“TOYOLAC” High Gloss ABS Resin

Technical Guide
for
Processing & Molding

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1. Introduction

High gloss ABS is a new development of specialty ABS by Toray Industries, Inc. to meet the market requirement in term of Aesthetic appearance improvement. In conjunction of improving the Glossiness of "TOYOLAC"

"TOYOLAC" High gloss ABS, it remains the basic physical and mechanical properties comparable to general purpose ABS with good impact strength and chemical resistancy & High glossiness.

Typical Mechanical Properties of "TOYOLAC" High Gloss ABS

HIGH GLOSS GRADE 高光泽						
Property 代表物性	Test Method 试验法	Test Condition 试验条件	Units 单位		High Flow High Gloss 高流动 高光泽	Middle Impact High Gloss 中抗冲击 高光泽
				Type 型号	100	700
				Suffix 区分字符	SG5	SG5
ISO STANDARD						
Melt Flow Rate 流动系数	ISO 1133	220°C / 10 kg	g/10min		44	26
Charpy Impact Strength (notched) 缺口冲击强度	ISO 179/1eA	23°C / 50 %RH	kJ/m^2		16	13
Deflection Temperature Under Load 热变形温度	ISO 75	1.8 MPa / 120°C/hr	°C		79	82
Tensile Strength 引张强度;降伏点	ISO 527	50 mm/min	MPa		46	56
Tensile Elongation at Break 拉伸伸长率			%		>10	10
Tensile Modulus 拉伸模数		1 mm/min	MPa		2400	-
Flexural Strength 弯曲强度	ISO 178	2 mm/min	MPa		68	84
Flexural Modulus 弯曲模数					2200	2560
Glossiness 光泽度	Toray Method 东丽法	Incident Angle 60°	%		98	98
Density 比重	ISO 1183	23°C	kg/m^3		1040	1050
Flammability 燃烧性	UL94 File No. E41797				HB	HB

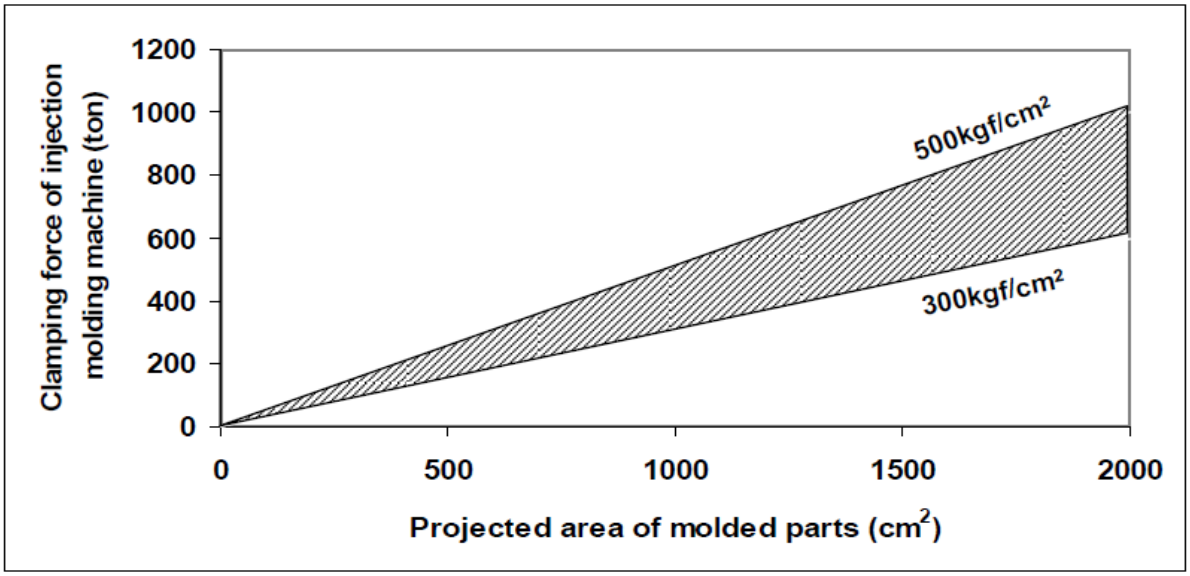
***** Mirror finish surface with minimum holding pressure & mold temperature***

Processing & Molding Conditions

Injection molding machine

- Clamping force of injection molding machine should be calculated below mentioned formula (pressure in cavity of ABS resin is generally around 300-500 kgf/cm^2), and refer to below relation graph. Appropriate injection molding machine should be used to match the mold size.

Clamping force (ton)
= Projected area of molded parts (cm^2)×pressure in cavity (kgf/cm^2)÷1000



- Shot volume of injection molding machine is recommended around 60-80%. It's suitable for following below mentioned formula. In case of less than 50% shot volume, residence time of material inside cylinder should be longer. That situation causes discoloration and deterioration of mechanical property.

Shot volume of injection molding machine > Weight of molded parts ÷ Specific

- Screw type of injection molding machine should be recommended full-fright type (compression ratio 2.0～2.5). There is a possibility that using of high compression ratio type and high kneading type cause burning and discoloration defects.

Molding conditions

Pre-Drying

Generally, ABS resin is hygroscopic and absorbs moisture in proportion to the environmental humidity. The absorb process of moisture is reversible process, therefore wet pellets can be removed moisture to environmental air with low humidity. Dried pellets should absorb moisture until the content reaches equilibrium moisture with the moisture in the air. The exact amount of moisture content depends on the relative humidity, how long the resin was exposed.

Processing undried ABS resin can be cause in silver streaking problem on moldings. For "TOYOLAC" ABS the suggested moisture level for molding is less than 0.1%, more desirable is 0.05%.

Typical drying temperature and time of "TOYOLAC" ABS by using oven with internal air circulation are shown as follows;

Drying Temperature : 80～85ºC
Drying Time : 3～5 hrs

Injection molding temperature and pressure

Injection molding conditions should be properly controlled according to the molding machines, the shape and size of the products, and the mold structure. Typical molding conditions show as follows;

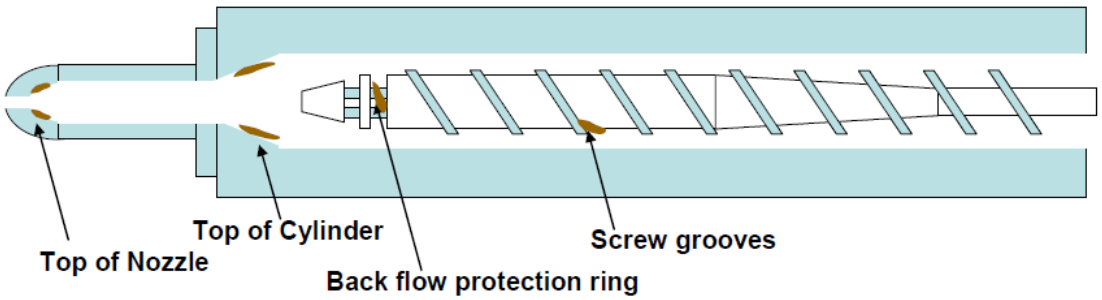
Melt temperature of polymer	: 220 ~ 250 ºC
Injection pressure	: 70 ~ 140 MPa
Mold temperature	: 30 ~ 60 ºC
Screw rotating speed	: 30 ~ 70 r. p. m.

It should be properly controlled according to the injection moulding machines, the shapes and size of the products, and the mould structure. Temperature in excess of above recommended could result of discoloration or burn marks troubles. Those troubles are a sign of damage to the material. Melt temperature of resin should be between 230ºC and 250ºC. It should be checked frequently and maintained within above recommended range to prevent defect of appearance and mechanical properties. If shutdown is required, remove the material from the machine and purge out completely to avoid burning trouble.

This excess heat could be controlled by gate and land dimension, slower injection rate or lower injection pressure. In case of accidental thermal degradation, noxious and corrosive gas may be occurred. Purge the barrel, shut off machine, quench purge shot in water. Please refer to further information that is mentioned under the title “Purging”.
Even though cylinder temperature of injection molding machine is controlling recommended temperature range, longer residence time might be cause of thermal degradation and carbonized materials should be generated.

Purging

- Purging operation should be required if carbonized material is generated during continuous molding operation. Equipment cleaning should include frequent purging with natural color ABS resin or AS resin. In case of carbonized material does not stop generating even though purging operation has been carried out sufficiently, screw should be taken out and remove carbonized materials that are stuck on screw surface, screw grooves, top of nozzle and cylinder should be cleaned up.



- If shut-down is required, remove the material from the machine and purge with natural ABS resin (or AS resin) or proper screw cleaning agent due to avoid the burning trouble and the corrosion of equipment.
- In case of molding operation is resumed after shut-down, purging operation should be required until carbonized material does not come out throughout

Recycle Property

Regrind material such as runners, spurs and short-shots of “TOYOLAC” ABS resin can be used as recycle materials. Recycle property of “TOYOLAC” 700 SG5 is shown in table below. Regrind material such as runners, sprues and short-shots of “TOYOLAC” ABS resin molded under proper molding conditions can be used for recycle materials.

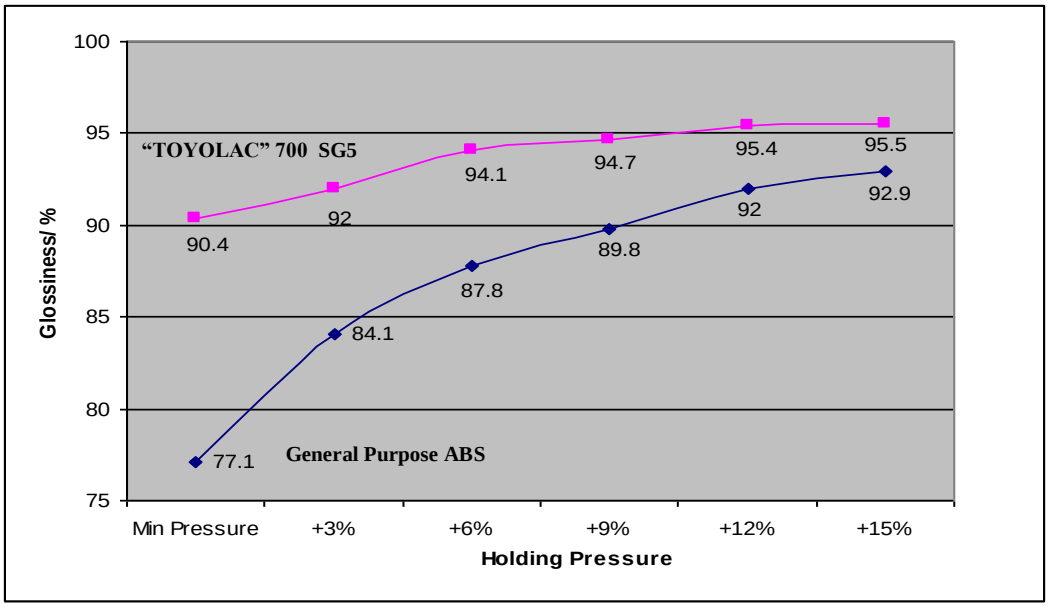
Those non-degraded regrind up to 20% can be reprocessed with fresh pellets of the same grade. Please do not mix it up with other grades of “TOYOLAC” ABS resin or other plastics. And dry it up before reprocessing. Recycle property of “TOYOLAC” 700 SG5 is shown Table. Those data showed there is no significant deterioration in mechanical properties of recycled materials.

"TOYOLAC" 700 SG5 RECYCLE PROPERTY								
Property	Test Method	Test Condition	Units	Blend Ratio of Recycle Material				
				0%	10%	20%	50%	100%
ISO STANDARD								
Melt Flow Rate	ISO 1133	220°C / 10 kg	g/10min	27	28	27	27	28
Charpy Impact Strength (notched)	ISO 179/1eA	23°C / 50 %RH	kJ/m^2	17	17	17	17	17
Deflection Temperature Under Load	ISO 75	1.8 MPa / 120°C/hr	°C	81	83	84	84	84
Tensile Strength	ISO 527	50 mm/min	MPa	53	53	53	53	53
Tensile Elongation at Break			%	23	18	16	14	8
Tensile Modulus		1 mm/min	MPa	2935	2854	2857	2857	2857
Flexural Strength	ISO 178	2 mm/min	MPa	81	81	81	81	81
Flexural Modulus				2678	2604	2607	2607	2607
Glossiness	Toray Method	Incident Angle 60°	%	95	95	95	95	95
Density	ISO 1183	23°C	kg/m^3	1045	1045	1045	1045	1045

****These values are typical value for this product under specific test conditions and not intended for use as limiting specification.**

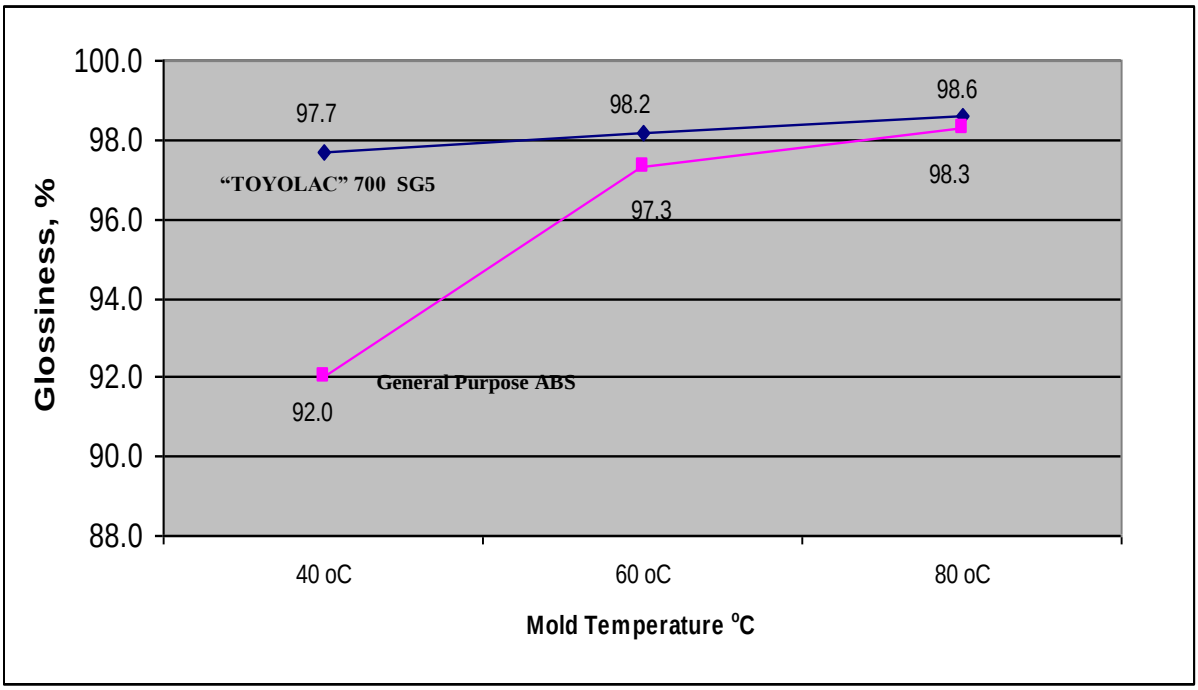
Effect of Holding Pressure and Temperature to Glossiness of "TOYOLAC" 700 SG5

Glossiness Vs Holding Pressure



Remark: Normal mold surface, mold temperature 40 °C

Glossiness Vs Mold Temperature



Spiral Flow Length

"TOYOLAC" 700 SG5 High Gloss ABS resin has excellent flow ability. The flow ability of "TOYOLAC" high gloss grade give good flow behaviour as general purpose grade the Spiral Flow Length, in figure below as a function of the injection temperature with injection pressure as parameter. It is useful for comparing the flow ability of products under the same conditions even if this test has not been standardised

Moulding Condition:

a. Moulding Machine : Toshiba Machinery, IS50A

b. Moulding Temperature : 210, 230, 250°C

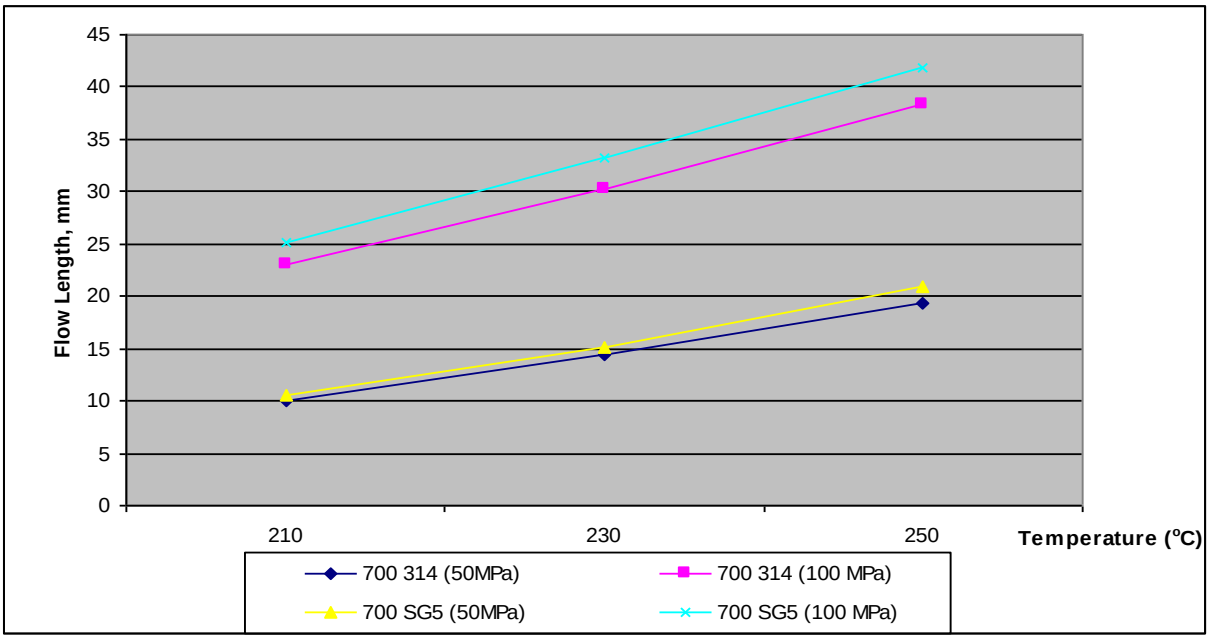
c. Mould Temperature : 60°C

d. Injection Speed : Medium (FCV B-0 : fill-in time 2 sec.)

e. Holding Time : 13 sec.

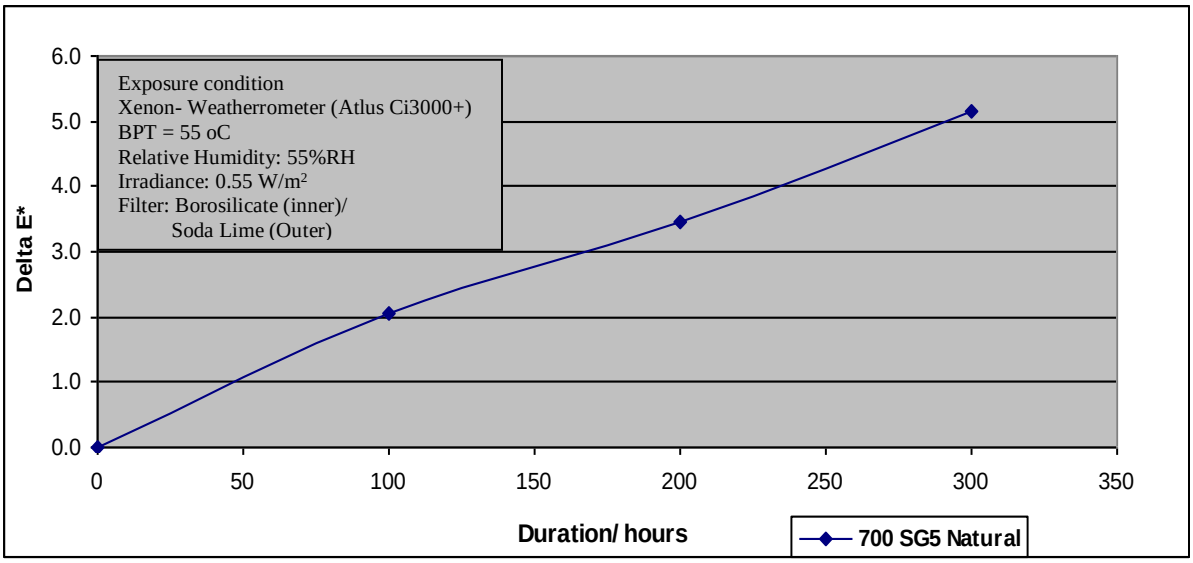
f. Cooling Time : 20 sec.

g. Mould Dimension : 10W×2mmt (Spiral Flow)



Light Resistance Performance of “TOYOLAC” ABS Resin

The graphs below plotted are colour difference (ΔE*) of "TOYOLAC" 700 SG5 against irradiation time of Xenon-weatherometer. The graphs show the almost linear increase in ΔE* against irradiation time. Light resistance grade is much better in light resistance ability than standard grade. Discoloration depends on colour shade and pigment content. Therefore, these data are typical values representative of our "TOYOLAC" 700 SG5 Natural colour. It should not be taken as a guarantee that the material behaves the same way when different colour shades or pigments are used.



Troubleshooting

Typical molding problems and problem solutions are shown as Table 1. Particular molding problem may be caused by several factors such as improper molding conditions, imperfect design of mold and moldings. Any one of the suggested remedies may solve a particular problem. However some problems may require a combination of suggested remedies.

Table 1. Checklist of Troubleshooting of "TOYOLAC" ABS resin

Problems / Remedy	Short Shots	Flash	Sink Marks	Burn Marks	Poor Weld Line	Low Gloss	Jetting	Excessive Warpage	Scratches	Air Marks	Silver Streaking	Crack, Whitening
Increase Injection Speed	✓		✓		✓	✓		✓				✓
Decrease Injection Speed				✓			✓			✓	✓	
Increase Injection Pressure	✓		✓		✓				✓			
Decrease Injection Pressure		✓		✓				✓			✓	✓
Increase Mold Temperature	✓				✓	✓	✓				✓	✓
Decrease Mold Temperature			✓					✓	✓			
Increase Barrel Temperature	✓				✓	✓	✓	✓				✓
Decrease Barrel Temperature		✓	✓	✓					✓		✓	
Decrease Nozzle Temperature				✓								
Increase Nozzle Temperature					✓	✓						
Check Nozzle, Sprue, Runner & Gate Size	✓		✓	✓			✓		✓		✓	✓
Check Gate Position & Number	✓				✓		✓		✓		✓	
Improve Venting	✓			✓	✓	✓				✓	✓	
Increase Filling Quantity	✓		✓						✓			
Decrease Filling Quantity		✓										
Check Clamping Force		✓										
Increase Holding Pressure						✓						
Decrease Holding Pressure		✓						✓				✓
Increase Holding Pressure Time			✓			✓						
Decrease Holding Pressure Time		✓						✓				✓
Increase Cooling Time			✓						✓			
Decrease Screw r.p.m.											✓	
Check Pellet Drying											✓	

Important Notes:

1. In as much as Toray Plastics (Malaysia) Sdn. Bhd. has no control over the use to which other may put this material, it does not guarantee that the same result as those described herein will be obtained. Nor does Toray Plastics (Malaysia) Sdn. Bhd. guarantee the effectiveness or safety of any possible or suggested design for articles of manufacturer as illustrated

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2. The material described here are not recommended for medical application involving any implantation inside the human body. Material Safety Data Sheet (MSDS) for the materials concerned should referred to before any us.