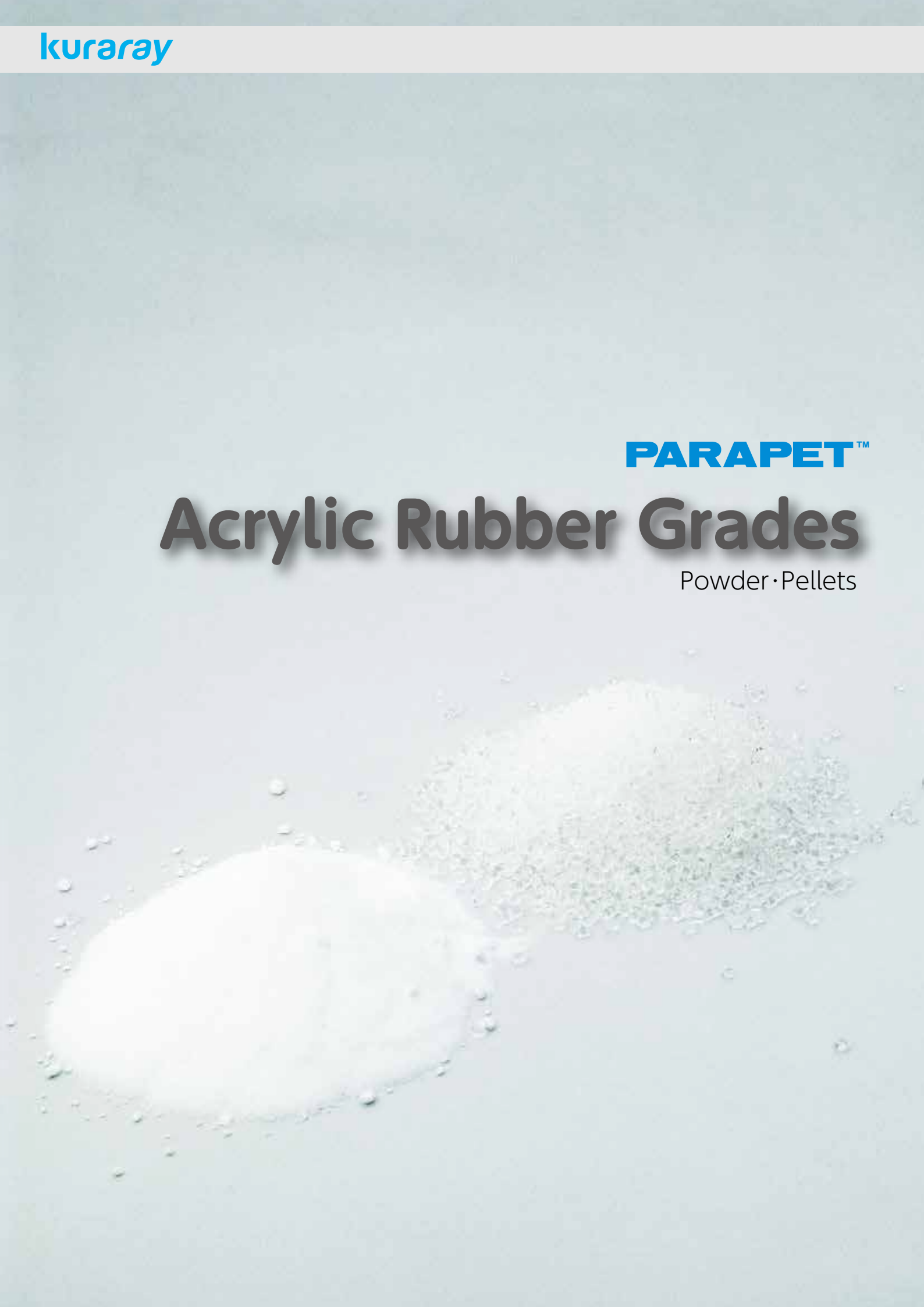
kuraray

PARAPET™

Acrylic Rubber Grades

Powder・Pellets



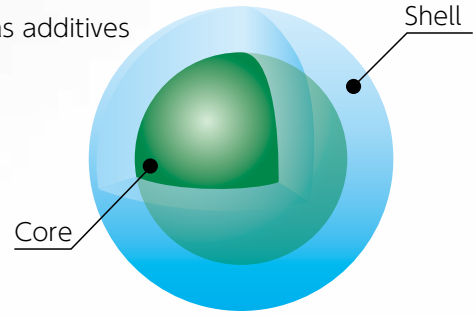
■What are “PARAPET™” Acrylic Rubber grades?

They are products made of acrylic core-shell type rubber particles that have impact resistance and flexibility maintaining transparency and weather resistance, which are the advantages of methacrylic resin.
Kuraray is developing grades with various characteristics by devising the particle designing of the multi-layer structure.
“PARAPET™” Acrylic Rubber grades are used for molding (injection molding and extrusion molding for film or sheet) and as additives to thermoplastic resins.

Core (rubber performance): Cross-linked rubber particles mainly composed of acrylic

↕ Graft bonding

Shell (compatible): Acrylic polymer



Image

List of Acrylic Rubber grades

grade	SA	GR-F	GR-FH
Type	Soft grade (A60-A90)	Film grade (resisting bending whitening and warm water whitening)	Film grade (resisting bending whitening and ensuring high hardness)
Rubber particle size of core-shell type	Small	Small	Small
Main application	Soft materials, films, sealants, and additives	Film (e.g., building materials)	Film (e.g., decorations)
Main molding method	Profile extrusion, calendar molding, and injection molding	Extrusion (T die)	Melt extrusion (T die)

* Product forms include powder (with a diameter of several hundred micrometers) and pellets.


Powder


Pellets

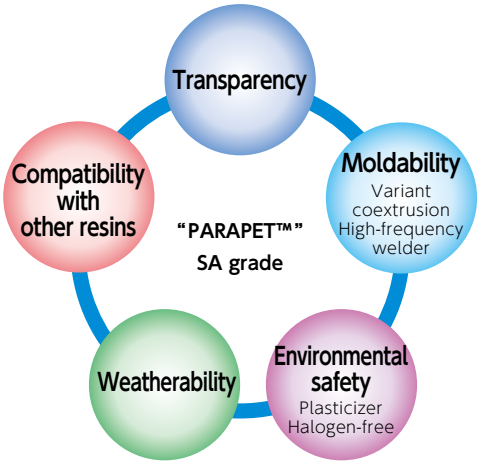
SA

Overview of “PARAPET™” SA grade

Overview and Features

“PARAPET™” SA grade is a unique acrylic resin with flexibility developed by Kuraray’s emulsion polymerization technology.
We succeed in softening acrylic resin without Plasticizers.
The “PARAPET™” SA grade consists of core-shell rubber particles with the following features:

- Soft material with high transparency
- Plasticizer-free
- Excellent weather resistance and hydrolysis resistance
- Good adhesion and compatibility with other resins
- Possible to extrude deformed shapes with complicated cross-sectional appearances due to its high viscosity
- Pellet and powder types available



The grade map

Hardness (Type D)	D40	D50	D70
Hardness (Type A)	A30	A50	A100
“PARAPET™” SA grade	SA-CW001 (A60) / SA-FW001 SA-NW001 (A70) / SA-FR201 (A80) / SA-NW201 (A90)	Adjustable by adding hard PMMA	
Other soft resins	Soft PVC (A50-)		
	TPU(A80-D80)		
	TPO(A60-95)		
	TPS(A30-70)		
	TPEE(A90-D70)		

* : Both powder and pellet types are available.
* : Only pellet types are available.
* The SA grade has a refractive index matched to polymethyl methacrylate (PMMA). Therefore, hardness adjustment is easy.

SA

Application Examples

Characteristics of "PARAPET™" SA grade (mentioned in the parentheses) match to various applications.

Injection molding

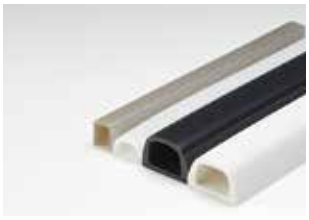
Pen grip
(Adhesion performance with polar resin and designability)

Smartphone case
(Transparency and weather resistance)

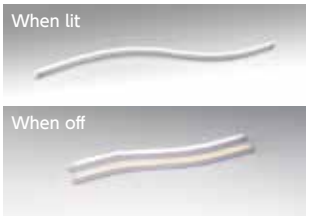
Door guard
(Transparency and weather resistance)

Profile extrusion

Joint
(Adhesion performance with polar resin and ease of extrudability of complex shapes)



Building packing materials
(Extrudability, designability, and flexibility)



Flexible LED light covers
(Extrudability and transparency)

Film

Film
(Designability and weather resistance)

Additive

E.g., elastomer additives
(Affinity with other resins and addition of acrylic features)

Physical Properties

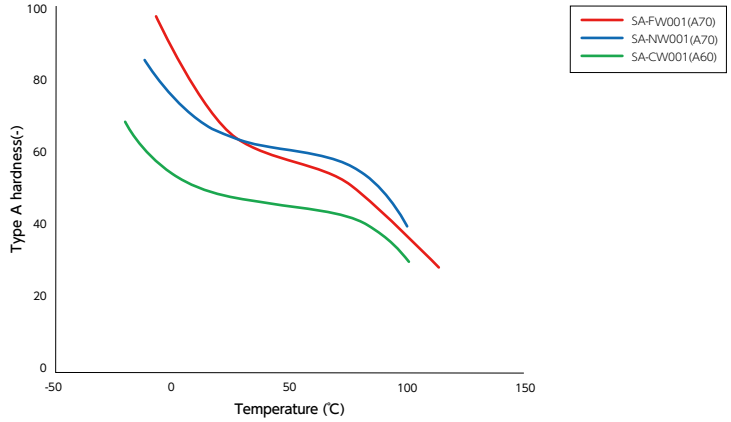
grade				SA-F (Standard)			SA-N (Improved low-temperature characteristics)			SA-C (Low hardness)	
Product name				SA-FP	SA-FW001	SA-FR201	SA-NP	SA-NW001	SA-NW201	SA-CP	SA-CW001
Shape				Powder	Pellet	Pellet	Powder	Pellet	Pellet	Powder	Pellet
Optical properties	Total light transmittance	ISO13468-1	%	90	90	90	90	90	90	90	90
	Haze	ISO13468-1	%	1	1	1	2	2	2	2	2
Mechanical properties	Hardness	ISO7619-1		A70	A70	A80	A70	A70	A90	A60	A60
	Tensile strength (500 mm/min.)	ISO37	MPa	10	10	14	12	12	14	9	9
	Elongation at break (500 mm/min.)	ISO37	%	200	200	200	200	200	170	240	240
	Tensile stress M_{100}	ISO37	MPa	5	5	8	7	7	11	4	4
	Compression permanent strain (70℃, 22 hrs.)	ISO815	%	45	45	70	50	50	75	45	45
	Permanent elongation	ISO/DIS2285	%	12	12	16	12	12	20	-	-
	Abrasion resistance	ISO9352	mg	50	50	95	45	45	220	-	-
Thermal properties	MFR (230℃, 98.07N)	ISO1133	g/10min	18	18	22	10	10	27	4	4
Other properties	Specific gravity	ISO1183	kg/cm3	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
	Coefficient of linear expansion		m/m・℃	2×10^{-4}	2×10^{-4}	2×10^{-4}	2×10^{-4}	2×10^{-4}	2×10^{-4}	2×10^{-4}	2×10^{-4}
	Surface intrinsic resistance		Ω	$10^{15}<$	$10^{15}<$	$10^{15}<$	$10^{15}<$	$10^{15}<$	$10^{15}<$	$10^{15}<$	$10^{15}<$

* All values in the above table are typical values and not guaranteed values. * All measurements were taken at 23℃.

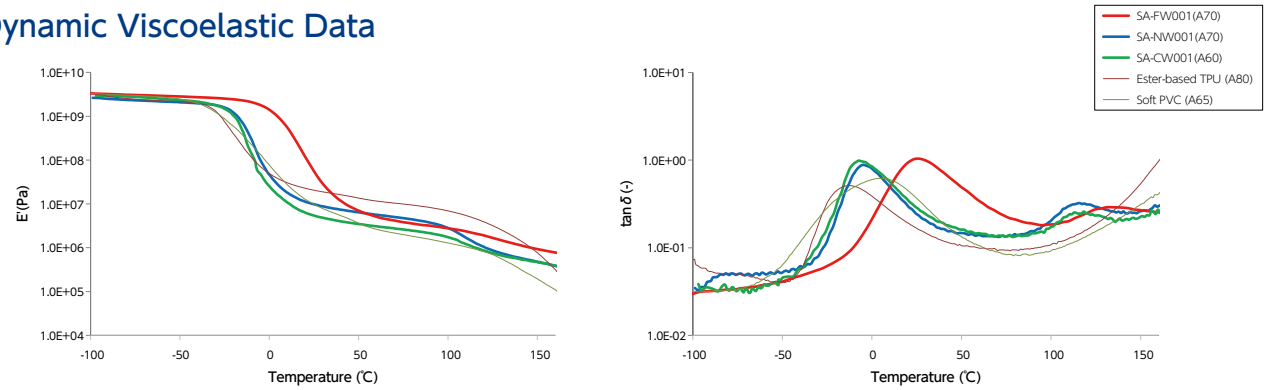
Temperature Dependency

The SA grade maintains stable hardness from room temperature to around 80°C, and it has relatively excellent heat resistance for a soft resin.

Hardness (Type A)

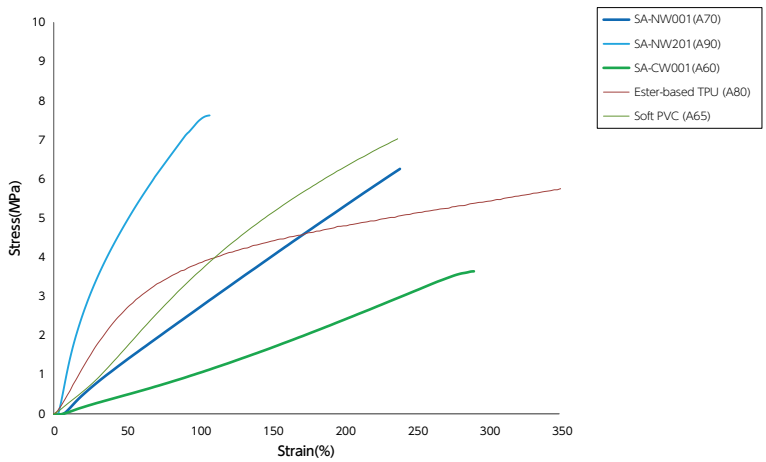


Dynamic Viscoelastic Data



Measurement method: Tensile mode, sine wave, frequency of 11.0 Hz, heating method (at the heating rate of 3°C/min.)
Test piece: Pressed piece

SS Curve

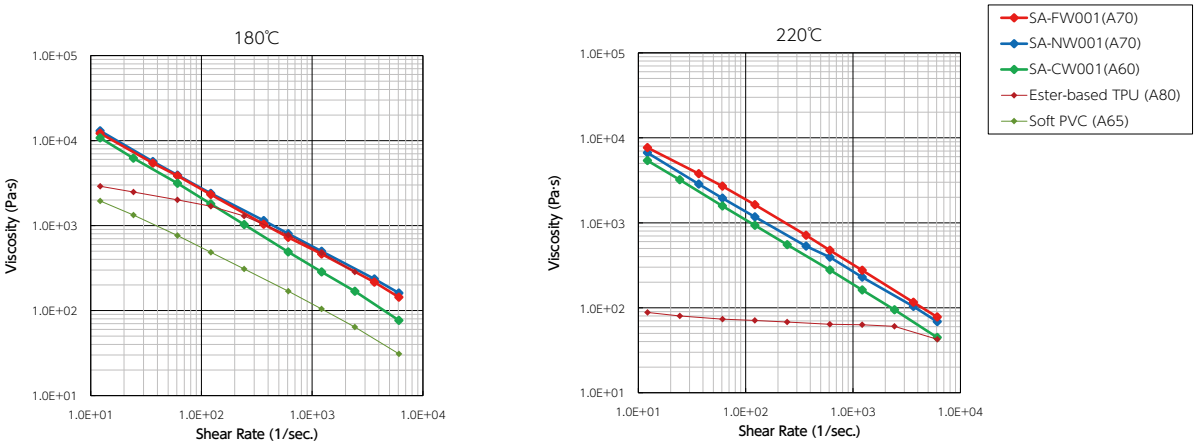


Test piece: 3 mmt (press molded)
Test speed: 500 mm/min.

SA

Capillary Flow Data

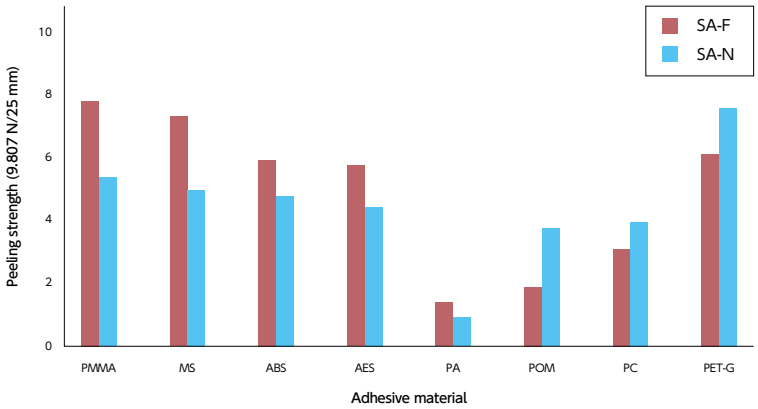
“PARAPET™” SA grade is a soft material that maintains high viscosity even in a high-temperature range and has good deformability for complicated cross-sectional shapes.
Contact Kuraray if you need temperature-specific data for each product type.



* No data on soft PVC (A65) at 220°C is available.

Compatibility with Other Resins (Two-color Moldability)

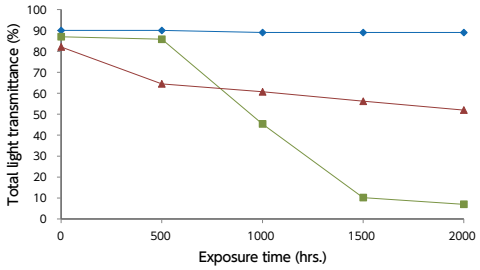
The SA grade has a high affinity for various polar resins and has good thermal adhesion. Therefore, it can be combined with multiple resins by two-color molding, insert molding, coextrusion molding, etc.

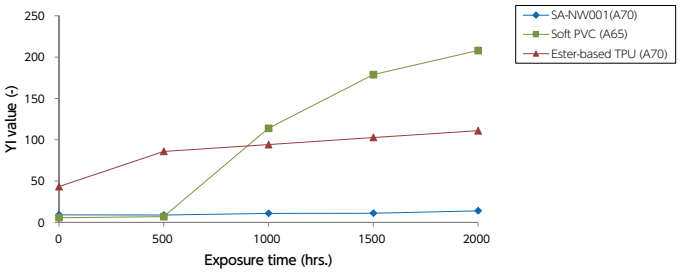


	SA grade
PMMA	+
SA grade	+
PS	+
MS	+
ABS	+
AES	+
PET-G	+
PC	+
TPU	+
PVC	+
PET	-
PA	-
PE	-
PP	-

Weatherability

(1) Optical property transition





Measurement method: ISO 4892-4(Methods of exposure to laboratory light sources Part 4: Open-flame carbon-arc lamps)
Irradiation intensity: 255±10% W/m2 at 480mm
Black standard temperature: 63℃
Relative humidity (RH): 50%
Cycle condition: 120 minutes cycle (Irradiation + Water spray for 18 min. and irradiation for 102 min.)
Test piece: hot press plate (3mmt)

	0hr	1000hr	1500hr	2000hr
SA-NW001				
Soft PVC				
Ester-based TPU				

(2) Transition of mechanical properties

	Item	Test method	Unit	Exposure time [hrs.]				
				0	500	1000	1500	2000
SA-NW001	Hardness	ISO48	-	A70	A71	A72	A76	A76
	Tensile strength	ISO37	MPa	12	11	10	10	10
	Elongation at break	ISO37	%	200	160	130	110	110
	Tensile stress M_{100}	ISO37	MPa	7	7	7	8	8
SA-CW001	Hardness	ISO48	-	A60	A61	A62	A63	A63
	Tensile strength	ISO37	MPa	9	9	9	10	10
	Elongation at break	ISO37	%	240	210	180	170	170
	Tensile stress M_{100}	ISO37	MPa	4	5	5	5	5
Soft PVC	Hardness	ISO48	-	A65	A66	A70	A72	A72
	Tensile strength	ISO37	MPa	13	11	11	10	10
	Elongation at break	ISO37	%	800	600	550	430	400
	Tensile stress M_{100}	ISO37	MPa	3	4	4	5	5
Ester-based TPU	Hardness	ISO48	-	A72	A74	A78	A79	A80
	Tensile strength	ISO37	MPa	23	19	7	7	7
	Elongation at break	ISO37	%	2,000	1,200	800	650	600
	Tensile stress M_{100}	ISO37	MPa	4	4	4	3	3

Molding Conditions

Temperature (℃)		150	200	250
Profile extrusion molding	Cylinder temperature	150–210		
	Die temperature		180–210	
Injection molding	Cylinder temperature		180–240	

* The drying conditions are at 70°C × 4 to 6 hours (unopened items), and at 70°C × 10 hours for opened products and unopened products that have been stored for a long time.
* Contact your Kuraray representative for detailed molding conditions.

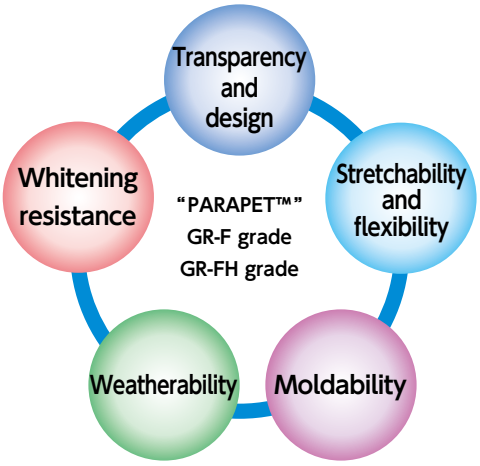
GR-F

Overview of “PARAPET™” GR-F grade and GR-FH grade

Overview and Features

“PARAPET™” GR-F grade and GR-FH grade are impact-resistant acrylic resins for films developed by Kuraray’s emulsion polymerization technology.
They are core-shell rubber particles with the following features:

- They have high weather resistance peculiar to acrylic resin, transparency, and designability.
- Film molding is possible with core-shell rubber particles alone.
- Hardness adjustment is easy since the refractive index is adjusted to polymethyl methacrylate (PMMA).
- Film molding with suppressed stress bleaching and hot water bleaching is possible (*).
- We can provide both pellet and powder types.



* The GR-F grade has good stress whitening resistance and hot water whitening resistance.
* The GR-FH grade is good only for stress whitening.

Application Examples

Characteristics of “PARAPET™” GR-F and GR-FH grade (mentioned in the parentheses) match to various applications.

Decorative film for building materials
(Weather resistance, design resistance, and bending whitening resistance)

Decorative film for automobiles
(Weather resistance, design resistance, bending whitening resistance)

High-brightness reflective film
(Weather resistance, design, and adhesion with polar resin)

Physical Properties

Molding Material

Item	Test method		Test condition	Unit	Film grade GR-F	Film grade GR-FH	Control (1)* HR-S	Control (2)** GR 00100
	ISO No.	JIS No.						
Total light transmittance	ISO 13468-1	JIS K7361-1	3mmt	%	91≦	91≦	92≦	91≦
Haze	ISO 14782	JIS K7136	3mmt	%	≦1.0	≦0.5	≦0.3	≦1.8
Refractive index	ISO 489	JIS K7142	nd	-	1.49	1.49	1.49	1.49
Tension modulus	ISO 527-2	JIS K7161	1A/1	Mpa	1,200	1,400	3,300	1,700
Charpy impact strength (with notches)	ISO 179	JIS K7111	1eA	KJ/m^3	4.5	2.5	1.4	6.5
Deflection temperature under load (with annealing)	ISO 75-2	JIS K7191	1.80MPa	℃	65	76	101	83
Vicat softening temperature	ISO 306	JIS K 7206	B50	℃	72	86	110	90
MFR	ISO 1133	JIS K 7210	230℃ 37.3N	g/10min	1.3	1.4	2.4	1.5

* HR-S: "PARAPET™" Optical grade (Heat resistant type)
** GR00100: "PARAPET™" Impact resistant grade (General type)

Film

By adding to Polymethyl methacrylate, you can adjust general physical properties.
The table below compares the physical properties of GR-F grade and GR-FH grade alone, along with the physical properties of those by adding "PARAPET™" HR-S (an optical grade with heat resistance) to each resin.

Membrane formation method: Melt extrusion
Film formation conditions: Cylinder temperature: 230°C to 270°C; Die temperature: 250°C to 280°C
Thickness: 75 μm

Item	Test method		Unit	GR-F	100wt%	80wt%			Control (3)* (Soft film)	Controln (4)** (Hard film)
				GR-FH			100wt%	80wt%		
	ISO No.	JIS No.		HR-S		20wt%		20wt%		
Total light transmittance	ISO 13468	JIS K 7361-1	%		92	92	92	92	92	92
Haze	ISO 13468	JIS K 7136	%		0.3	0.3	0.1	0.1	0.9	0.9
Pencil hardness	ISO 15184	JIS K 5600-5-4	-		<6B	<6B	4B	2B	<6B	H
Tension modulus	ISO 527-1	JIS K 7127	MPa		1100	1400	1300	1700	1300	2200
Tensile yield strength	ISO 527-3	JIS K 7127	MPa		34	41	41	46	42	57
Tensile breaking strength	ISO 527-3	JIS K 7127	MPa		29	35	37	46	34	55
Tensile breaking elongation	ISO 527-3	JIS K 7127	%		23	18	20	16	21	12
Tear strength	ISO 6383-1	JIS K 7128-1	N/mm		1.6	1.1	1.2	1.2	1.8	1.3
MIT fold resistance	ISO 5626	JIS P 8115	Times		340	200	210	130	180	70

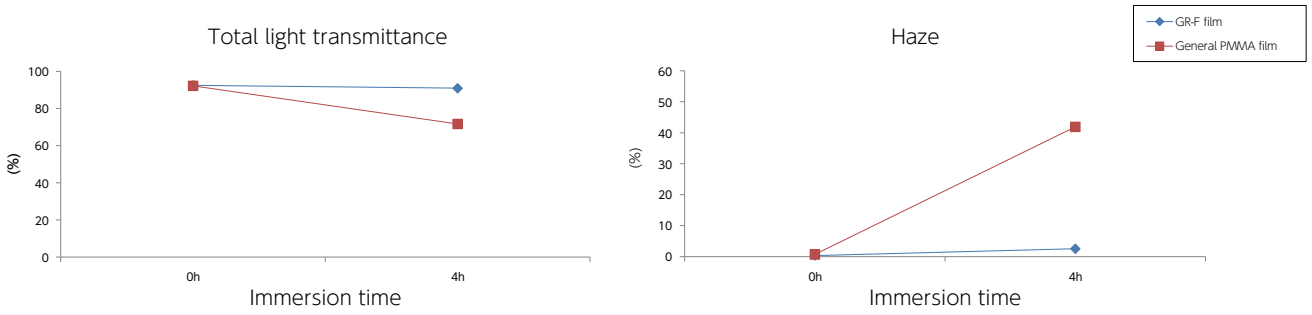
* General PMMA film (soft)
** General PMMA film (hard)

GR-F

Whitening Resistance

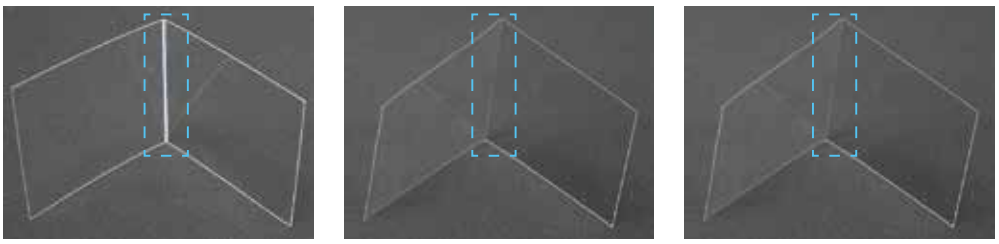
Warm Water Whitening

The GR-F grade consists of core-shell rubber particles with excellent warm water whitening resistance.



Test piece: Melt extruded film (50 μm)
Measuring method: Immersed in warm water at 95°C → Air purge → Left at room temperature for 5 minutes → Measured

Stress Whitening (Bending Whitening)



General PMMA film
Bend whitening

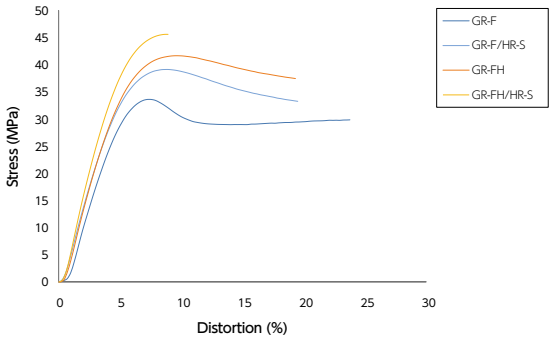
GR-F grade
No folding whitening

GR-FH grade
No folding whitening

SS Curve

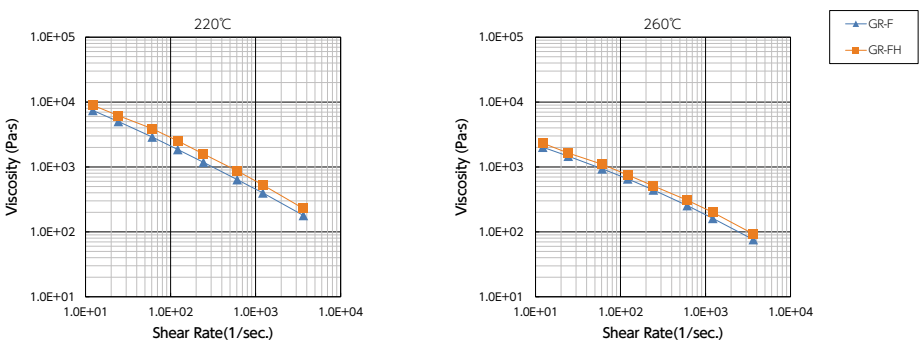
This graph shows comparison of the Film physical properties which made of GR-F or GR-FH only itself and added 20wt% "PARAPET™" HR-S (an optical grade with heat resistance) to each resin.

Specimen: Melt extruded film (75 μm)
Test speed: 200 mm/min.



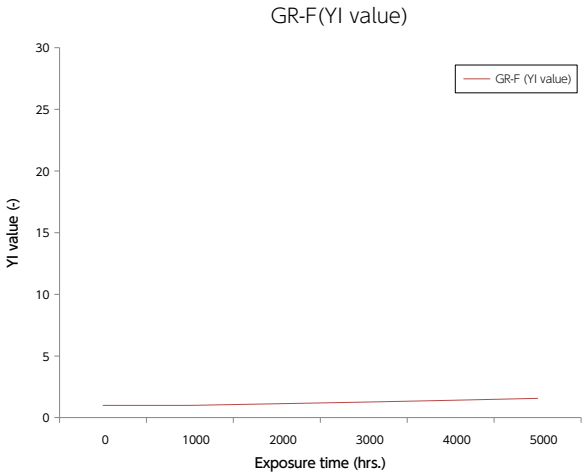
Capillary Flow Data

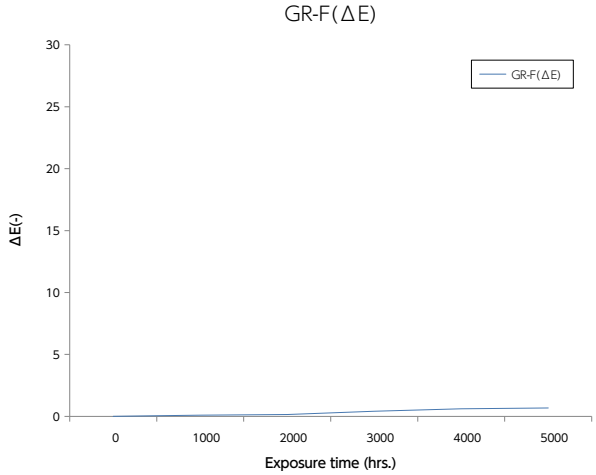
If you need temperature-specific data of each product type, please contact us.



Weatherability

Transition of Optical Characteristics





Measurement method: ISO 4892-2 (xenon)
Irradiation intensity: 60 W/m2 (300-400 nm)
Black standard temperature: 65℃
Relative humidity (RH): 50%
Cycle condition: 120 minutes cycle (Irradiation + Water spray for 18 min. and irradiation for 102 min.)
Test piece: Molten extruded film (75 μm) with UV absorber formulation

Film formation condition (melt extrusion)

Temperature (℃)		200	250	300
GR-F grade GR-FH grade	Cylinder temperature		230℃ – 270℃	
	Die temperature		250℃ – 280℃	

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Handling Precautions

- For details on the safety, handling, and storage of each type of product, refer to the corresponding material safety data sheet (MSDS).
- Check related laws and regulations and take safety measures suitable for the usage and application before use.
- The contents of this catalog are subject to change without notice.
- Contact Kuraray if you are considering using the product for medical or food applications. Never use the product for implant medical devices or medical applications.
- Consider and adequately set your industrial property rights and conditions of using applications exemplified in this catalog.
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* All numerical values and graphs in this catalog are typical examples and are not guaranteed values or data.

https://www.parapet.jp/english/

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