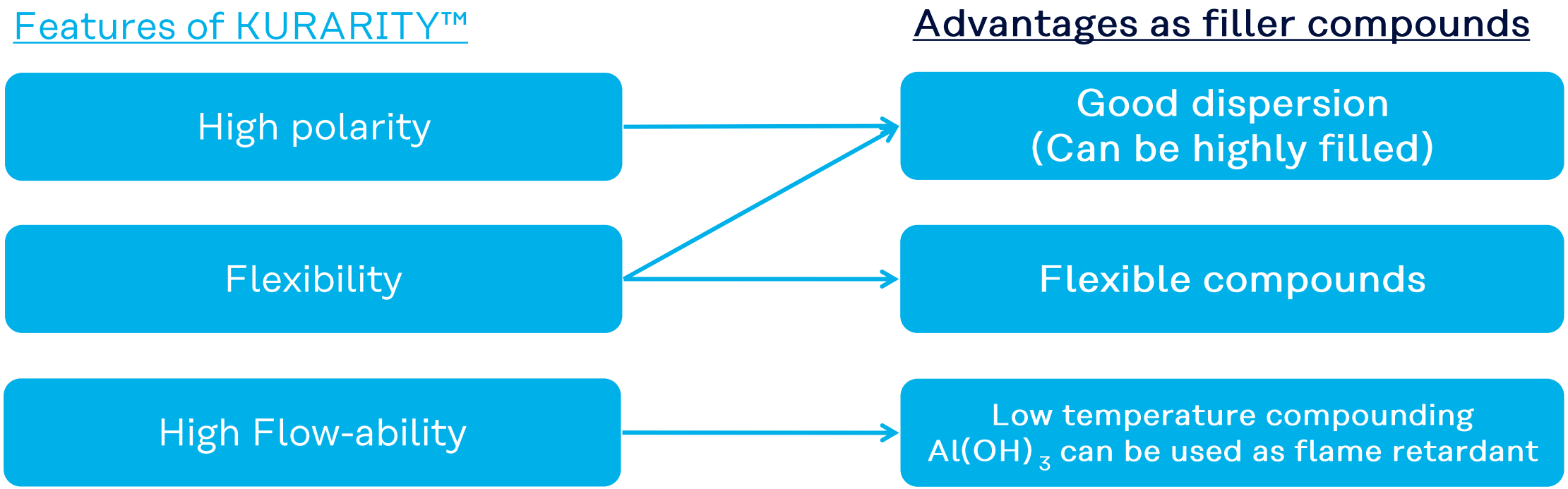
Recommended additives

-Demolding agent: Zinc stearate 0.01-0.05 phr

-Slipping agent*): N,N'-Ethylene bis(oleic amide) 0.01-0.05 phr

*) Slipping agent have proved suitable to protect components with highly smooth surface from scratches as well as to reduce tackiness of components.

Advantages of KURARITY™ for filler compounds



KURARITY™ / TiO_2 compounds

KURARITY™ LA2250				100	50	30			
KURARITY™ LA3320							100	50	30
TiO_2 (Ishihara Sangyo Kaisha, CR-90, 0.25μm)					50	70		50	70
Items	Methods	Conditions	Units						
Hardness type A	ISO 7619-1	After 15sec	-	55	65	75	14	28	50
Specific gravity	ISO 1183	-	-	1.08	1.47	1.76	1.06	1.46	1.75
Strength at break	Kuraray In-house method	500 mm/min, 1 mmt, Strain between chucks	MPa	11	11	10	7.1	6.7	7.2
Elongation at break			%	920	430	120	1700	970	430
100% Modulus			MPa	1.8	4.0	9.7	0.21	0.47	1.7
Transmittance	ISO 13468-1	1 mmt / 0.3 mmt	%	92 / 92	0.0 / 0.3	0.0 / 0.2	92 / 92	0.0 / 0.4	0.0 / 0.2

Compounding conditions: Kneading: Kneader temp.: 140-160 degC, Pelletizing: Extruder temp.: 130-140 degC
Injection molding temp.: 150-160 degC

- ✓ KURARITY™ can make highly filled compounds without losing flexibility.
- ✓ Highly filled KURARITY™ / TiO_2 sheet showed low transmittance value with < 1mmt thickness.

KURARITY™ / $Al(OH)_3$ compounds

KURARITY™ LA2250				100	50	30			
KURARITY™ LA3320							100	50	30
$Al(OH)_3$ (Nippon Light Metal Company, BF013, 1μm)					50	70		50	70
Items	**Methods**	**Conditions**	**Units**						
Hardness type A	ISO 7619-1	After 15 sec	-	55	81	92	14	42	77
Specific gravity	ISO 1183	-	-	1.08	1.71	2.19	1.06	1.68	2.15
Strength at break	ISO 37	500 mm/min, 1 mmt	MPa	11	8.5	8.3	7.1	4.6	3.3
Elongation at break			%	920	220	60	1700	670	250
100% Modulus			MPa	1.8	7.5	---	0.21	1.2	3.2
Flammability	UL-94 V	1 mmt	-	none	V-2	V-0	none	V-2	V-0

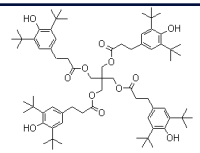
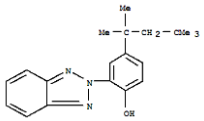
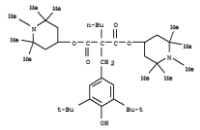
Compounding conditions: Kneading: Kneader temp.: 140-160 degC, Pelletizing: Extruder temp.: 130-140 degC
Injection molding temp.: 150-160 degC

- ✓ KURARITY™ can make highly filled compounds without losing flexibility.
- ✓ KURARITY™ can compound at low temperature (< 200deg.C), $Al(OH)_3$ can be used as flame retardant.

Example of KURARITY™ / filler compounds

Filler	Particle size [μm]	Specific gravity	Addition amount [wt%]	Example of provided character by filler
$Mg(OH)_2$	2.3	2.4	> 70	Flame retardant
$Al(OH)_3$	1	2.4	> 70	Flame retardant
$CaCO_3$	4	2.7	> 40	Extender
Talc	4	2.7	> 40	Extender
Mica	4	2.8	> 40	Vibration control
TiO_2	0.25	4	> 70	Light shielding, reflective
$BaSO_4$	1.5	4.5	> 40	Light diffusion
Sb_2O_3	1-2	5.2	> 40	X-ray shielding

Stabilizers for KURARITY™

	Recommendation	Equivalent Material	Amount	CAS No.	
Antioxidant Hindered phenol type	ADKSTAB™ AO-60 (ADEKA)	Irganox® 1010 (BASF)	0.1 phr	6683-19-8	
Antioxidant Phosphates type	ADKSTAB™ PEP-36 (ADEKA)	NA	0.1 phr	80693-00-1	
UVA	VIOSORB 583 (KYODO CHEMICAL)	TINUVIN® 329 (BASF)	0.2 phr	3147-75-9	
HALS	TINUVIN® 144 (BASF)		0.2 phr	63843-89-0	

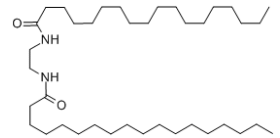
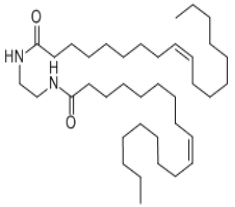
✓ Any anti oxidants are not applied to KURARITY™ in production since the weatherability of KURARITY™ is excellent. .

✓In general, additives are not required. Just in case of using KURARITY™ in a severe circumstance, it is recommended to use the above two anti oxidants to prevent coloring under long-term heat exposure. (in extruders, tanks of hot-melt coaters) Our experience tells to use them both at once in order to maximize the anti oxidant effects.

✓ In addition to the anti oxidants, adding the UVA and HALS like the above will reinforce the excellent weatherability of KURARITY™

*IRGANOX and TINUVIN are registered trademarks of BASF SE
*ADKSTAB is a registered trademark of ADEKA Corporation
*VIOSORB is a registered trademark of Kyodo Chemical Co., Ltd.

Other applicable additives for KURARITY™

	Recommendation	Amount	CAS No.	
Anti-Blocking Agent	ALFLOW® H-50T (NOF CORPORATION)	0.03-0.1 phr	110-30-5	
	N,N'-Ethylenebis(stearamide)			
Demoulding	Zinc stearate	0.01-0.05 phr	557-05-1	
Slipping Agent	SLIPACKS O (Nippon Kasei Chemical Co., Ltd.)	0.01-0.05 phr	110-31-6	
	N,N'-Ethylenebis(oleic amide)			

- ✓ The ALFLOW® is already applied to KURARITY™ LA2140e,LA2330 and LA2250. No anti-blocking agents are applied to LA1114 and LA4285.
- ✓ You can add the above recommended amount of the anti-blocking agent in case you need to reinforce the anti-blocking performance of KURARITY™.
- ✓ Experience has shown that the demolding agent helps to demold molded components without loosing smooth surface of the components.
- ✓ The slipping agent is recommended in case you feel the surface of the molded components is sticky. This slipping agent is also useful to protect the surface from scratches by certain degrees.

*ALFLOW is a registered trademark of NOF corporation

Silicone based additive to improve abrasion resistance

	LA2270	LA2270 GENIOPLAST® 0.5% Dryblended	LA2270 GENIOPLAST® 1% Dryblended
Appearance (Injection molded)			
Taber abrasion H22, 1 kgf, 1000 times	730 mg	100 mg	100 mg

*GENIOPLAST® is from Asahi Kasei Wacker Silicone Co., Ltd.
GENIOPLAST is a registered trademark of Wacker Chemie AG

Injection molding conditions: Temp.=210 deg.C , V=20 mm/s, mold=150mm*100 mm*2 mmt

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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 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 KURARITY™ for any application.
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