

kuraray

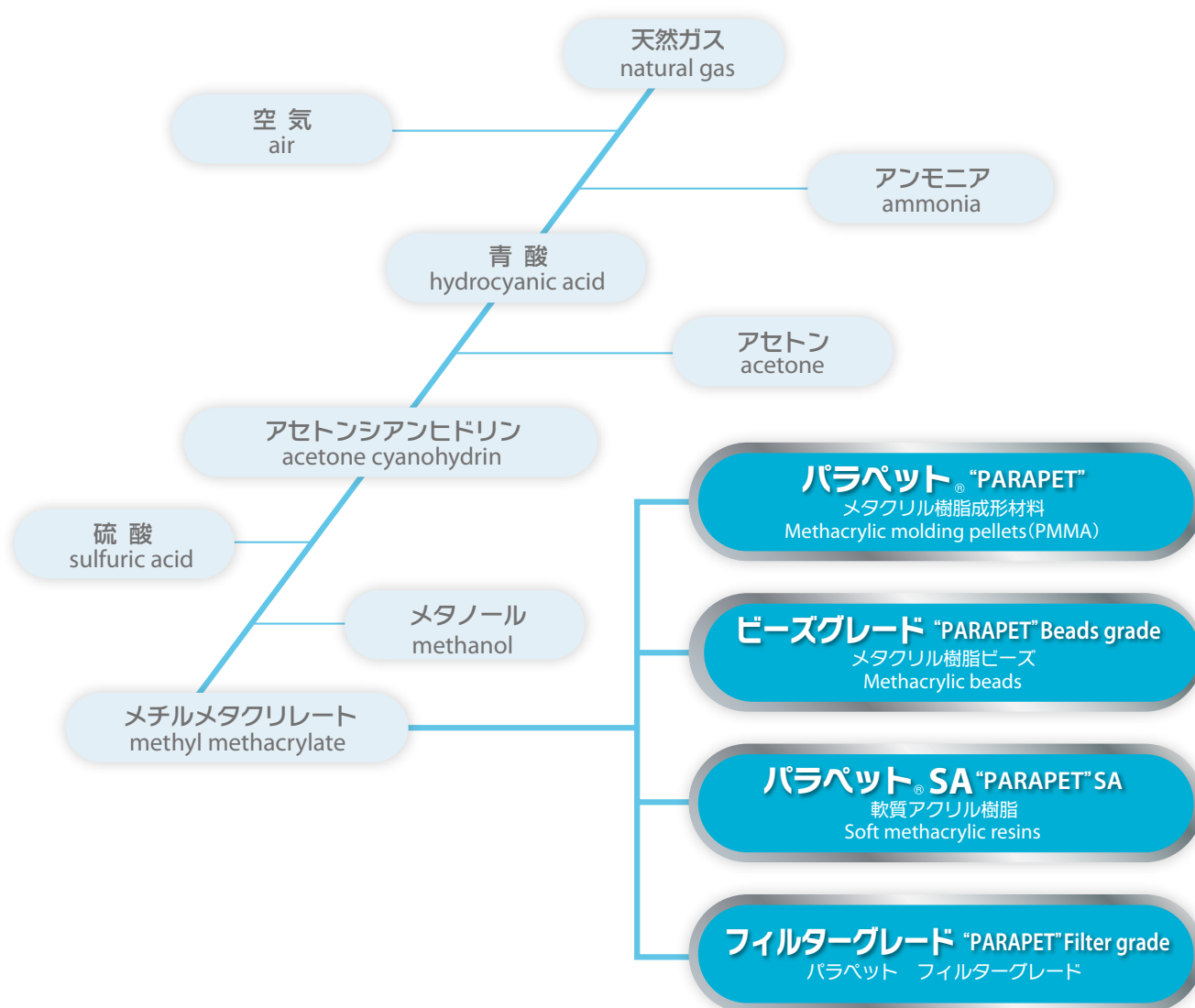
m e t h a c r y l i c m o l d i n g r e s i n s



PARAPET

パラペット®

KURARAY CO., LTD.



「パラペット®」は株式会社クラレが製造販売しているメタクリル樹脂成形材料の登録商標です。
メタクリル樹脂 (PMMA) は以下の特長があり、「プラスチックの女王」と呼ばれています。

"PARAPET" is the trade name for the methacrylic molding resins (PMMA), manufactured by KURARAY Co., Ltd.

- 1 透明性が優れ、輝きある光沢があります。
Superior transparency with bright luster.
- 2 耐候性、表面硬度はプラスチックの中で最も優れています。
Most excellent weatherability and surface hardness among plastics.
- 3 耐薬品性が良好です。
Excellent chemical resistance.
- 4 電気絶縁性が良好です。
Excellent electrical insulation.
- 5 機械加工性、強度に優れています。
Excellent mechanical strength and workability.
- 6 着色が自由で、美しい色調が得られます。
Freely colored resulting in attractive colors.

「パラペット®」はこれらの優れた特性により、光学レンズや液晶バックライト導光板、自動車、照明、雑貨等の身の回りのあらゆる製品にその用途は広がっています。

"PARAPET"s superior features have been expanding into the daily products that surround us, such as lighting and automotive applications, light guide plates for liquid crystal backlights, and optical lenses.

Standard grade	Each grade of “PARAPET™” has various features. Please select the grade that meets your product need and appropriate molding method.			
	Product type	Characteristics		Applications
	G	General	General purpose resin. Especially, superior mold release and easy flow.	general sundries, nameplates, illumination covers, stationeries, industrial parts, etc
	GF・GF-S	High flowability	Excellent flow resin for large and thin walled product.	
	EH	Extrusion	Suitable for extrusion and superior in solvent resistance and mechanical strength.	
	HR・HR-L	Heat resistant	Heat resistance grade with superior mechanical strength, and excellent solvent resistance.	car taillights, car meter covers, nameplates, illumination covers, illumination lenses, extrusion sheets
	HR-G	Heat and solvent resistant	Of the standard grade products, especially superior in solvent resistance.	
	HR-F	Heat resistant, high-flowability	Heat resistant and high-flowability.	

Optical grade	A superior transparency, specialized in optical applications.		
	Product type	Characteristics	Applications
	GH S	Suitable for light guide plate for LCD. Superior in optical characteristics, fluidity and transferability.	light guide plates, optical lenses, etc
	HR-S	Especially superior in heat resistance.	

High impact grade	“PARAPET™” GR series demonstrates excellent resistance to impact and also has a superior optical and weather resistance attributes as a methacrylic resin.		
	Demonstrates excellent resistance to chemicals, this grade is useful in decreasing cracking during printing and paintcoating. Various lineup are available to meet your requirements as heat resistance, high flow etc. ※Please see the physical properties table for product name and lineup.		

Special grade	The grades specialized in antistatic and radial specific wavelength selection.			
	Product type	Characteristics		Applications
	SF-L	Antistatic	The antistatic grade maintaining the superior properties of acrylic resin.	stationeries, name plates, etc
	Filter grade	Near infrared rays passing	This grade is a sharply cut filter with specific wavelength selection provided for methacrylic resin. ※Please see the page of ""PARAPET"" Filter grade"for more information.	remote controls for TVs, audio devices, etc
		Ultra violet rays absorbing		various kinds of camera flash cover,etc
	GR-F	Antistress whitening	This grade has superior stress and warm water whitening resistance.	film, modifier

Beads grade	Possessing the properties of a standard grade, this series has a small particle diameter that is suitable for use in various mixing and modifying applications.			
	Product type	Characteristics		Applications
	GF-P	High flowability	Methacrylic beads that have GF grade's physical properties. Average particle diameter: 270 μm	binder, shock absorbing material, modifier
	G-P	General	Methacrylic beads that have G grade's physical properties. Average particle diameter: 250 μm	
	EH-DP	Extrusion	Methacrylic beads that have EH grade's physical properties. Average particle diameter: 330 μm	
	HR-LP	Heat resistant	Methacrylic beads that have HR-L grade's physical properties. Average particle diameter: 310 μm	
	H-BP	Super high flowability	Average particle diameter:310 μm	
	SS-P	Equilibrium particle size	Average particle diameter:170 μm	

“PARAPET™” SA	High flexibility grade, possessing the weather resistance and transparency attributes of methacrylic resin. ※Please see the page of “PARAPET™” SA for more information.					
	Product type		Characteristics		Applications	
	Pellet	SA-F	FW001	Standard	Standard soft methacrylic resin. This grade is separated by hardness as FW001 and FR201.	pen grip, general sundries, film, parts for vehicles
			FR201			
		SA-N	NW001	Excellent in low temp	This grade maintains softness even at low temperatures. This grade is separated by hardness as NW001 and NW201.	
			NW201			
	SA-C	CW001	Softest	This grade is softest in the “PARAPET™” SA.		
	Powder	SA-FP		Standard	Powder type of SA-F. A-Hardness: 70	modifier
		SA-NP		Excellent in low temp	Powder type of SA-N. A-Hardness: 70	
		SA-CP		Softest	Powder type of SA-C.A-Hardness: 60	

kuraray "PARAPET™" Examples of Applications, Specifications

Vehicles



Optical,electric parts



Daily goods, wares and others



Specifications

(1) UL standard

"PARAPET™" is certified to be in accordance to the standard (94HB, 746Cf1) of UL (Underwriters Laboratories, Inc., U.S.A).

UL standard
File No.E54562

"PARAPET™" Grades

94HB

G, GF, GF-S, HR, HR-F, HR-G,EH, GR, GH, GH-K

746Cf1

HR, GH

(2) SAE standard (AMECA)

In order to use "PARAPET™" as lens for vehicles, etc., "PARAPET™" is certified to be in accordance to the SAE (Society of Automotive Engineers) standard.

SAE standard

"PARAPET™" Grades

HR, HR-F, HR-G, HR-S, GR

(3) HS code

HS code of "PARAPET™" is listed at right.

HS code

"PARAPET™" Grades

3906.10

GH, GH-K, HR, HR-S, HR-L, SS

3906.90

G, GF, GF-S, SA, GR, GR-F, EH

Property	Test Method		Condition	Unit	Standard (Heat Resistance) Grade							Optical Grade		
	ISO No.	JIS No.			GF	G	EH	HR	HR-L	HR-G	HR-F	GH S	GH-K	HR-S
					High Flow	General	Extrusion	Heat Resistant	Heat Resistant	Heat and solvent Resistant	Heat Resistant Good Flow	Light Guide Plate	Heat Resistant	Heat Resistant
Optical														
Light transmission	ISO 13468-1	JIS K7361-1	3mm	%	92≦	92≦	92≦	92≦	92≦	92≦	92≦	92≦	92≦	92≦
Haze	ISO 14782	JIS K7136	3mm	%	≦0.3	≦0.3	≦0.3	≦0.3	≦0.3	≦0.3	≦0.3	≦0.3	≦0.3	≦0.3
Refractive Index Nd	ISO 489	JIS K7142	nd	—	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49
Mechanical														
Tensile modulus	ISO 527-2	JIS K7161	1A/1	MPa	3300	3300	3300	3300	3300	3300	3300	3300	3300	3300
Tensile strength	ISO 527-2	JIS K7161	1A/5	MPa	67	70	75	77	77	78	65	62	60	77
Tensile strain at break	ISO 527-2	JIS K7161	1A/5	%	3	4	7	5	5	7	3	2	2	5
Flexural modulus	ISO 178	JIS K7171	—	MPa	3300	3300	3300	3300	3300	3300	3300	3300	3300	3300
Flexural stress at break	ISO 178	JIS K7171	—	MPa	108	110	125	128	114	126	100	90	80	114
Charpy impact strength/unnotched	ISO 179	JIS K7111	1eU	1eU	19	20	23	22	22	23	20	20	19	22
/notched	ISO 179	JIS K7111	1eA	1eU	1.3	1.3	1.4	1.4	1.4	1.4	1.3	1.3	1.2	1.4
Rockwell hardness	ISO 2039-2	JIS K7202	M scale	—	94	98	99	102	103	99	102	100	97	103
Thermal														
Deflection temperature under load /annealed	ISO 75-2	JIS K7191	1.80MPa	℃	86	93	100	101	101	94	101	95	95	101
Vicat softening point	ISO 306	—	B50	℃	92	99	101	110	110	103	108	104	103	110
MFR	ISO 1133	—	230℃ 37.3N	g/10min	15	8	1.3	2	2.4	0.6	5.5	10	22	2.4
Specific heat	—	JIS K7123	—	J(g・℃)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Coefficient of linear expansion	—	JIS K7197	—	1/℃	6×10 ⁻⁵	6×10 ⁻⁵	6×10 ⁻⁵	6×10 ⁻⁵	6×10 ⁻⁵	6×10 ⁻⁵	6×10 ⁻⁵	6×10 ⁻⁵	6×10 ⁻⁵	6×10 ⁻⁵
Thermal conductivity	—	JIS KA1412	—	W/(m・℃)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Electrical														
Surface resistivity	—	JIS K6911	—	Ω	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶
Volume resistivity	—	JIS K6911	—	Ωm	>10 ¹³	>10 ¹³	>10 ¹³	>10 ¹³	>10 ¹³	>10 ¹³	>10 ¹³	>10 ¹³	>10 ¹³	>10 ¹³
Dielectric breakdown strength	—	JIS K6911	4kV/sec	MV/m	20	20	20	20	20	20	20	20	20	20
Dielectric constant	—	JIS K6911	60Hz	—	4	4	4	4	4	4	4	4	4	4
Other														
Density	ISO 1183	JIS K7112	—	g/cm ³	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19
Water absorption at 23℃	ISO 62,method 1	—	24 hr	%	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Molding shrinkage	ISO 294-4	JIS K7152-4	—	%	0.2~0.6	0.2~0.6	0.2~0.6	0.2~0.6	0.2~0.6	0.2~0.6	0.2~0.6	0.2~0.6	0.2~0.6	0.2~0.6
Flammability	UL94	—	—	class	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB
Burning velocity	—	JIS K6911	—	cm/min	3	3	3	3	3	3	3	3	3	3

*All values in the above table are typical values of natural color product.

Property	Test Method		Condition	Unit	High Impact Grade							
	ISO No.	JIS No.			GR04940	GR04970	GR00100	GR01240	GR01270	GR-H24	GR-H42	GR-H60
					General	General	General	Heat Resistant	Heat Resistant	High-Flowability	High-Flowability	High-Flowability
Optical												
Light transmission	ISO 13468-1	JIS K7361-1	3mm	%	92≦	91≦	91≦	92≦	91≦	92≦	91≦	91≦
Haze	ISO 14782	JIS K7136	3mm	%	≦1.0	≦1.5	≦1.8	≦1.0	≦1.5	≦1.0	≦1.4	≦1.5
Refractive Index Nd	ISO 489	JIS K7142	nd	—	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49
Mechanical												
Tensile modulus	ISO 527-2	JIS K7161	1A/1	MPa	2500	2100	1700	2500	2100	2400	2100	1600
Tensile strength	ISO 527-2	JIS K7161	1A/5	MPa	59	48	40	62	50	55	45	38
Tensile strain at break	ISO 527-2	JIS K7161	1A/5	%	17	50	60	15	40	22	50	61
Flexural modulus	ISO 178	JIS K7171	—	MPa	2600	2200	1800	2600	2200	2500	2200	1700
Flexural stress at break	ISO 178	JIS K7171	—	MPa	95	78	62	96	79	88	76	61
Charpy impact strength/unnotched	ISO 179	JIS K7111	1eU	KJ/m²	56	71	91	50	73	56	71	101
/notched	ISO 179	JIS K7111	1eA	KJ/m²	3	4.5	6.5	3	4.5	2	4	5
Rockwell hardness	ISO 2039-2	JIS K7202	M scale	—	84	68	44	85	68	81	63	39
Thermal												
Deflection temperature under load /annealed	ISO 75-2	JIS K7191	1.80MPa	℃	91	86	83	95	90	86	84	77
Vicat softening point	ISO 306	JIS K7206	B50	℃	97	93	90	102	97	94	92	88
MFR	ISO 1133	JIS K7210	230℃ 37.3N	g/10min	5	3	1.5	1.8	1.7	10	6	3
Specific heat	—	JIS K7123	—	J(g・℃)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Coefficient of linear expansion	—	JIS K7197	—	1/℃	9×10 ⁻⁵	10×10 ⁻⁵	11×10 ⁻⁵	9×10 ⁻⁵	10×10 ⁻⁵	9×10 ⁻⁵	10×10 ⁻⁵	11×10 ⁻⁵
Thermal conductivity	—	JIS KA1412	—	W/(m・℃)	2	2	2	2	2	2	2	2
Electrical												
Surface resistivity	—	JIS K6911	—	Ω	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶
Volume resistivity	—	JIS K6911	—	Ωm	>10 ¹³	>10 ¹³	>10 ¹³	>10 ¹³	>10 ¹³	>10 ¹³	>10 ¹³	>10 ¹³
Dielectric breakdown strength	—	JIS K6911	4kV/sec	MV/m	20	20	20	20	20	20	20	20
Dielectric constant	—	JIS K6911	60Hz	—	4	4	4	4	4	4	4	4
Other												
Density	ISO 1183	JIS K7112	—	g/cm ³	1.18	1.17	1.16	1.18	1.17	1.18	1.17	1.16
Water absorption at 23℃	ISO 62,method 1	—	24 hr	%	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Molding shrinkage	ISO 294-4	JIS K7152-4	—	%	0.4~0.8	0.4~0.8	0.4~0.8	0.4~0.8	0.4~0.8	0.4~0.8	0.4~0.8	0.4~0.8
Flammability	UL94	—	—	class	HB	HB	HB	HB	HB	HB	HB	HB
Burning velocity	—	JIS K6911	—	cm/min	3	3	3	3	3	3	3	3

*All values in the above table are typical values of natural color product.

Results of resistance tests to various chemicals of "PARAPET™" are shown as follows: For chemicals for special uses, preliminary tests should be performed to determine the usability of "PARAPET™" under the application conditions.

Acid

98% Sulfuric acid	✗
20% Sulfuric acid	○
35% Hydrochloric acid	△
62% Nitric acid	✗
20% Nitric acid	○
10% Phosphoric acid	○
10% Chromic acid	△
80% Formic acid	✗
Glacial acetic acid	✗
10% Acetic acid	○
10% Lactic acid	○
Saturated citric acid	○

Petroleum oil

High-octane gasoline	△
Kerosene	○
Light oil	○
Heavy oil	△
Petroleum benzene	○
Solvent naphtha	○
Lubricating oil	○
Diesel oil	○
Turpentine	○

Aromatic series , Hydrocarbon

Benzene	✗
m-Cresol	✗
Toluene	✗
Cyclohexane	✗
n-Hexane	○
Normal heptane	○

Alkali

28% Liquid ammonium	○
Saturated sodium hydroxide	○
2% Soapsuds	○

Inorganic salts (aqueous solution)

Saturated sodium chloride	○
Saturated potassium chloride	○
10% Potassium chromate	○
30% Hydrogen peroxide	○

Ketone

Methylethyl ketone	✗
Acetone	✗

Ether, Ester

Cellosolve	✗
Diethyl ether	△
Ethyl acetate	✗
Butyl acetate	✗
Dibutyl phthalate	○

Halogenated hydrocarbon

Chloroform	✗
Methylene dichloride	✗
Carbon tetrachloride	△

Alcohol

100% Methyl alcohol	△
10% Methyl alcohol	○
98% Ethyl alcohol	△
50% Ethyl alcohol	○
100% Isopropyl alcohol	△
10% Isopropyl alcohol	○
Butyl alcohol	○
Phenylcarbinol	✗

Gas

Ammonia gas	○
Chlorine gas	△
City gas	○
Ozone	○

Seasoning, Spice, and Beverage

Cider	○
Beer	○
Fruit juice	○
Wine	○
Vegetable oil	○
Animal oil	○
Soy sauce	○
Chinese red chili oil	△
Alcohol (<20%)	○

Package, etc.

Insulating tape	○
Packing tape	○
Plaster	○
Cement	○

Paint, etc.

Lacquer	✗
Oily paint	○
Water paint	○

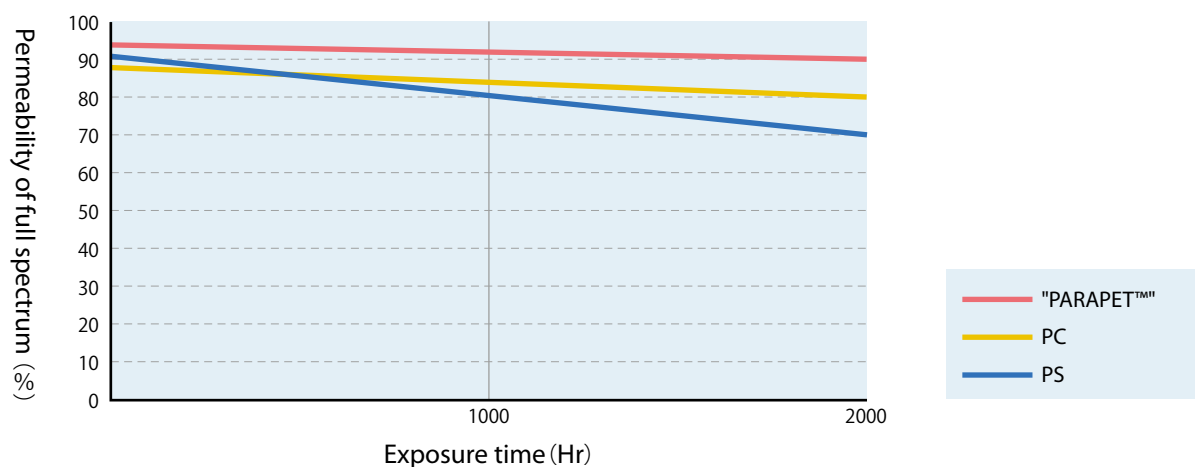
Other

Seawater	○
Bleaching solution	△
Phenol	✗
Carbon disulfide	✗
Nitrobenzene	✗
Tetrahydrofuran	✗
Diethylene glycol	○
Glycerine	○
Diethylamine	○

Comparison of Various Physical Properties with Other Resins

Resin Type	Physical Properties	Light transmission ISO 13468-1/JIS K7361-1 (%)	Deflection temperature under load ISO 75-2/JIS K7191 (°C)	Rockwell hardness ISO 2039-2/JIS K7202 (Mscale)	Thermal expansion JIS K7197 (1/°C)
"PARAPET™"		92≤	86~101	94~102	6 × 10 ⁻⁵
Polystyrene		90	65~104	70~80	6~8 × 10 ⁻⁵
AS resin		89	83~104	80~90	6~8 × 10 ⁻⁵
Polycarbonate		89	130~145	70~90	7 × 10 ⁻⁵
MS resin		90	85~90	70~85	6~8 × 10 ⁻⁵
Polyethylene		—	—	—	11~13 × 10 ⁻⁵
Polypropylene		—	—	—	6~11 × 10 ⁻⁵
Nylon 6		—	—	—	8~13 × 10 ⁻⁵
Carbon steel		—	—	—	1~2 × 10 ⁻⁵
Aluminum		—	—	—	2.4 × 10 ⁻⁵

Weatherability of "PARAPET™" and Other Resins



Molding Shrinkage

Molding shrinkage changes based on the molding shape and molding conditions. In other words, molding shrinkage depends on orientation strain and the inner cavity density of the resin. Among molding conditions, resin temperature and mold temperature especially affect molding shrinkage. The table on the right shows the molding shrinkage of "PARAPET™" compared to other resins.

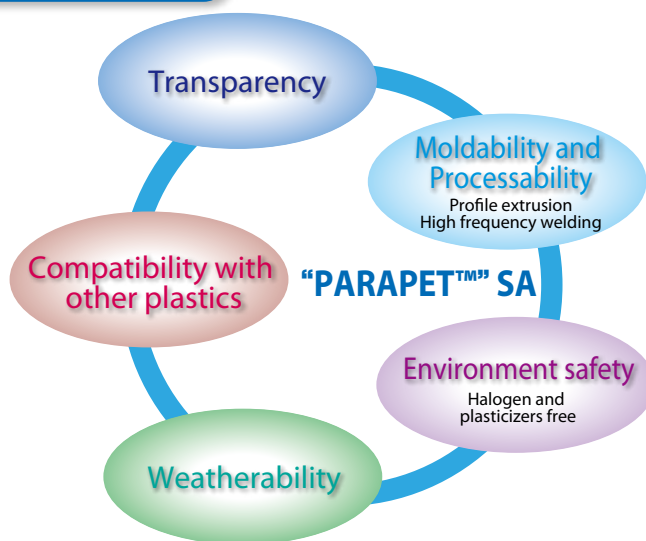
In the design of mold assumed use of "PARAPET™", the molding shrinkage value is between 0.2 to 0.6% (using the JIS measuring method).

In comparing the resin's flow direction to a flow in a right angled direction, the shrinkage in the flow direction generally gets larger rate of 0.05 to 0.15%.

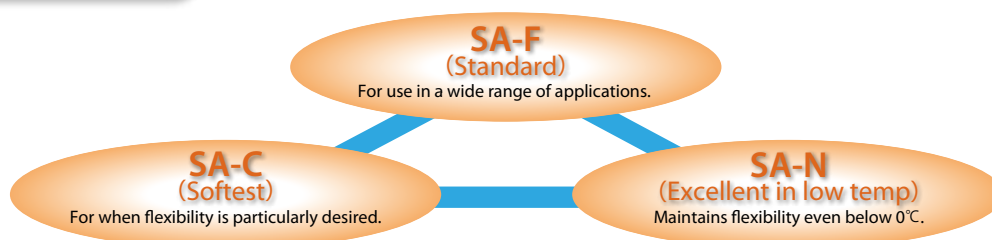
Resin Type	Molding Shrinkage (%)
"PARAPET™"	0.2~0.6
Polycarbonate	0.5~0.7
Polystyrene	0.2~0.6
AS resin	0.2~0.6
ABS resin	0.3~0.8
Polypropylene	1.0~2.5
Polyethylene (H.D)	2.0~5.0
Nylon resin-66	1.0~2.5

Overview and Characteristics of “PARAPET™” SA

- “PARAPET™” SA was developed via Kuraray's polymer technology. It is an unique and flexible thermoplastic acrylic resin. Softening acrylic resin will increase the viscosity, but we overcame this problem by avoiding to use the plasticizers.
- Because the base is acrylic-based polymer, the acrylic origin allows for transparency and weather resistance. “PARAPET™” SA has many characteristics: ① Capable of thermal bonding with a diverse amount of polar resins ② Superior in extruding complex forms, ③ Secondary workability (ultrasonic waves, high frequency based welding, cutting) .
- We can provide pellet type of course, as well as powder type which is suitable for mixing and additive applications.



Grade Lineup



Applications

Injection molding (General sundries, etc)



- Transparency
- Colorability
- Mold transcription
- Thermal adhesion

Films



- Weatherability
- Antistress whitening
- Printability

Profile extrusion (Hose, etc)

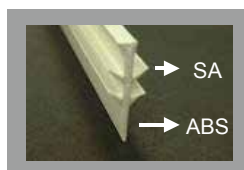


Various shape reproducibility

Two-color-moldings (Joint filler, etc)



Good thermal adhesion to other plastics



Modifiers

Modify the property of other plastics

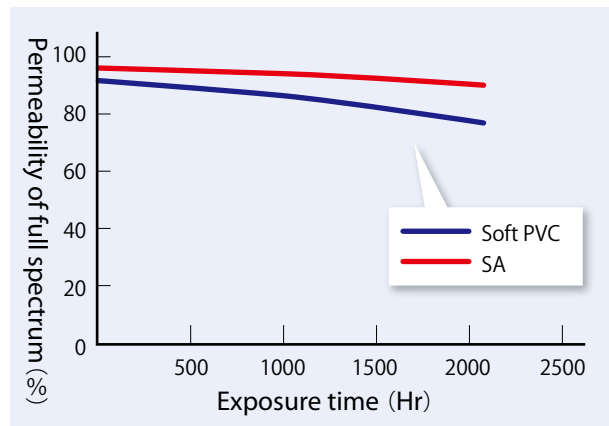
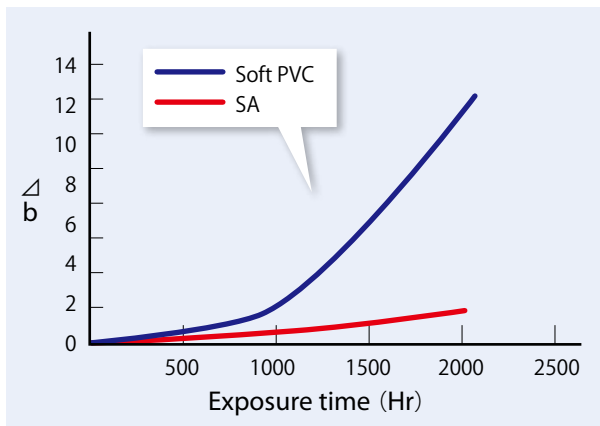
Good adhesion property with other plastics

Transparency, Weather Resistance

- “PARAPET™” SA has the highest level of transparency among soft material, and its visible region is over 90% transmittance.
- Being a methacrylic resin, mechanical, optical and visible degradation is very low.
- Because no plasticizers are included, there is no heat deterioration or deterioration over time caused from bleed-out.

<Sunshine weatherometer exposure test results>

① Optical properties



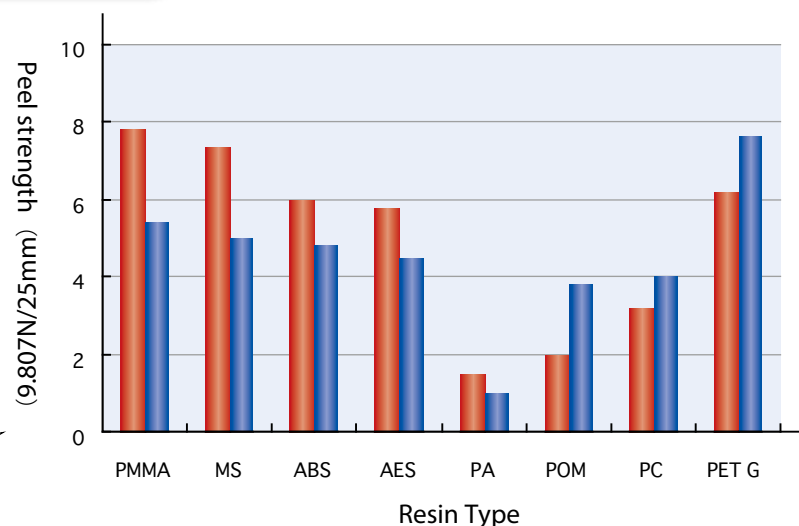
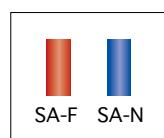
② Mechanical properties

Property	Test method	Unit	Exposure time			
			0hr	500hr	1000hr	2000hr
Hardness	ISO 48		A70	A70	A72	A74
Tensile strength at break (500mm/min)	ISO 37	MPa	12	10	9	8
Tensile elongation at break (500mm/min)	ISO 37	%	200	200	160	140
100% Modulus	ISO 37	MPa	7	7	7	7
Permanent set	ISO/DIS2285	%	12	12	15	18

Compatibility with Other Resins

“PARAPET™” SA has excellent thermal bonding properties and has very high affinity towards a diverse amount of polar polymers.

For that reason, it is possible to combine with other resins for coextrusion molding, insert molding, and two-color molding.



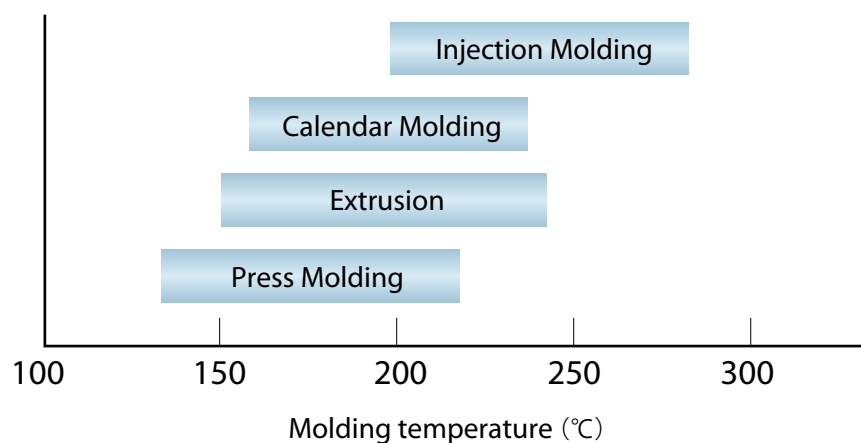
Properties

Grade			SA-F (Standard)			SA-N (Excellent in low temp)			SA-C (Softest)	
Lineup			SA-FP	SA-FW001	SA-FR201	SA-NP	SA-NW001	SA-NW201	SA-CP	SA-CW001
Type			Powder	Pellet	Pellet	Powder	Pellet	Pellet	Powder	Pellet
Optical Properties										
Light Transmission	ISO 13468-1	%	90	90	90	90	90	90	90	90
Haze	ISO 13468-1	%	1	1	1	2	2	2	2	2
Mechanical Properties										
Hardness	ISO 48		A70	A70	A80	A70	A70	A90	A60	A60
Tensile Strength At Break	ISO 37	MPa	10	10	14	12	12	14	9	9
Tensile Elongation At Break	ISO 37	%	200	200	200	200	200	170	240	240
100% Modulus	ISO 37	MPa	5	5	8	7	7	11	4	4
Compression Set	ISO 815	%	45	45	70	50	50	75	45	45
Permanent Set	ISO/DIS 2285	%	12	12	16	12	12	20	-	-
Abration Resistance	ISO 9352	mg	50	50	95	45	45	220	-	-
Thermal Properties										
MFR (230°C,98.07N)	ISO 1133	g/10min	18	18	22	10	10	27	4	4
Other Properties										
Density	ISO 1183	g/cm ³	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Coefficient of liner expansion		m/m·°C	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 Resistance		Ω	10 ¹⁵ <	10 ¹⁵ <	10 ¹⁵ <	10 ¹⁵ <	10 ¹⁵ <	10 ¹⁵ <	10 ¹⁵ <	10 ¹⁵ <

※These are typical values and should not be used to set specifications.

※All values were measured at 23°C.

Molding Conditions



Pre-drying conditions : Ordinary 80°C 4~6Hrs

Formability

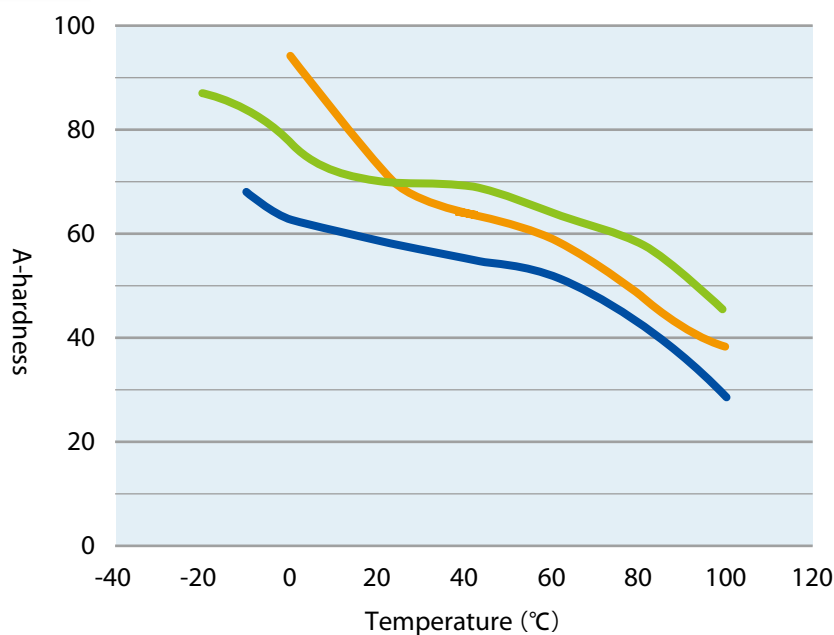
- Excellent resistance to thermal decomposition; does not contain radicals that cause elimination reaction or unsaturated bonding.
- Formability over a wide range of temperatures with no oxidative degradation under 200°C, and has excellent recyclability.
- Coloration is also possible with various sorts of coloring methods.
- Excellent in secondary workability such as cutting and welding with heat, high frequency and ultrasonic waves.

Environment Safety

- Halogen and plasticizers free.
- Clean material that when incinerated does not release toxic substances that would harm people or the environment nor harm the incinerator.

Temperature Dependence

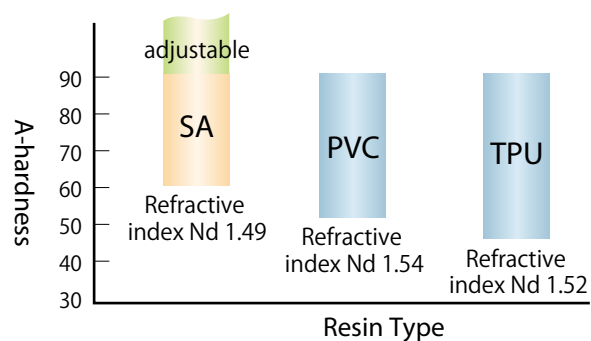
“PARAPET™” SA is a great heat-resistant soft polymer and maintains a steady hardness from room temperature to up to 80°C.



— SA-FW001
 — SA-NW001
 — SA-CW001

Adjustment of Hardness

“PARAPET™” SA has a refractive index that has been adjusted to agree with Methacrylic resin. For that reason, hardness can be adjusted by being optionally blended.



3 About the Terminology

In considering the spectral transmission curve of the filter, the relationship of wavelength and transmittance is measured in the following way. (JIS B 7710)

1 Wavelength of high pass region or high pass limit wavelength.

When the filter transmittance climbs above a wavelength range of 72%, this wavelength limit is called the high pass limit wavelength.

2 Absorption region or absorption limit wavelength

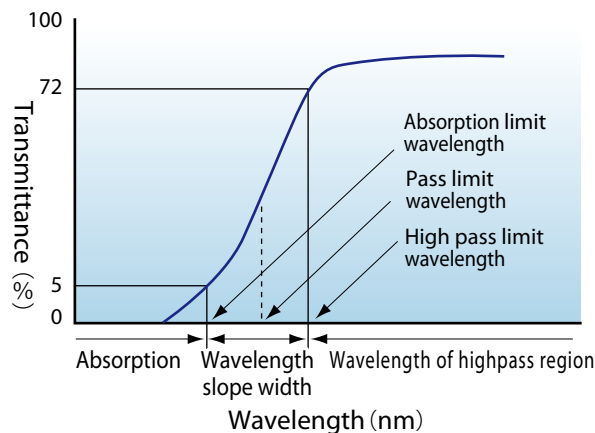
When the filter transmittance goes below a wavelength range of 5%, this wavelength limit is called the absorption limit wavelength.

3 Wavelength slope width

Indicate the interval between the high pass limit wavelength and absorption limit wavelength.

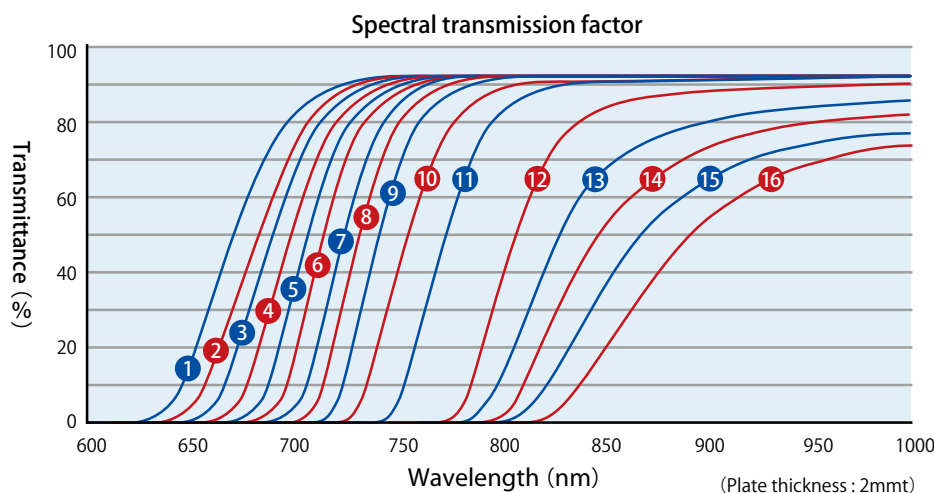
4 Pass limit wavelength

Wavelength that corresponds to the center of the wavelength slope width



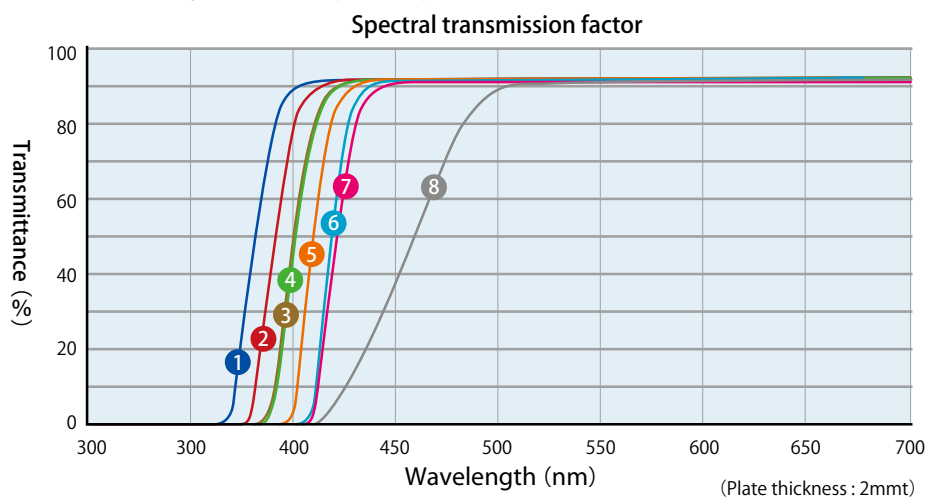
4 Spectral Transmission Factor

《Near infrared rays passing filter grade》



- | | |
|--------|---------|
| 1 PF64 | 9 PF72 |
| 2 PF65 | 10 PF73 |
| 3 PF66 | 11 PF75 |
| 4 PF67 | 12 PF78 |
| 5 PF68 | 13 PF79 |
| 6 PF69 | 14 PF80 |
| 7 PF70 | 15 PF81 |
| 8 PF71 | 16 PF83 |

《Ultra violet rays absorbing filter grade》



- | |
|----------|
| 1 PF-370 |
| 2 PF-380 |
| 3 PF-390 |
| 4 PF-395 |
| 5 PF-400 |
| 6 PF-407 |
| 7 PF-410 |
| 8 PF-420 |

1 What is Filter Grade?

“PARAPET™” Filter Grade is a sharply cut filter grade with specific wavelength selection provided for methacrylic resin. There are two types of filter grade that can either absorb ultraviolet rays or pass infrared rays.

※You can choose the base resin of the grade from the “PARAPET™” series that matches your working environment.

《Near infrared ray pass grade》

Allowing passage for either the emission or reception of near infrared rays only, this grade has the ability to completely block other harmful light rays.

《Ultraviolet ray absorption grade》

This grade has the ability to absorb ultraviolet rays. This grade is used in various kinds of camera flash covers and applications such as sunglass lenses where there is a particular risk of degradation due to ultraviolet rays in the environment.

Characteristics

- Superior in formability due to the base being methacrylic resin.
- Can prevent work error by completely cutting out visible rays of light.

Examples of applications

《Near infrared ray pass grade》

Filter application for all kinds of equipment that use infrared rays (near infrared light-emitting diode)

- Television, audio, air conditioner use wireless remotes
- Cameras with Auto focus function
- Burglary-resistive alarm systems
- Automatic door sensor

《Ultraviolet ray absorption grade》

- Various kinds of camera flash cover
- Sunglass lens

2 Color Numbers and Optical Characteristics

《Ultraviolet ray absorption grade》

Light emission			
Color number	Pass limit wavelength (nm)	Absorption limit wavelength (nm)	Wavelength slope width (nm)
PF64	662	640	45
PF65	673	650	47
PF66	682	660	44
PF67	691	670	42
PF68	700	680	40
PF69	708	690	37
PF70	718	700	36
PF71	727	710	34
PF72	737	720	34
PF73	750	730	39
PF75	770	750	39

(Plate thickness : 2mmt)

Reception			
Color number	Pass limit wavelength (nm)	Absorption limit wavelength (nm)	Wavelength slope width (nm)
PF78	802	780	44
PF79	827	792	70
PF80	852	805	93
PF81	875	814	122
PF83	902	830	144

(Plate thickness : 2mmt)

《Ultraviolet ray absorption grade》

Color number	Rising wavelength (nm)	Absorption limit wavelength (nm)
PF370	360	370
PF380	375	380
PF390	380	390
PF395	385	390
PF400	395	400
PF407	400	407
PF410	405	410
PF420	410	420

(Plate thickness : 2mmt)

Deflection Temperature under Load

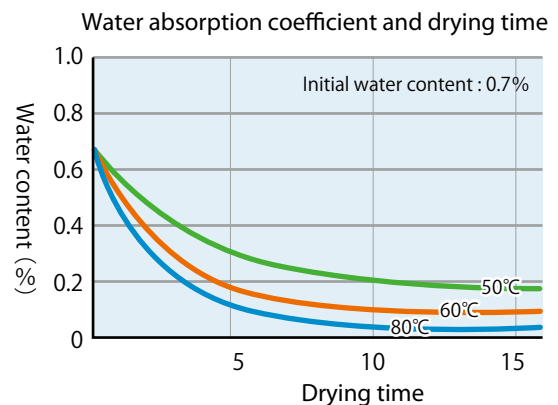
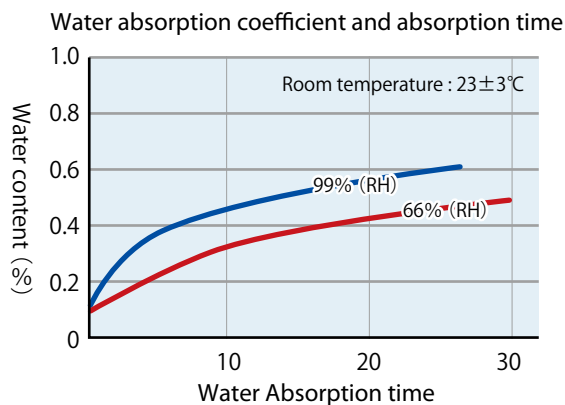
Deflection Temperature under Load is the temperature at which a molded piece deforms when elevated heat is added to the piece at a specified load. Use of heat deflection temperature is one standard for grade selection when molding conditions require heat to be present in the mold for an extended amount of time. In general, it is safe to use the product at low temperatures with a deflection temperature under load between 10 to 20°C. The Vicat softening temperature (the point at which the piece becomes heated, softens, and its mechanical properties severely decrease) is also an important value that indicates the limit at which the material can be used.

Water Absorption and Drying Time of Methacrylic Molding Resin

Methacrylic resin easily absorbs water and thus requires preliminary drying. Pellets that have absorbed water can result in defects such as silver streaking.

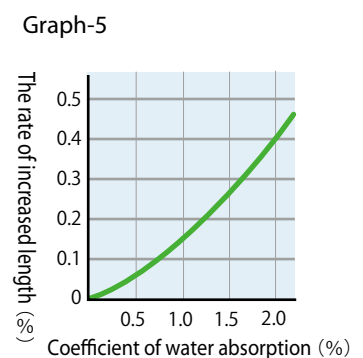
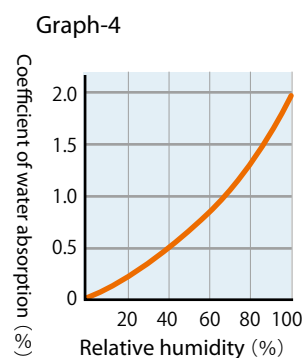
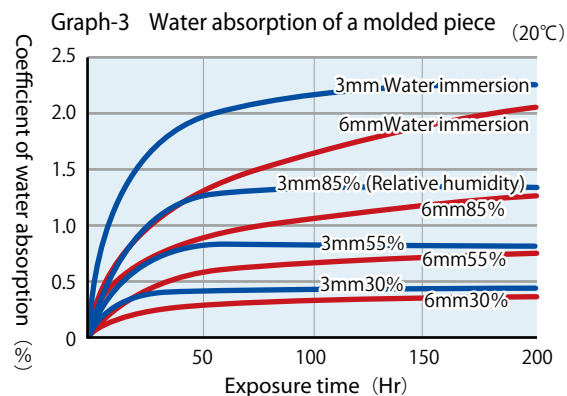
For molding with a general injection molding machine, water content needs to be below 0.1%.

Drying methods include use of a drying oven with internal air circulation (laboratory constant temperature drying oven (with blower)), hot dryer, or dehumidifying dryer. Below shows the relationship between water content and drying time using a hot air dryer with pellets spread in a metal bowl at a thickness of 4 cm.



Change of Length and Water Absorption

Graph-3 shows the water absorption of a molded piece at various atmospheric temperatures. Under normal conditions, water absorption is very slow with saturation taking about 2 to 3 months to occur. When the piece thickness is increased, the period before saturation can take even longer. Graph-4 represents various coefficients of water absorption at saturation at 23°C. Graph-5 shows the relationship between the rate of increased length and the coefficient of water absorption.



Condition of Injection Molding

Molding conditions of the “PARAPET™” main grade is as below. But the molding conditions depends on the machine type, mold structure and molding shape, therefore it is necessary to adjust it in case.

Property	GF	G	HR	GR
Pre-drying temp (°C)	75~80	75~80	75~85	75~85
Pre-drying time (Hr)	4~6	4~6	4~6	4~6
Mold temp (°C)	40~60	40~60	50~80	50~80
Cylinder temp (°C)	180~220	190~230	200~250	220~260
Injection pressure (MPa)	60~140	60~140	80~140	70~150

- Preparatory drying is essential because the methacrylic resin tends to absorb moisture. Moisture absorbed pellets causes defects such as silver streaks, and flow marks.
- To prevent disfigurement of the molding materials from contamination, it is necessary to protect the molding chamber against dust, eliminate contamination after unpacking and keep clean both inside and outside the machine.
- Too high injection speed may loss surface luster of molded parts.

Annealing

In injection molding, there is a certain amount of residual strain. Residual strain can greatly affect mechanical strength and crack resistance. In case of good mechanical strength is necessary and need secondary workability as bonding, painting and antistatic treatment, we recommend to annealing to eliminate the residual strain.

Below are the conditions for general annealing of “PARAPET™” molding material. The general temperature for annealing is at a low temperature with a deflection temperature under load between 10 to 15°C. General processing time and cooling time vary greatly based on the thickness and shape of the molding product. One warning in particular is that if the cooling temperature is elevated too quickly, there is the risk that residual molding strain may occur.

Annealing Conditions

Property	GF	G	HR	GR
Temp (°C)	65~75	65~75	70~85	55~65
Time (hr)	2~4	2~4	2~4	2~4

Cooling Conditions

	Thickness	Cooling velocity
Maximum cooling temperature rate: up to 50°C	4mm 以下	45°C/hr
	5~9mm	20°C/hr
	10~20mm	10°C/hr

※ After Annealing, it is recommended to cooled to around 50°C

【Handling and restriction of use】

- 1.The vapors from heated "PARAPET™" may cause irritation of the eyes and respiratory tract. Use the material under adequate ventilation.
- 2."PARAPET™" is a combustible thermoplastic. Keep the material away from heat and ignition sources.
- 3.Static charges can accumulate. Employ bonding or grounding in operations capable of generating static electricity.
- 4.Do not use "PARAPET™" for medical purposes or implants that contact the internal tissues of human body.
Do not use the products that may touch the baby's mouth or baby may swallow.
- 5.Please contact our sales personnel when using "PARAPET™" in medical purposes, cosmetics, toys, safety equipment, food containers and packaging, etc.
- 6.Be sure to read the Safety Data Sheet (SDS) before using "PARAPET™".



kuraray

株式会社クラレ
メタアクリル事業部
化成品・樹脂販売部
樹脂販売課

〒100-0004 東京都千代田区大手町
2-6-4 常盤橋タワー

KURARAY CO., LTD.

Resin Marketing and Sales Section
Methacrylate Materials Marketing and Sales Department
Methacrylate Division

Tokiwabashi Tower, 2-6-4, Otemachi, Chiyoda-ku,
Tokyo 100-0004, Japan

TEL: (+81)(0)3-6701-1532 / FAX: (+81)(0)3-6701-1576

URL: <https://www.KURARAY.co.jp/>
<https://www.parapet.jp/>