LG MMA

2017 PMMA & SMMA Brochure

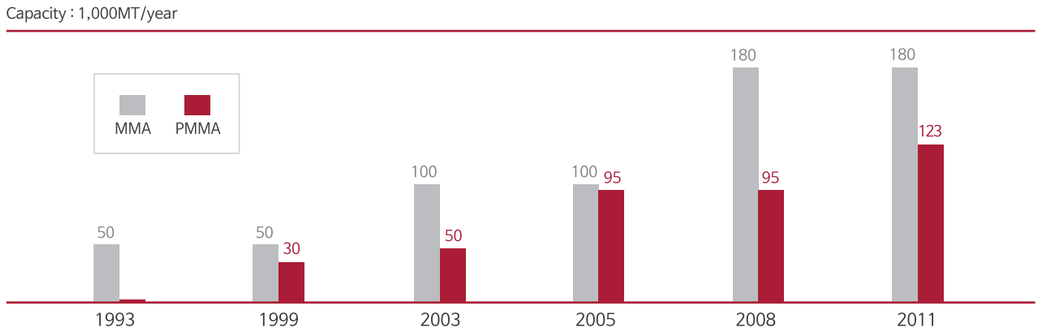
PMMA
SMMA

Polymethyl methacrylate &
Styrene-Methyl methacrylate
copolymer

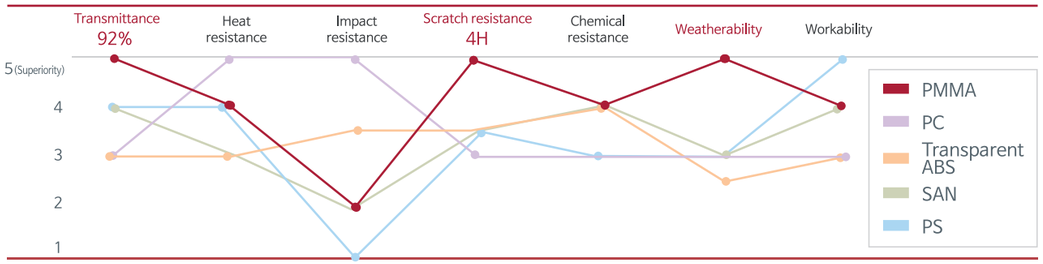
Introduction of LG MMA

As the leader of the domestic PMMA industry, LG MMA has integrated production facilities from MMA to PMMA and also maintains a technical service system capable of responding immediately to customer needs. LG MMA was established in 1991 as a joint venture of LG Chemicals, Japan's Sumitomo Chemical and Nippon Shokubai. In 1993, LG MMA completed construction of its first MMA plant, took over the PMMA business from LG Chemicals in 1999, completed its 2nd MMA plant in 2003 and 2nd PMMA plant in 2005.
In addition, the company completed its 3rd MMA plant in 2008 and started producing 180,000 tons of MMA and 123,000 tons of PMMA, becoming the number one domestic supplier and emerging as a world-class MMA producer.

Production Capacity



Comparison of LG PMMA with Other Transparent Resins



Outstanding Characteristics of LG PMMA

PMMA is synthetic resin mainly composed of MMA monomer. With its excellent transparency, weatherability and colorability this highly polymerized material is widely used for automobile and electronic parts.

High Transparency
The most excellent transparency among all plastics (Transmits more than 92% of the visible ray area)

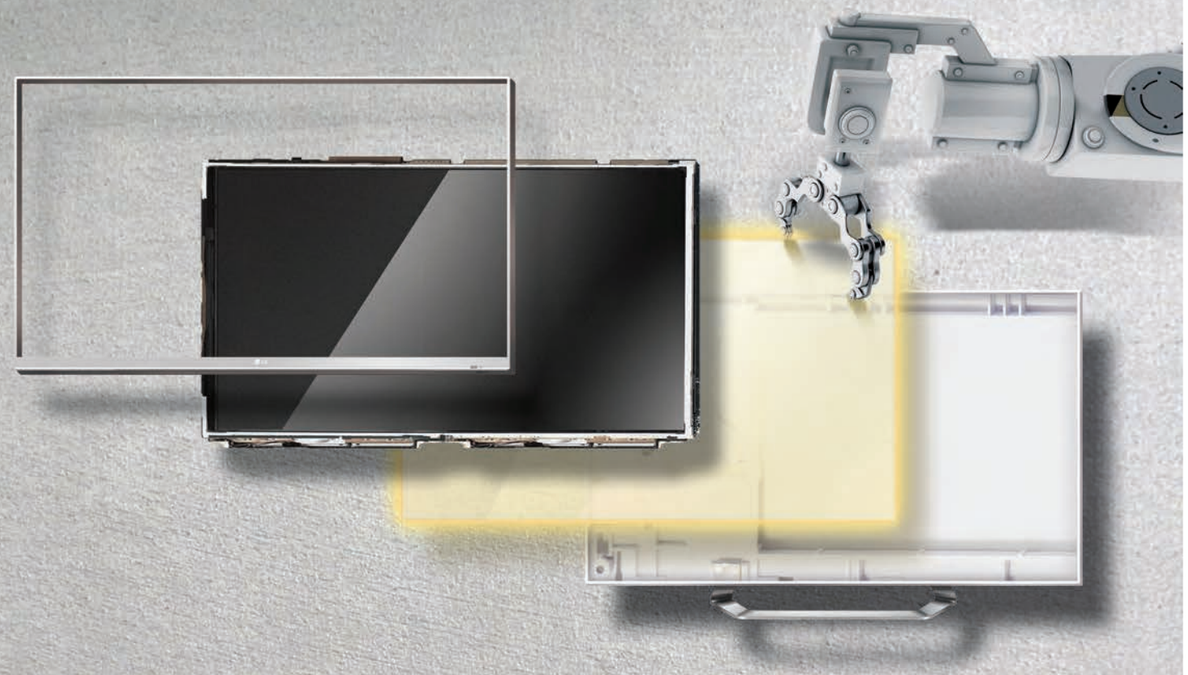
Excellent Weatherability
The most excellent weatherability among plastics

High Scratch Resistance
Excellent scratch resistance with its high degree of surface hardness among plastics

Standards & Certification

Item		LG PMMA
Flammability	UL 94 (HB) / CSA (HB)	All Grades
Weatherability	AMECA	IH830, IH830A, IH830C, IH830CA, IH830HR, EG920, EH910, HP202, HI835MS, HI835H
Hazardous Material	RoHS (Directive 2002/95/EC) JHPC / IMDS	All Grades
FDA	US FDA regulation / 21CFR177.1010	IH830, IG840, IF850, IF870S, HI855M, HI855S, HI855H
Management System	ISO14000 (Environment) KGS18000 (Safety) / ISO/TS 16949 (Quality)	All Grades

General PMMA
Optical & Extrusion Grade



Application

Light guide panels for LCD

- LED TV
- Monitor
- Note book

General sheet

- Signboard
- Billboard
- Aquarium
- Soundproof walls
- Lighting dome

Properties

	Item	Condition	Unit	Method	Optical Grade		Extrusion Grade	
					HP202	HP210	EG920	EH910
Optical Properties	Light transmittance	3mm	%	ISO 13468-1	92	92	92	92
	Haze	3mm	%	ISO 14782	<0.5	<0.5	<0.5	<0.5
Thermal Properties	Melt flow index	230℃, 3.8kg	g/10min	ISO 1133	2.0	11	1.4	1.0
	Heat deflection temperature	1.8MPa	℃	ISO 75	100	98	100	101
	Vicat softening temperature	B/50	℃	ISO 306	106	101	106	108
Mechanical Properties	Charpy Impact strength	notched	kJ/m^2	ISO179	1.5	1.5	1.5	1.5
	Rockwell hardness	M scale	-	ISO 2039-2	99	96	98	98
	Tensile strength	5mm/min	MPa	ISO 527	72	64	71	70
	Tensile elongation	5mm/min	%	ISO 527	6.2	3.0	6.0	7.5
	Tensile modulusFlexural	1mm/min	GPa	ISO 527	3.1	2.9	2.9	2.9
	Flexural strength	2mm/min	MPa	ISO 178	115	83	113	115
	Flexural modulus	2mm/min	GPa	ISO 178	3.2	2.8	3.0	3.0

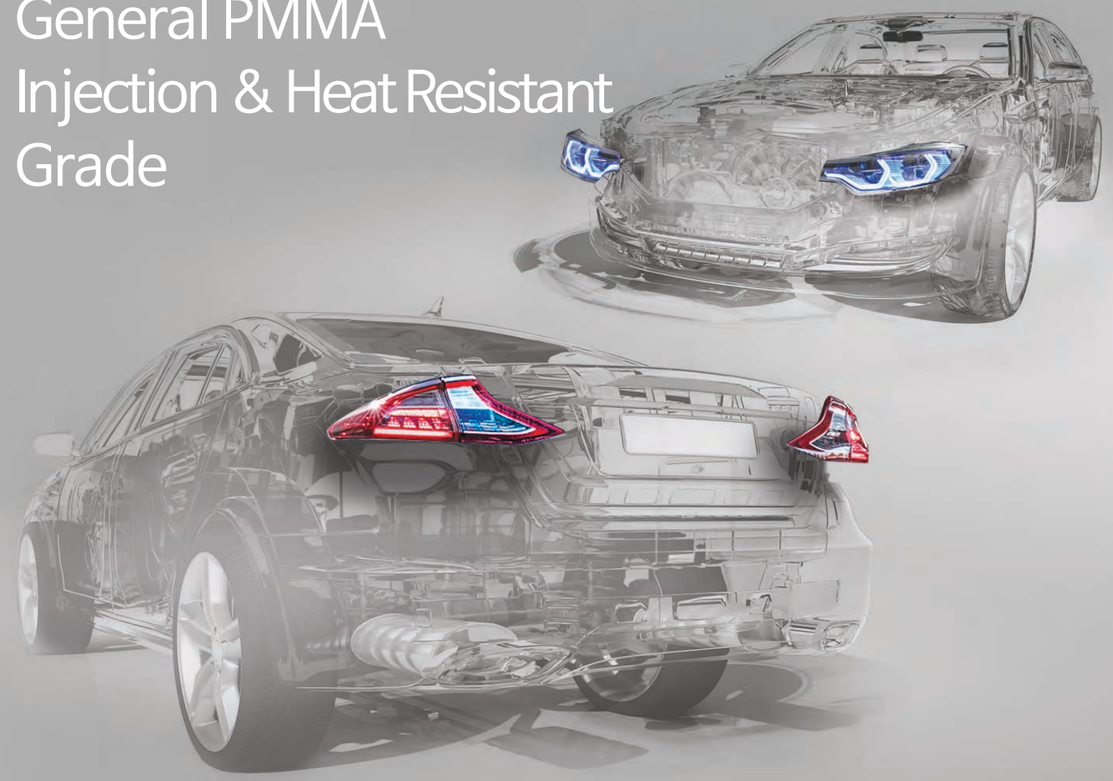
	Item	Condition	Unit	Method (ASTM/ISO)	Value (in common)
General Properties	Density	-	g/cm^3	ISO 1183	1.19
	Refractive index	nd	-	ISO 489	1.49
	Water absorption	24hr	%	ASTM D570	0.3
	Mold shrinkage	-	%	ASTM D955	0.2-0.6
	Coefficient of linear expansion	-	1/℃	ASTM D696	6×10^{-5}
	Flammability	1.5mm	Class	UL94	HB
Electrical Properties	Volume resistivity	-	Ω · cm	ASTM D257	$>10^{15}$
	Dielectric strength	4kV/s	kV/mm	ASTM D149	20
	Dielectric constant	60Hz	-	ASTM D150	3.1
	Power factor	60Hz	-	ASTM D150	0.05

REMARKS : The listed values should be used for reference purpose only.

Typical Extrusion Molding Condition

Item		Temperature (℃)
Cylinder	Feed zone	170 - 200
	Melting zone	220 - 250
	Metering zone	230 - 260
Die		220 - 250
Guide Roll		80 - 100

General PMMA Injection & Heat Resistant Grade



Application

Electronic

- Display window of home appliance

General goods

- Cosmetic container
- Food container
- Lens
- Stationery
- Accessories

Automobile

- Rear combination lamp
- Head lamp light pipe & aspherical lens
- Pillar garnish
- Cluster cover window
- Center high mounted stop lamp
- Side repeater lamp
- Emblem
- Map lamp

Properties

	Item	Unit	Injection Grade							
			IH830	IH830L	IH830C	IH830HF	IG840	IF850	IF860	IF870S
Optical Properties	Light transmittance	%	92	92	92	92	92	92	92	92
	Haze	%	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Thermal Properties	Melt flow index	g/10min	2.3	2.3	2.0	4.5	5.7	13	16	23
	Heat deflection temperature	℃	101	102	101	103	102	92	91	90
	Vicat softening temperature	℃	109	111	108	112	98	88	87	86
Mechanical Properties	Charpy Impact strength	kJ/m²	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	Rockwell hardness	-	99	101	100	100	95	92	91	89
	Tensile strength	MPa	71	72	74	64	65	62	60	56
	Tensile elongation	%	5.0	4.5	5.0	3.0	4.0	4.0	3.0	2.8
	Tensile modulusFlexural	GPa	2.8	2.9	2.9	2.9	2.8	2.8	2.8	2.8
	Flexural strength	MPa	111	113	113	116	105	101	96	94
	Flexural modulus	GPa	3.0	3.0	3.0	3.1	3.0	2.9	2.8	2.8

	Item	Unit	Heat Resistant Grade			
			IH830HR	IH830XT	EF120	IH830HT
Optical Properties	Light transmittance	%	92	92	92	92
	Haze	%	<0.5	<0.5	<0.5	<0.5
Thermal Properties	Melt flow index	g/10min	1.7	2.5	1.1	1.7
	Heat deflection temperature	℃	113	114	118	113
	Vicat softening temperature	℃	105	111	109	106
Mechanical Properties	Charpy Impact strength	kJ/m²	1.5	1.5	1.5	1.5
	Rockwell hardness	-	102	101	100	97
	Tensile strength	MPa	75	68	75	67
	Tensile elongation	%	5.0	5.0	5.0	3.0
	Tensile modulusFlexural	GPa	3.2	3.2	3.2	3.3
	Flexural strength	MPa	120	120	120	92
	Flexural modulus	GPa	3.1	3.2	3.1	3.0

	Item	Condition	Unit	Method (ASTM/ISO)	Value (in common)
General Properties	Density	-	g/cm³	ISO 1183	1.19
	Refractive index	nd	-	ISO 489	1.49
	Water absorption	24hr	%	ASTM D570	0.3
	Mold shrinkage	-	%	ASTM D955	0.2-0.6
	Coefficient of linear expansion	-	1/℃	ASTM D696	6×10^{-5}
	Flammability	1.5mm	Class	UL94	HB
Electrical Properties	Volume resistivity	-	Ω · cm	ASTM D257	$>10^{15}$
	Dielectric strength	4kV/s	kV/mm	ASTM D149	20
	Dielectric constant	60Hz	-	ASTM D150	3.1
	Power factor	60Hz	-	ASTM D150	0.05

REMARKS : The listed values should be used for reference purpose only.

Impact Resistant PMMA
Transparent HI Grade

Application

Electric / Electronic

- Home appliance housing
- Cellular phone window & key pads
- TV bezel, DVD & VCR play er front panel & housing
- Audio front panel

Properties

	Item	Unit	HI835 Series				HI855 Series		
			HI835MS	HI835M	HI835S	HI835H	HI855M	HI855S	HI855H
Optical Properties	Light transmittance	%	91	91	91	91	91	91	91
	Haze	%	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Thermal Properties	Melt flow index	g/10min	2.0	3.2	2.8	2.1	6.4	5.7	4.1
	Heat deflection temperature	℃	87	83	82	77	79	77	73
	Vicat softening temperature	℃	97	93	90	86	88	86	78
Mechanical Properties	Charpy Impact strength	kJ/m²	2.7	3.2	3.6	4.8	3.0	3.6	5.2
	Rockwell hardness	-	83	71	59	47	61	53	40
	Tensile strength	MPa	49	40	39	37	38	35	33
	Tensile elongation	%	28	34	46	54	46	49	41
	Tensile modulusFlexural	GPa	2.5	2.0	1.8	1.5	2.0	1.8	1.5
	Flexural strength	MPa	84	74	67	56	71	64	54
	Flexural modulus	GPa	2.4	2.0	1.8	1.5	2.0	1.8	1.5
General Properties	Density	g/㎤	1.17	1.17	1.17	1.16	1.17	1.17	1.16

	Item	Unit	HI5 Series					
			HI572	HI533	HI535	HI537	HI553	HI555
Optical Properties	Light transmittance	%	90	91	91	91	91	91
	Haze	%	<1.5	<1.5	<1.5	<2.0	<1.5	<1.5
Thermal Properties	Melt flow index	g/10min	19	2.6	2.3	1.2	6.5	5.0
	Heat deflection temperature	℃	73	80	76	73	79	75
	Vicat softening temperature	℃	84	93	87	83	89	85
Mechanical Properties	Charpy Impact strength	kJ/m²	2.4	4.7	5.9	7.0	4.4	5.5
	Rockwell hardness	-	76	78	64	46	63	45
	Tensile strength	MPa	39	42	37	34	38	34
	Tensile elongation	%	3.5	26	33	35	45	45
	Tensile modulusFlexural	GPa	2.4	2.2	1.7	1.5	2.0	1.6
	strength	MPa	82	73	63	48	71	60
	Flexural modulus	GPa	2.4	2.1	1.8	1.5	2.0	1.8
General Properties	Density	g/㎤	1.17	1.17	1.17	1.16	1.17	1.17

	Item	Condition	Unit	Method (ASTM/ISO)	Value (in common)
General Properties	Refractive index	nd	-	ISO 489	1.49
	Water absorption	24hr	%	ASTM D570	0.4
	Mold shrinkage	-	%	ASTM D955	0.4-0.8
	Coefficient of linear expansion	-	1/℃	ASTM D696	7×10^{-5}
	Flammability	1.5mm	Class	UL94	HB
Electrical Properties	Volume resistivity	-	Ω · cm	ASTM D257	$>10^{15}$
	Dielectric strength	4kV/s	kV/mm	ASTM D149	15
	Dielectric constant	60Hz	-	ASTM D150	3.1
	Power factor	60Hz	-	ASTM D150	0.04

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Impact Resistant PMMA
Opaque EMMA

Application of EMMA

PMMA is excellent in impact resistance compared to general glasses, but relatively lower among plastics so it is demanded to be improved in this respect. LG MMA has improved the impact resistance of PMMA using acrylic rubbers, and maintained the weatherability. Impact resistant grade of PMMA is applied to the area where impact strength is required such as signboards, lightings, displays, and vending machines.

Properties

	Item	Unit	HC353	HC308	HC556	HC503
Thermal Properties	Melt flow index	g/10min	3.6	8.0	7.1	3.5
	Heat deflection temperature	℃	90	77	80	75
	Vicat softening temperature	℃	92	83	86	76
Mechanical Properties	Charpy Impact strength	kJ/m²	4.7	10	5.2	10
	Rockwell hardness	-	84	55	57	97(R)
	Tensile strength	MPa	41	33	37	26
	Tensile elongation	%	18	30	23	13
	Tensile modulus	GPa	2.0	2.1	2.3	1.6
	Flexural strength	MPa	84	65	73	53
	Flexural modulus	GPa	2.6	2.1	2.1	1.6
General Properties	Density	g/㎤	1.16	1.13	1.16	1.13

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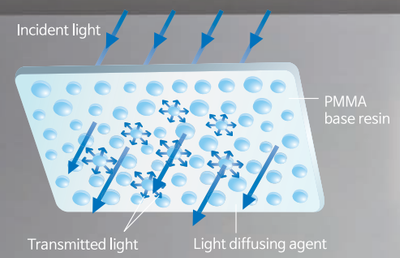
Diffusion Grade

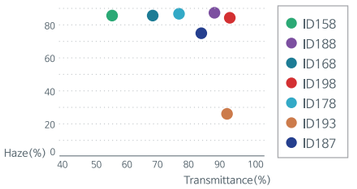
High Transmittance, High Diffusivity



Diffusion Grade of PMMA for Lighting Applications

"ID" grade of LG PMMA realizes high light transmittance and high diffusion with our unique diffusion agent and maximizes the efficiency of lighting fixtures without exposing the luminous source of LED illumination. High transmittance/low diffusion, high transmittance/high diffusion and low transmittance/high diffusion products may be used depending on the features of lighting.

Haze vs. Tt

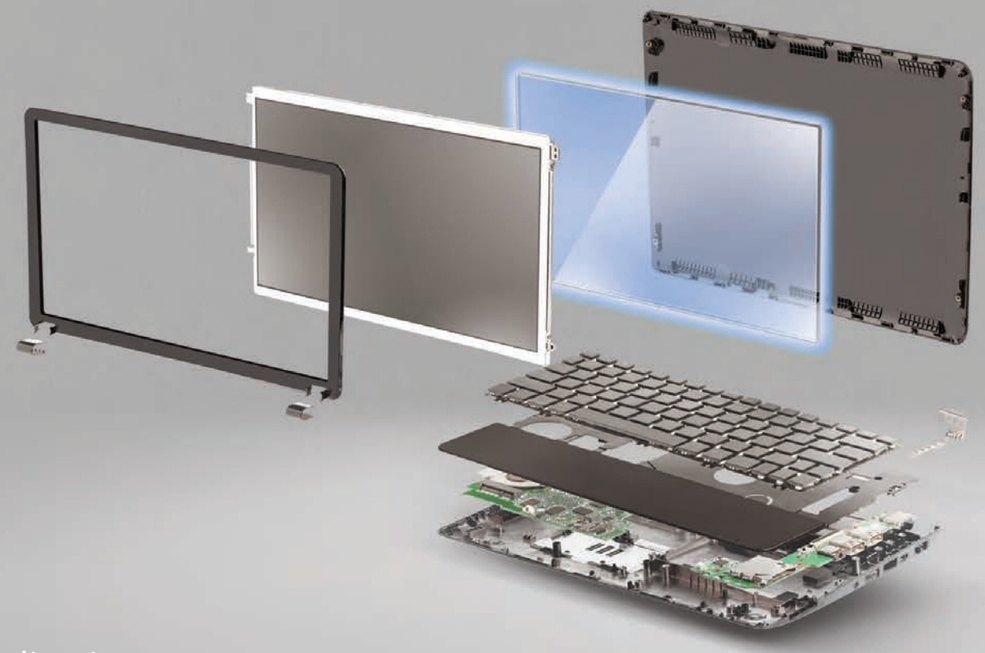


Optical properties

Property	Thickness	Unit	Method	Injection Grades						
				ID198	ID193	ID188	ID178	ID187	ID168	ID158
Tt	1mm	%	JIS K 7105	91	92	90	88	88	81	70
	2mm	%	JIS K 7106	90	91	83	76	82	68	57
	3mm	%	JIS K 7107	86	90	75	65	76	57	48
Haze	1mm	%	JIS K 7105	76	16	84	86	59	82	83
	2mm	%	JIS K 7106	84	30	87	87	75	87	87
	3mm	%	JIS K 7107	86	37	87	88	81	87	87
Base PMMA				IH830C, IG840, IF850 etc						

The three-digit numbers after 'ID' mean base PMMA, transmittance and haze (based on 2mm thickness).
Base PMMA may apply the injection grade, extrusion grade and impact resistance grade.

SMMA
Optical & Injection Grade



Application

Light guide panels for

- LED TV
- Monitor
- Note book

Injection molding compounds **for**

- food and cosmetic containers

Characteristics of SMMA

SMMA resin is a transparent copolymer based on MMA (methylmethacrylate) and SM (styrene monomer). While possessing optical characteristics and transparency similar to acrylic resin, it also shows excellent workability and low residual stress of molded product. In particular, low moisture absorption rate compared to general acrylic resin allows for application to high temperature and humidity. It is also appropriate for food and cosmetic containers due to outstanding chemical resistance to solvents, such as alcohol.

- Excellent optical properties, high transmission rate and low haze
- Optical properties similar to acrylic resin
- Low moisture absorption rate
- Outstanding weatherability
- Excellent processability
- Low residual stress in molded product
- Low specific gravity (1.11g/cm³)

Properties

	Item	Condition	Unit	Method	Optical Grade		Extrusion Grade	
					HX238	HX208	HX238S	HX208S
Optical Properties	Light transmittance	3mm	%	ISO 13468-1	91	91	91	91
	Haze	3mm	%	ISO 14782	<0.5	<0.5	<0.5	<0.5
Thermal Properties	Melt flow index	230℃, 3.8kg	g/10min	ISO 1133	7.9	8.0	7.9	8.0
	Heat deflection temperature	1.8MPa	℃	ISO 75	99	90	99	90
	Vicat softening temperature	B/50	℃	ISO 306	102	95	102	95
Mechanical Properties	Charpy Impact strength	notched	kJ/m²	ISO 179	1.3	1.4	1.3	1.4
	Rockwell hardness	M scale	-	ISO 2039-2	87	75	87	75
	Tensile strength	5mm/min	MPa	ISO 527	65	62	65	62
	Tensile elongation	5mm/min	%	ISO 527	5.2	3.0	5.2	3.0
	Tensile modulus	1mm/min	GPa	ISO 527	2.9	3.1	2.9	3.1
	Flexural strength	2mm/min	MPa	ISO 178	105	100	105	100
	Flexural modulus	2mm/min	GPa	ISO 178	3.2	3.1	3.2	3.1
General Properties	Density	-	g/㎤	ISO 1183	1.15	1.11	1.15	1.11
	Refractive index	nd	-	ISO 489	1.53	1.55	1.53	1.55
	Water absorption	24hr	%	ASTM D570	0.18	0.12	0.18	0.12
	Mold shrinkage	-	%	ASTM D955	0.2-0.6	0.2-0.6	0.2-0.6	0.2-0.6
	Coefficient of linear expansion	-	1/℃	ASTM D696	$6X10^{-5}$	$6X10^{-5}$	$6X10^{-5}$	$6X10^{-5}$
	Flammability	1.5mm	Class	UL94	HB	HB	HB	HB

REMARKS : The listed values should be used for reference purpose only.

Molding Guide

Pre-drying

PMMA and SMMA resins can be used without pre-drying, but they absorb moisture if they are stored for long time or stored under unfavorable conditions. When moisture absorption rate exceeds 0.1%, the molded product can have silver streak formed on the surface or foams formed on the inside. It is desirable to perform preliminary drying according to the following conditions.

Grade	Temperature	Time
Optical, General PMMA, SMMA	70~80℃	4~6hr
Impact resistant PMMA	60~70℃	

Annealing

When the molded product contacts paint or organic chemical solvents, it is essential for preventing craze or crack caused by internal stress of the molded product. Effective annealing condition is the highest temperature at which the molded product does not show deformation.

Grade	Temperature	Time
HP202, EH910, EG920	Max. 90℃	Over 5hr
IH830, IH830C, IH830A	Max. 80℃	
IF850, IF870S, SMMA (HX238, HX208)	Max. 70℃	
Impact resistant PMMA	Max. 60℃	

Injection Molding Condition

Grade	Melting temperature	Mold temperature
HP202, EH910, EG920, Heat resistant PMMA	230~260℃	60~80℃
IH830, IH830C, IH830A	220~250℃	50~70℃
IF850, IF870S, SMMA (HX238, HX208)	210~240℃	
Impact resistant PMMA		

Handling & Use

Static Electricity

It is important to keep the area clean where the material is stored and the surroundings of injection molders as the material easily absorbs dust due to static electricity.

Cautions in mixing with other grades and resins

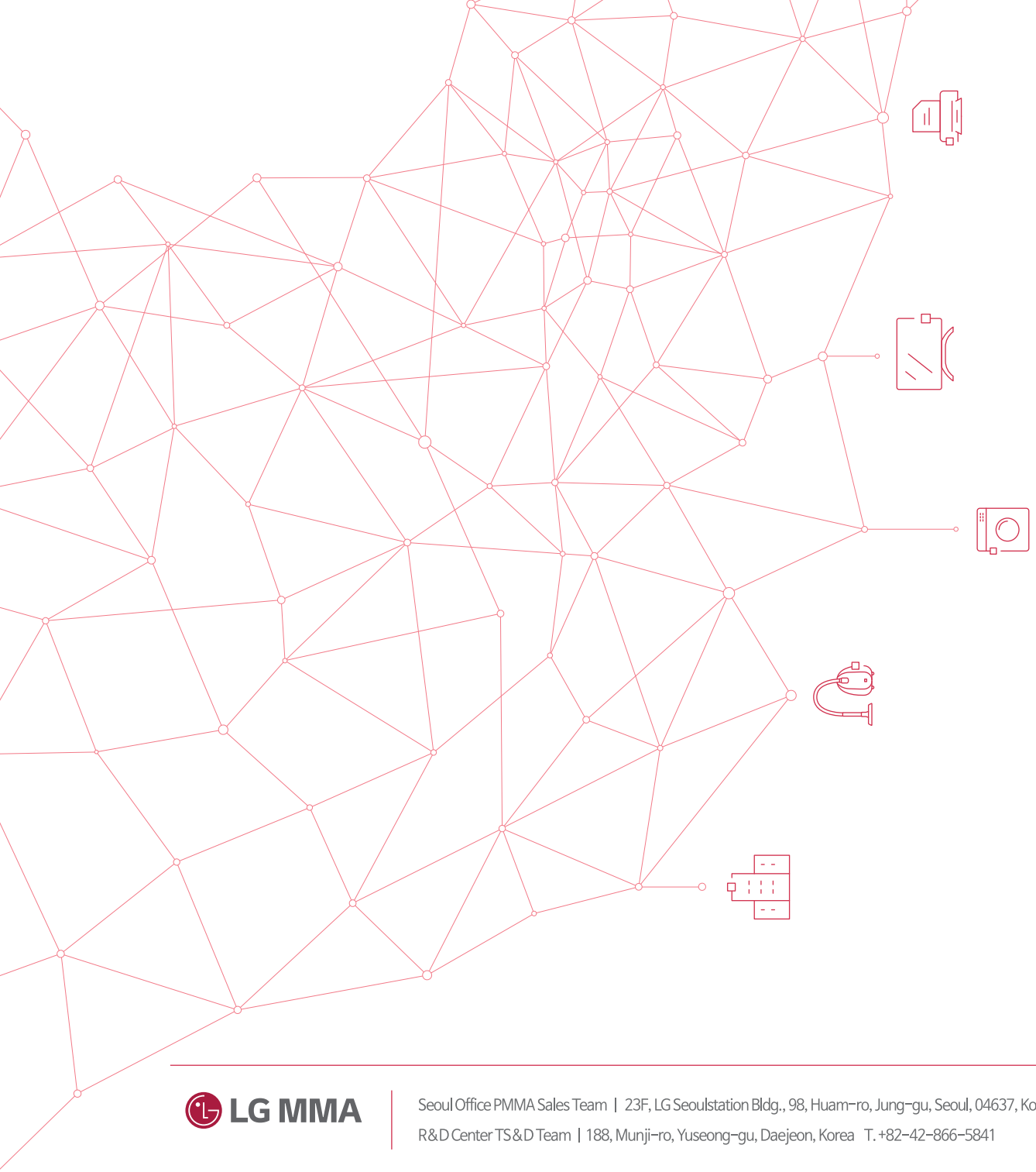
Take caution against mixing the material with other grades or resins when molding products.

Moisture Absorption

Do not leave the dry material in the air or neglect open sacks of the material.

Chemical Resistance

Suitable	Requires attention	Unsuitable	
Dilute acid	Hydrochloric acid	Acid	Ketone
Hydrochloric acid (10%)	Alcohol	Sulfuric acid	Acetone
Sulfuric acid (30%)	Methanol	Nitric acid	Methyl ethyl ketone
Nitric acid (30%)	Ethanol	Acetic acid	Methyl Isobutyl ketone
Acetic acid (10%)	Isopropyl alcohol	Formic acid	Ether
Alkali	Butyl alcohol	Aromatic hydrocarbon	Furan
Sodium hydroxide (50%)	Ether	Benzene	Tetrahydrofuran
Aqueous ammonia (10%)	Methyl ether	Toluene	Ester
Aliphatic hydrocarbon	Diethyl ether	Xylene	Methyl methacrylate
n-Hexane	Isopropyl ether	Phenol	Methyl acrylate
n-Heptane	Cyclohexane	Alicyclic hydrocarbon	Methyl acetate
n-Octane	Tetrachloromethane	Chlorobenzene	Ethyl acetate
Paraffin	Cyclohexanon	Alcohol	Propyl acetate
Inorganic salt solution	Benzaldehyde	Benzyl alcohol	
Aqueous salt solution (10%)		Furfuryl alcohol	
Oil and fats		Chlorinated aliphatic	
Turpentine oil		Methylene dichloride	
Kerosene		Ethylene dichloride	
Gasoline		Ethylene drichloride	
Solvent naphtha		Chloroform	
Water		Nitromethane	
Sea water		Nitroethane	
Soapy water (1%)		Nitrobenzene	
Oxygenated water (10%)		Acetaldehyde	
Dibutyl phthalate		Propylene oxide	
Dioctyl phthalate		Dioxane	
Formaline (40%)		Ethyl formate	
Ethylene diamine		Acetonitrile	
Diethylamine		Acrylonitrile	
		Dimethyl formamide	
		Aniline	



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