FORMOCON

ACETAL CO-POLYMER

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INTRODUCTION

The Polyacetal plant of Formosa Plastics Corporation located at the west-eastern part of Chung Yang Industrial Park, Chia Yi county which is about 250 km south to the Taipei city, Taiwan . This plant covered the area of 62,500 square meters, which is about 15.6 acres . Its capacity is about 20,000 metric ton per year. In an effort to fabricate high quality polyacetal copolymers and meet a various of applications, Formosa developed its own technique to build this Polyacetal plant.

Polyacetal resin is one kind of general purpose use of engineering plastics with high stiffness and high lubricant property of materials. In general, it could be applied to a various of applications, such as auto parts, electronic parts, household appliances, gears, zippers and so on.

The FORMOCON® is a trade name of Formosa's polyacetal copolymer. This polyacetal plant has received ISO9002 and ISO14001 certificates, and the UL (Underwriters Laboratory) certified the FORMOCON® materials, too. The extractables of FORMOCON® also meet the requirements of FDA CFR 177.2470. All of employees of Formosa devoted themselves to improving the qualities of polyacetal day by day, Formosa also provided a best customer service to the end user with their problems associated with the polyacetal processing.

FORMOCON®

Principle Physical Properties of Acetal Copolymer

Grade			FM025	FM090	FM130	FM270	FM350	FM450
Property	Unit	ASTM						
MI Value	g/10min	D1238	2.5	9	13	27	35	45
Specific Gravity		D792	1.41	1.41	1.41	1.41	1.41	1.41
Rockwell Hardness	MScale	D785	78	80	80	80	80	80
ROCKWELL	RScale	--	--	115	--	--	--	--
Flexural Strength	kgf/cm^2	D790	950	950	950	950	950	950
Flexural Modulus	kgf/cm^2		26000	26000	26000	26000	26000	26000
Tensile Strength at yield point	Kgf/cm^2	D638	610	620	620	620	620	620
Tensile Elongation at break point	%		75	60	55	45	40	35
Compressive 1%Deformation	kgf/cm^2	D695	320	320	320	320	320	320
Stress 10%Deformation			1100	1100	1100	1100	1100	1100
Izod Impact V-notched23℃ Strength 50%RH	kgf/cm^2	D256	7.6	6.5	6	5.4	5.1	4.5
Water 23℃ Absorption (69%) RH	%	D570	0.22	0.22	0.22	0.22	0.22	0.22
Flammability (UL94)		UL94	HB	HB	HB	HB	HB	HB
Mold Shrinkage (3mm^t,4in disk)	%		1.8-2.2	1.8-2.2	1.8-2.2	1.8-2.2	1.8-2.2	1.8-2.2
Heat Deflection 18.6kgf/cm^2	℃	D648	110	110	110-	110	110	110
Temperature 4.6kgf/cm^2	℃	D648	158	158	158	158	158	158
Linear Expansion Factor	Cm/cm℃x10^{-5}	D696	8.45	8.45	8.45	8.45	8.45	8.45
Melting Point	℃	DSC	165	165	165	165	165	165
Vicat Softing Temp.	℃	D1525	162	162	162	162	162	162
Volume Resistivity23℃50% RH	Ω.cm	D257	1x10^{14}	1x10^{14}	1x10^{14}	1x10^{14}	1x10^{14}	1x10^{14}
Surface Resistivity23℃50%RH	Ω	D257	1x10^{16}	1x10^{16}	1x10^{16}	1x10^{16}	1x10^{16}	1x10^{16}

NOTE:Above data are shown for reference only.

Feature and Applications of Grades

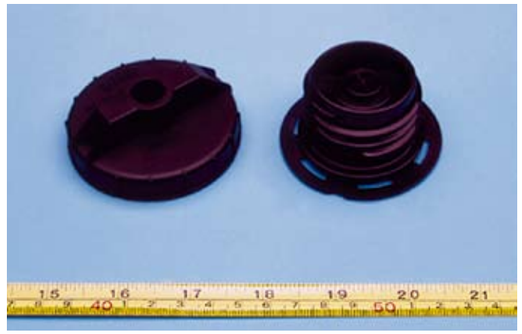
Grade	Feature	Application
FM025	High-viscosity Extrusion, Minimal mold	Extruded rods and sheets, Other extrusion parts
FM090	Standard-flow Minimal mold	Buttons and press-in fasteners, Plumbing and hardware, Gears, Electronic parts, Automotive parts, Household appliances, Bearing, Other injection parts
FM130	Medium-flow Minimal mold	Buttons and press-in fasteners, Zippers, Plumbing and hardware, Gears, Bearing, Electronic parts, Automotive parts, Household appliances, Other injection parts
FM270 FM350	High-flow Minimal mold	Press-in fasteners, Zippers, Gears, Electronic parts, Automotive parts, Household appliances, Other small mechanical parts
FM450	Superhigh-flow	Press-in fasteners, Zippers, Gears, Electronic parts, Automotive parts, Household appliances, Other small mechanical parts

Press-in fasteners

Zipper

Gears

Rotor



Cover of car gas tank

Pencil parts

Parts of floppy disc

Curtain parts

TYPICAL FEATURES OF FORMOCON®

1.Optimum features for mechanical, thermal, chemical and electrical properties

2. High stiffness, resistance to creep and fatigue

3. Excellent abrasion resistance and low coefficient of friction

4. Excellent oil resistance, resistance to organic solvent and water absorption resistance

5. Excellent dimensional stability

6. Processing temperature within a range of 180℃—210℃

7. Excellent flowability and molded property

I. Mechanical Properties

Sewer parts

Grinder parts

Handle of gas gun

Parts of cosmetic holder

Handle

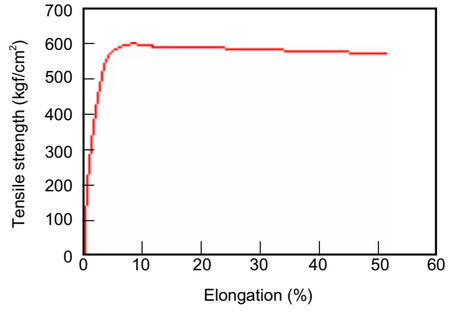
Printer parts

PROPERTIES OF FORMOCON®

1. Tensile Strength

The relationship of tensile strength and elongation of FORMOCON® is shown on the Figure 1.

Figure 1. Tensile strength versus elongation

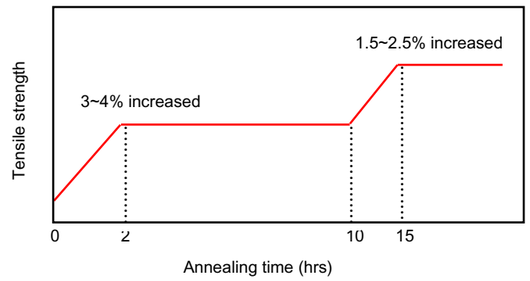


In general, the mechanical properties of POM, such as tensile strength, flexural strength, impact strength and so on, are above average among the 5 major engineering plastics. It still has a good dimensional stability even under a load within a temperature range of - 40℃—110℃ for a long time.

2. How Annealing Affects Properties

For practical purpose the main advantage of annealing is to relieve the build-in stresses and to increase the dimensional stability of molding article. The mechanical properties of molded articles will be influenced by annealing. Figure 2 Indicates that the tensile strength could be increased 3 to 4 % by annealing, it could get another 1.5 to 2.5 % increasing after 15 more hours annealing. During the period of annealing mentioned above both of elongation and compressive stress could be increased 30 % and 5 %, respectively. It probably allows the polymer segments to move from their frozen position to a random or lower stress location. In an effort to let molded articles get optimum mechanical properties it is necessary to have a annealing. A molded article put inside the oven within a temperature range of 80 - 120℃ for more than 16 hours.

Figure 2. Tensile strength versus annealing



II. Chemical Resistance

POM with properties of resistance to gasoline, oil, esters, aldehydes etc. can be manufactured to be a various of articles applied to household appliances and so on. The major chemical resistance characteristics are given in Table 1.

Table 1 Chemical resistance of POM to certain reagents

Chemical Name	Resistance	Chemical Name	Resistance
Gasoline, Kerosene	●	Weak Acids	▲
Oils	●	Strong Acids	×
Alcoholics	●	Weak Alkalis	▲
Ketones	●	Strong Alkalis	×
Ethers	●	Inorganic	●
Esters	●	Phenols	×
Aldehydes	●	Halides	○
Benzenes	●		

● : Excellent
○ : Good
▲ : Average
× : Bad

III. Thermal Properties

Both of thermal property and mechanical properties are important to plastics, their thermal stability will affect the decomposition, degradation, discoloration, appearance etc. of molded articles. POM with a good resistance to thermal property can expose to 110℃ environment based on UL746B without decomposition or degradation for a long time. The OIT (Oxidative Induction Time) thermograph of FORMOCON® FM090 tested at 240℃ with air purging by DSC (Differential Scanning Calorimeter) is shown on the Figure 3.

It tells us that a sample's thermal property remained stable up to 50 minutes.

Figure 3. The OIT thermograph of FORMOCON®
FM090

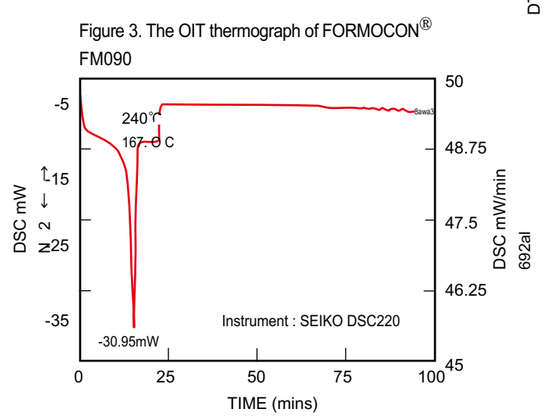
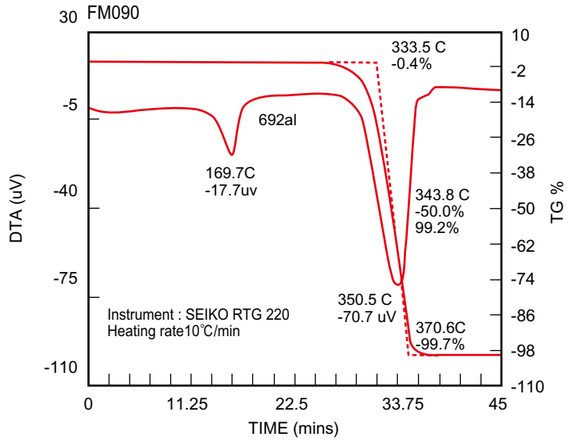


Figure 4 is a thermograph of TGA/DTA, the melting point of FM090 is around 169℃ and its weight loss started at 300℃ which is defined as the decomposition temperature. It concludes that FORMOCON® has an excellent thermal stability.

Figure 4. The TGA/DTA thermograph of FORMOCON®
FM090



IV. Weathering

If molded articles of POM are utilized outdoors they will become degradable gradually. Some of the factors included in weathering are the ultraviolet and infrared radiation of sun, oxygen, ozone, heat, moisture, atmospheric pollutants and temperature cycling.

V. Specification of UL

The specifications of plastic materials of Underwriters Laboratory (UL) of US are listed in the following Table 2.

Table 2 The specifications of UL of FORMOCON®

QMFZ 2 File No. E173318(M)

Grade	Color	Min. Thick-ness (mm)	UL94 Flame Class	R.T.I. (℃)			Hot Wire Ign.	High Amp Arc Ign.	High Volt TRACK Rate	D-495 Arc Resis-tance	IEC TRACK (CTI)
				Electr-ical	Mechanical						
					with impact	w/o impact					
FM025	all	0.8	94HB	110	90	90	5	0	---	---	---
		3.0	94HB	110	90	100	3	0	0	5	0
FM090	all	0.8	94HB	110	90	90	5	0	---	---	---
		3.0	94HB	110	90	100	3	0	0	5	0
FM130	all	0.8	94HB	110	90	90	5	0	---	---	---
		3.0	94HB	110	90	100	3	0	0	5	0
FM270	all	0.8	94HB	110	90	90	5	0	---	---	---
		3.0	94HB	110	90	100	3	0	0	5	0
FM350	all	0.8	94HB	110	90	90	5	0	---	---	---
		3.0	94HB	110	90	100	3	0	0	5	0
FM450	all	0.8	94HB	110	90	90	5	0	---	---	---
		3.0	94HB	110	90	100	3	0	0	5	0

Switchg of drinking fountain

Wheels

I NJECTION MOLDING CHARACTERISTICS OF FORMOCON®

The required properties of plastic materials applied to injection molding processing are generalized as followings: high flowability , good appearance, low injection pressure and processing temperature, low shrinkage and short overall cycle time. The major injection molding conditions of FORMOCON® FM090 are descried as follows: cylinder temperature within a range of 185 - 210℃, mold temperature of 40 - 90℃, retention time of melt resin are less than 10 minutes with pigments and less than 15 minutes without pigments, respectively. Some of processing characteristics of FORMOCON will be described in details in the following paragraph.

I. Shrinkage

FORMOCON® is one kind of crystalline polymers its shrinkage is larger than those amorphous polymers because of a difference of specific volume which it decreases with the temperature and the solid will occupy less room than the molten polymer between the crystalline phase and amorphous phase of POM. The shrinkage of molded articles is a function of the molding conditions, such as pressure and temperature (cylinder temperature, mold temperature etc.). A molded article dimension will be affected by energy of heat, moisture absorption, water immersion, crystallization propagation and so on. Several tests related to the physical properties have been done in Formosa's lab those data are given in the following figures:

Figure 5. Effect of mold temperature on shrinkage

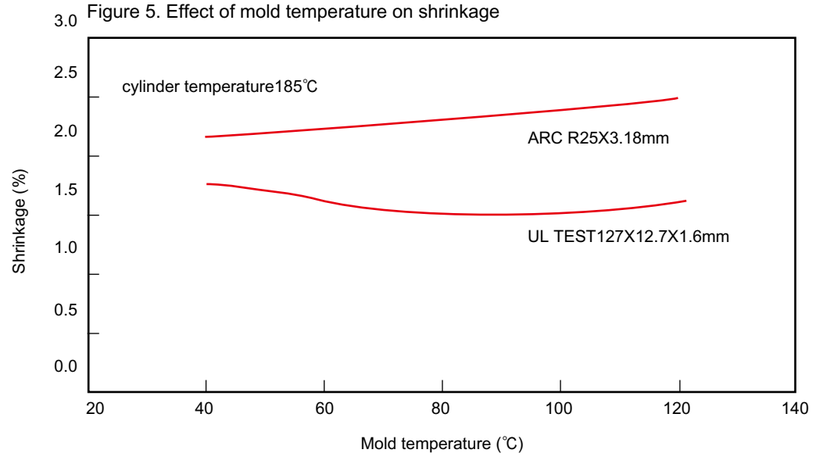
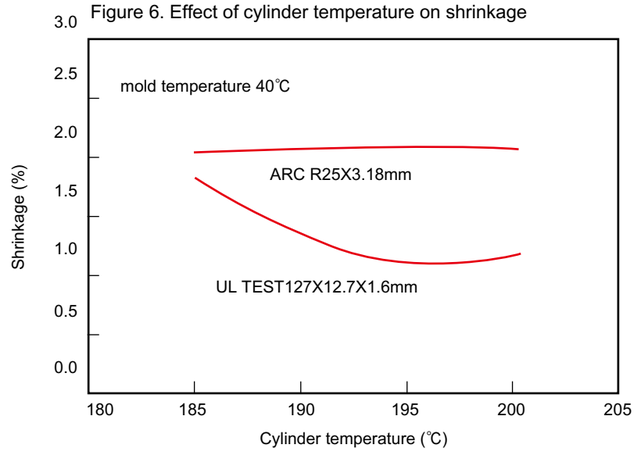
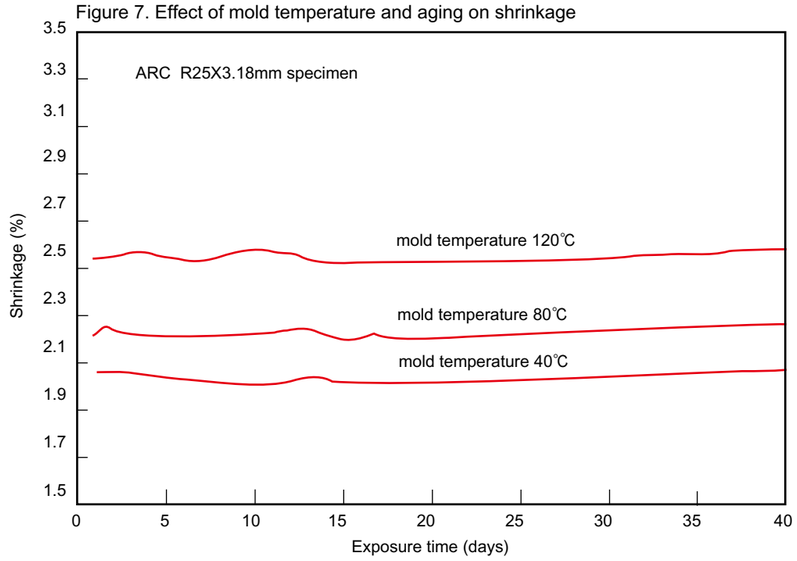


Figure 6. Effect of cylinder temperature on shrinkage



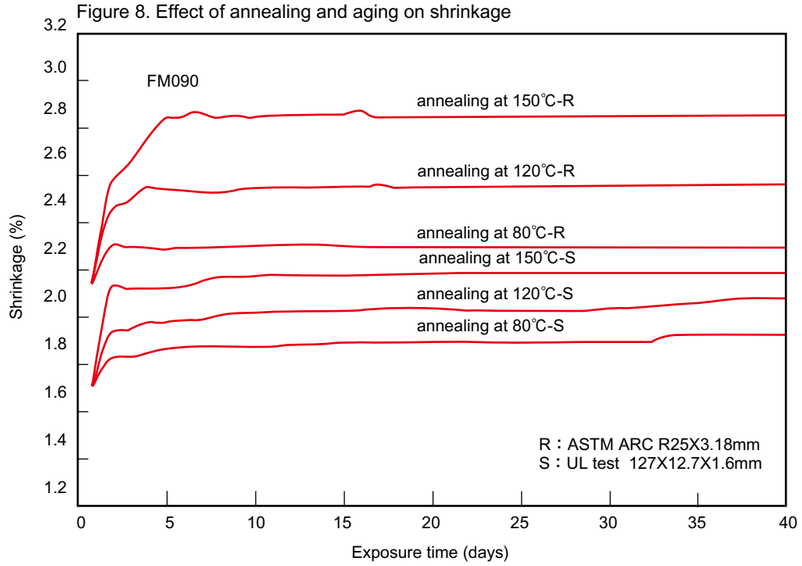
Three type of specimens of FM090 , dimensions based on ASTM ARC R25 x 3.18mm, fabricated by same molding conditions with different mold temperatures of 40℃, 80℃and 120℃. Figure 7 told us that molded specimens placed in the room temperature for a given time just got little deformation.

Figure 7. Effect of mold temperature and aging on shrinkage



In an effort to observe the effect of annealing on dimensional variations, specimens of FM090 specified by ASTM ARC R25 x 3.18mm and UL TEST 127 x 12.7 x 1.6 mm have been annealed at 80℃, 120℃ and 150℃for 16 hours. Figure 8 indicates that shrinkage of both samples annealed at 80℃are smaller than the others because of after-crystallization of both samples annealed at 120℃and 150℃, respectively. For better shrinkage controlled of molded articles, in general, an annealing temperature is 10 - 20℃ higher than to which temperature of molded article applied.

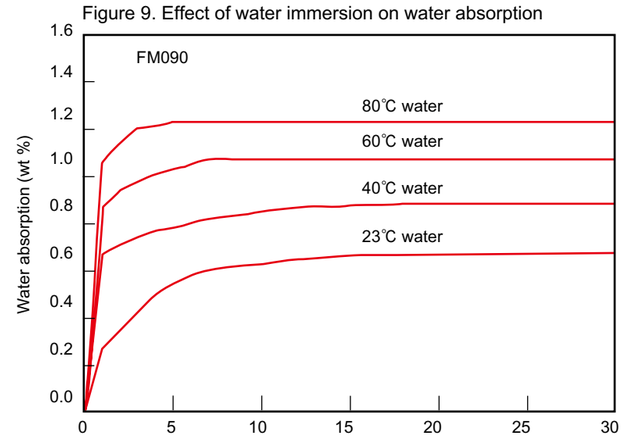
Figure 8. Effect of annealing and aging on shrinkage



II. Water Absorption

Depending on the degree of absorption, the physical properties of a plastic may be affected to a greater or lesser degree. For instance, stress released and deformation of molded articles will happen by absorbing moisture of environment. If a molded article immersed in water at elevated temperature its dimension will be increased by swelling. Figure 9 indicated that the water absorption of molded article is less than 0.2 % at the environment of 23℃and 50 % relative humility for a long given time. It also told us that the water absorption of a molded article is less than 0.7 % in the room temperature but it increased with the temperature of water immersed.

Figure 9. Effect of water immersion on water absorption



III. Material Recycling

FORMOCON® could be partially recycled with virgin POM or be in case of a regeneration rate of 100 % . Multiple pass extrusions of FORMOCON® FM090 have been carried out by a twin screw extruder. The changes in tensile strength, mold shrinkage (moldability), melt index and color are indicated in figures 10, 11, 12, 13. Figure 11 indicates that the shrinkage of FORMOCON® are very stable even after 6 pass extrusions. The other properties of tensile strength, flexural strength, melt index and color (yellowness index) just changed slightly with a increasing pass of extrusion.

Figure 10. Effect of numer of regenerations on tensile strength

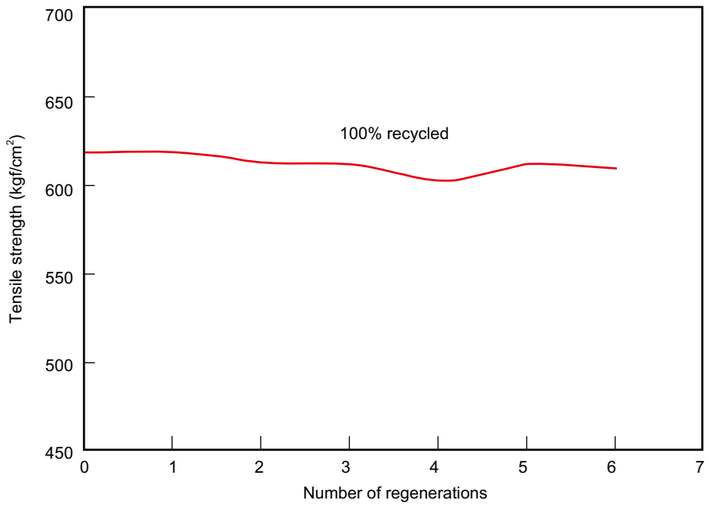


Figure 11. Effect of numer of regenerations on shrinkage

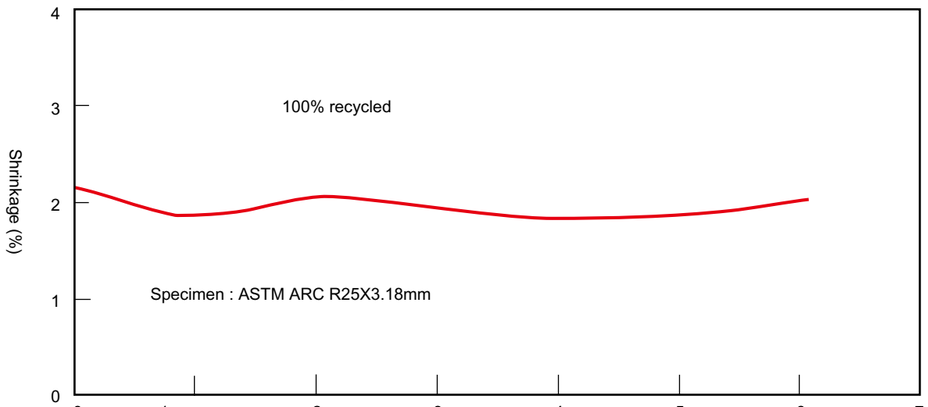


Figure 12. Effect of numer of regenerations on melt index and flexural strength

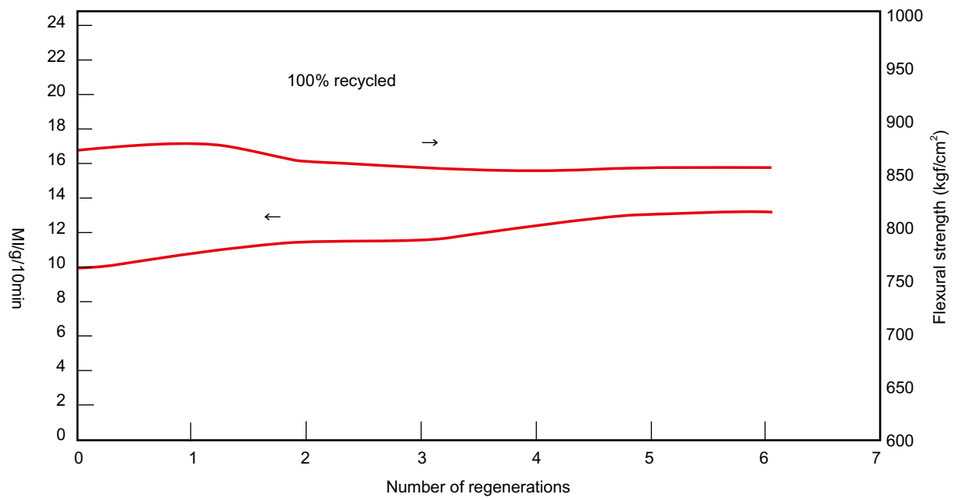
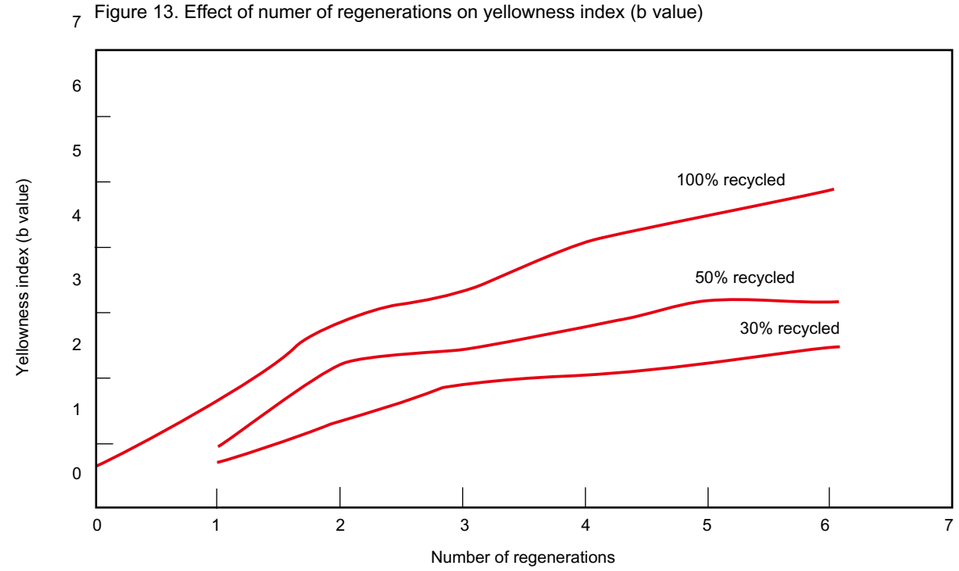
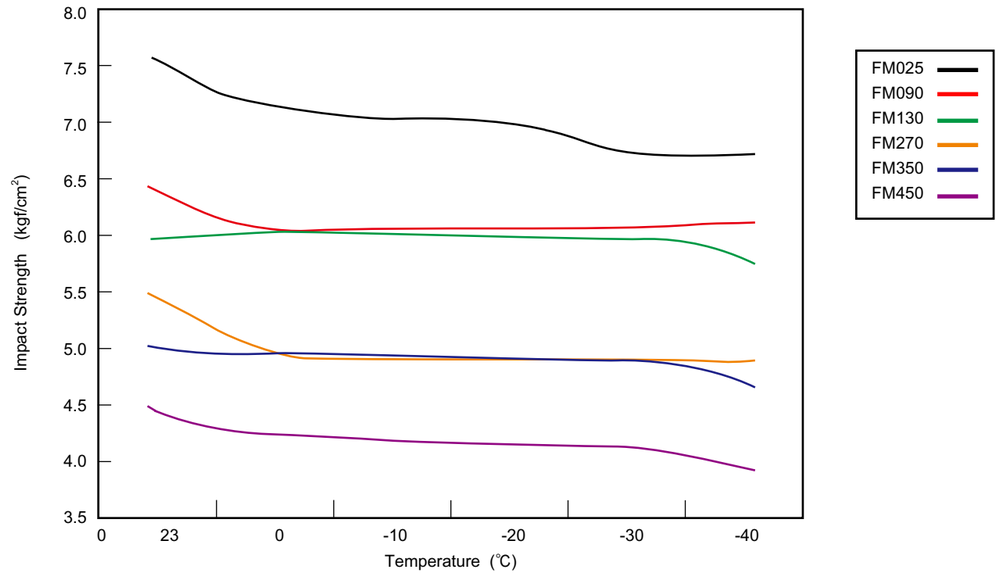


Figure 13. Effect of numer of regenerations on yellowness index (b value)



Ⅳ. Effect of Temperature on Impact Strength

Figure 14. Effect of temperature on impact strength



According to ASTM D 256, samples are tested at different temperatures, 23℃, 0℃, -10℃, -20℃, -30℃, -40℃, the impact strength vs test temperature curve are shown as fig14.

INJECTION MOLDING CONDITIONS OF FORMOCON®

1. Predrying：

Since the water absorption rate of Formocon is very low and the resin is sealed with moisture-proof package, it can be applied to molding without predrying immediately after opening package. However, it is recommended to conduct predrying if the resin is long exposed in the environment with high moisture or the resin is ready for injection molding of high precision.

Predrying Conditions：

* Drying under 80~90℃ for 3~4hours.
* Drying on the shelf of oven : the size of the resin pellet should be less than 25mm.
* Drying in the hopper of the dryer : Adjust the temperature and flow rate of the air or inert gas to keep dryer at the recommended temperature and maintain the drying period not less than 3~4hours.

2. Barrel Temperature：

The melting point of Formocon resin is 165℃. However, the resin melt temperature of injection molding is preferably kept in 190~10℃. The actual temperature of the melt resin will be 10~20℃ higher than the barrel temperature. It is recommended to detect actual temperature of the melt resin by inserting thermal couple into the melt resin exiting from nozzle of the injection machine and measuring the temperature of the resin.

The temperature profile of the barrel is set as follows, for example:

Rear（located near hopper）：	150 ~ 170 ℃
Middle ：	170 ~ 190 ℃
Front ：	180 ~ 200 ℃
Nozzle ：	190 ~ 210 ℃

3. Mold Temperature：

The standard mold temperature of Formocon is 60~80℃. However, the actual mold temperature will varies with the requirement of the properties , appearance conditions, deformation during use, molding cycling time of the mold product. In addition, to avoid warpage of the product, it is required to keep uniform temperature distribution of the mold.

For example, if the injection molding is implemented under high ambient temperature, to prevent deformation of mold product, it is necessary to set the mold temperature higher than the ambient temperature or carrying out annealing the mold product. Besides, if the appearance of the mold product is to be glossy, the mold temperature is increased to 120℃. On the other hand, to shorten the molding cycle time, the mold temperature is to decrease to 30~40℃. However, the following problems may occur due to the decreasing of mold temperature.

(1) The remaining of molded-in stress.
(2) Poor appearance of the mold product.
(3) The occurrence of after-shrinkage due to high mold temperature.
(4) The occurrence of high mold deposit.
(5) The incomplete filling of mold cavity.

4. Injection Pressure：

The standard injection pressure of Formocon is 49~98 MPa （500~1,000 kgf/cm^2）. However, the actual injection pressure will varies with the influential factors such as the fluidity, shrinkage rate, properties, and especially the appearance or dimensions of the mold product. And the standard holding pressure of Formocon is set 50~100% of injection pressure. The proper timing for switching from injection to holding pressure is at the time of 80 ~ 90% filling of mold cavity.

5. Injection Speed：

The standard injection speed of Formocon is 5~50mm/s（0.3~3m/min. However, the actual injection speed will varies with influential factors such as the shape, thickness and quality requirement of mold product, as well as the dimensions of runner and gate of the mold.

Under the case of requiring high precision of molding due to processing thin wall-thickness mold product or existing numerous runners in the mold, the high injection speed is preferably used. Under the case of the occurrence of the cavity or flow marks due to thick wall-thickness mold product, the low injection speed is preferably used.

6. Screw Rotation and Back Pressure：

The standard screw rotation and back pressure of Formocon are set as follows, Screw rotation : 80~150rpm

Back pressure（Gauge）：0.5~1.0MPa （5~10kgf/cm^2）

To reduce the temperature fluctuation of melt resin, it is preferably implemented to decrease screw rotation and increase back pressure of injection machine. However, the feasibility of adopting the method depends on the factor of productivity.

When back pressure is set too low, the air will be trapped and flow rate of resin become unstable. On the other hand, as back pressure is set too high, it will result in dropping of resin from nozzle and prolonging plasticizing of the resin.

7. Molding Cycle Time：

(1) Injection Time (Injection + Holding Pressure)：

The total time of injection and holding pressure is set to be a little longer than the gate sealing time. The gate sealing time is the minimum time required for the weight of mold product to become constant in the injection molding. It can be obtained in the injection test by measuring the time required to achieve maximum weight of mold product through increasing injection time step by step (for instance, increasing 2 seconds each time).

(2) Cooling Time：

The cooling time is the time required for the mold product to become solidified enough to be ejected. In general, to produce stable mold product, it is required to make the holding time longer than the gate sealing time. Besides, the cooling time is decided according to the plasticization time and the ejection time based on the principle that mold product must keep high stability of shape and dimensions during ejection. In addition, longer cooling time is required in the situations such as mold product with thicker portion, higher mold temperature, slender mold core with heat sink and deformation of mold product.

8. Warnings：

* The resin is not allowed to heat over 240℃ to avoid resin decomposing.
* Materials such polyvinyl chloride (PVC) containing chloride or the flame retardant containing halogen will accelerate decomposing Formocon , so those are not allowed to contaminate Formocon® to be molded.

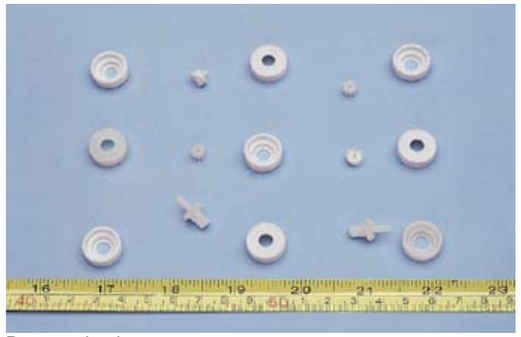
TROUBLESHOOTING GUIDE FOR INJECTION MOLDING

Problem	Possible Cause	Remedy
Short Shots	1.Insufficient feeding 2.Melt flow too restricted 3. Material too cold 4.Mold temperature too low 5.Injection pressure too low 6.Back pressure of entrapped air causing resistance 7.Injection speed too low	1.Raise injection volume 2.Raise injection pressure, raise cylinder temperature, raise injection forward time, raise mold temperature 3.Raise cylinder temperature 4.Raise mold temperature 5.Raise injection pressure 6.To reduce rate of injection, raise vent cavities at point of final fill 7.Raise injection speed
Flashing	1.Inadequate clamping setting 2.Cavities 3.Injection holding pressure too high 4.Resin flowability too high	1.Adjust clamping mechanism to obtain optimum holding pressure, reduce injection pressure, reduce cylinder temperature 2.Seal cavities and cores tightly, line up cavities and cores, reduce vents of cavities 3.Decrease injection dwell pressure, booster time and plunger forward time 4.To reduce resin and mold temperature
Silver Streaks	1.Resin temperature too high 2.Contamination by foreign material 3.Moisture and volatiles in material 4.Excessive condensation and lubricant on mold surface 5.Mold temperature too low	1.Decrease nozzle & cylinder temperature, reduce overall molding cycle 2.Inspect molding powder for evidence of contamination, insure reground material being properly handled 3.Preheat material (70 - 90℃for several hours) 4.Thoroughly clean mold surface, avoid excessive lubrication of granules and mold 5.Raise mold temperature

Problem	Possible Cause	Remedy
Brittleness	1.Resin too cold 2.Mold surface too cold 3.Resin overheated 4.Contaminated foreign material, too much reground 5.Internal stress	1.Raise rear cylinder temperature & nozzle temperature 2.Raise mold temperature 3.Decrease temperature across the cylinder, reduce back pressure 4.Avoid contamination, reduce reground resin 5.Raise cylinder temperature, reduce injection pressure, decrease cycle, raise mold temperature Warping
Warping	1.Distortion due to internal strains 2.Parts too hot when ejected 3.Knockout pins working unevenly 4.Excessive shrinkage 5.Differential shrinking of part having irregular cross-section	1.Decrease injection pressure, raise mold cooling time, raise mold temperature 2.To reduce cylinder & mold temperature, raise mold cooling time 3.Adjust or repair knockout pins 4.To reduce mold temperature, raise injection pressure, change gate size 5.Redesign part with a more uniform cross-section to obtain balanced filling
Bubbles and Voids	1.Internal shrinkage after outer surface have set-up 2.Material too hot 3.Moisture and volatile in material 4.Inadequate venting causing entrapment of air	1.Redesign mold with increasing size of sprue, runner and gate, raise injection pressure, raise injection speed, increase plunger forward time 2.Decrease cylinder temperature, balance mold temperature 3.Dry resin, reduce volatiles in material, increase injection back pressure, raise cylinder temperature 4.Vent cavities at point of final fill, relocate gate to obtain optimum filling
Unmelted Granules	1.Material too cold 2.Cycle too short/insufficient energy of cylinder	1.Increase cylinder temperature 2.Increase cycle time

Problem	Possible Cause	Remedy
Dimensional Variations	1.Operation conditions unstable 2.Molding problems 3.Machine problems 4.Materials problem	1.Readjust operation conditions be consistent 2.Keep mold temperature even, increase injection pressure, increase injection forward time and boost time 3.Increase plasticizing capacity, keep screw stop action consistent 4.To reduce batch to batch variation, preheat material
Sticking in Mold	1.Overpacking material in cavities 2.Mold design	1.Reduce material feed, reduce injection pressure, reduce injection forward & boost time, increase overall cycles 2.Polish in same direction a part is ejected, improve mold surface, increase the taper, increase the effective knockout area, check the operation of the knockout system
Sprue Sticking	1.Injection pressure too high 2.Material too hot 3.Sprue diameter too large for cooling 4.Sprue taper too small 5.Orifice of nozze larger than orifice of sprue bushing 6.Too much material packed into sprue	1.Reduce injection pressure 2.Decrease cylinder temperature 3.Decrease the sprue diameter 4.Increase the taper of sprue 5. Replace with sprue having smaller orifice 6.Decrease injection pressure, reduce plunger forward time, raise mold temperature in sprue bushing area
Weld Lines	1.Material too cold 2.Excessive lubricant on mold surface 3.Gate too far from the weld 4.Insufficient venting at the weld 5.Mold temperature too low	1.Increase cylinder temperature 2.Avoid excessive lubrication of granule and mold, clean mold surface 3.Using multiple gate and runner or add additional gates 4.Add run-off at weld, decrease injection speed 5.Increase mold temperature 6.Increase injection pressure

Problem	Possible Cause	Remedy
Sink Marks	1.Thermal contraction of material during set up 2.Uneven mold temperature 3.Moisture/volatile in material 4.Insufficient material sealed in cavities	1.Increase injection pressure, increase feed capacity, raise plunger forward time, increase size of gates, nozzle, runners and sprue 2.Redesign mold temperature control system 3.Dry material, reduce volatiles in material 4.Increase feed capacity
Scorching	1.Gas entrapment 2.Material degraded and carbonated in the cylinder 3.Injection speed too fast	1.Reduce injection pressure and speed, change gating pattern, increase runner-sprue-nozzle system 2.Decrease cylinder temperature, reduce overall molding cycle 3.Decrease plunger speed, booster time and injection pressure, raise gates size
Burning Spot	1.Excessive energy added to resin 2.Injection speed too fast 3.Gas entrapment	1.Decreae cylinder temperature, decrease overall molding cycle 2.Reduce injection speed, using higher flowability resin 3.change gating pattern, increase runner-sprue-nozzle system
Surface Disturbance	1.Mold temperature too low 2.Injection pressure too low 3.Moisture in material 4.Excessive lubricant on mold surface 5.Short shot 6.Screw speed too low	1.Increase mold temperature 2.Increase injection pressure 3.Preheat material, avoid condensation in the mold surface 4.Avoid excessive lubricant or mold release, clean mold surface 5.Raise injection pressure, raise feed rate, increase mold temperature 6.Increase screw speed, increase cylinder temperature



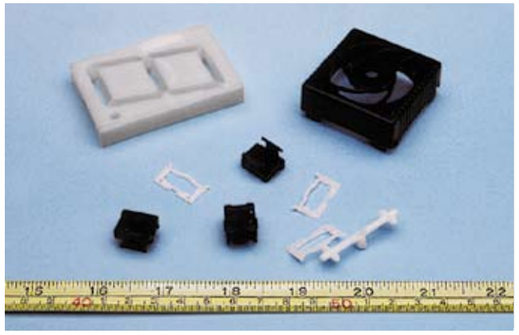
Drawer wheel

Button & press-in fasteners

Screw fasteners

Wheels

Connectors



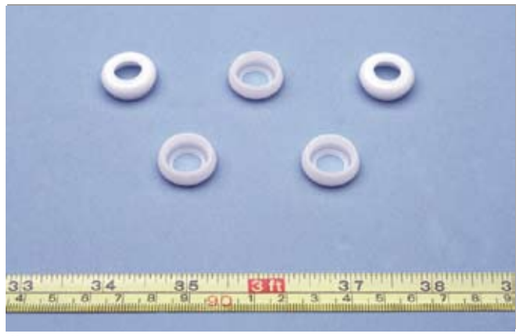
Fan parts of computer

Connectors

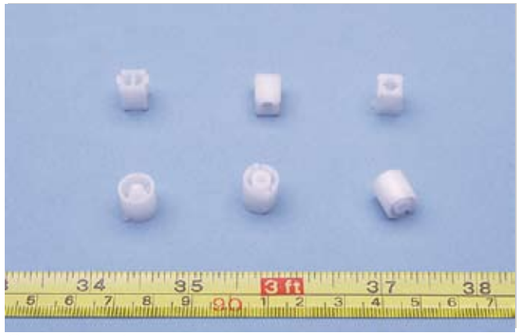
Rotators

Fixture, rotor

Wheels



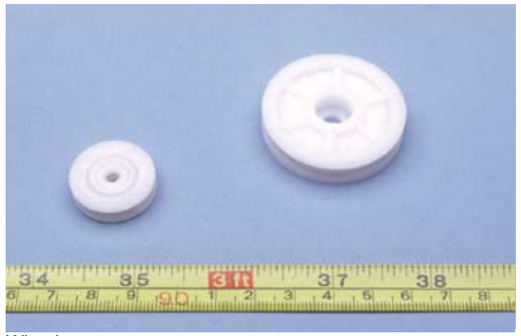
Gears



Computer parts

Tube fittings

Camera parts



Wheels

Toy parts

INSTRUMENTS OF QC AND R&D

Differential scanning calorimeter

High performance Liquid chromatography

Gas chromatography

Thermogravimetric analyzer

Hardness tester (rockwell)

Spectrocolorimeter

Melt indexer

Injection molding machine

Izod impact tester

UV absorber

Universal tensile tester

Lab type twin screw extruder

CERTIFICATIONS AND APPROVALS

Since 1994, FPC has established quality management system and obtained ISO 9001 certification in order to improve the quality of POM and meet the requirements of our customers. Our management system also has been certified to other important international standard certifications such as ISO-14001:1996，OHSAS-18001 and so on.

Our product FORMOCON® are listed in UL (Underwriters Laboratories) of USA, and also comply with the regulations of FDA (Food and Drug Administration)。

FORMOCON® FM090 is certified by NSF (National Sanitation Foundation), and comply with the requirements of NSF standard 61 for the drinking water system components.

Following is a list of certifications and approval for reference. For further or specific compliance information, please contact FPC sale department
(Tel: 886-2-27122211＃6094、6095，Fax: 886-2-27137012)

◎ Management System Approvals

▲ ISO 9001:2000 （Quality Management System）

▲ ISO 14001:1996 （Environment Management System）

▲ OHSAS 18001:1999 （Occupational Safety and Health Management System）

▲ SONY GREEN PARTNER

◎ Safety & Sanitary Approvals

▲ UL (Underwriters Laboratories: USA)
File no.:E173318

▲ CSA (Canadian Standard Associate : Canada)

▲ NSF (National Sanitation Foundation : USA)
NSF61 （Drinking Water System Component）
Customer no.: 8220, Plant no.: 82201 DCC: IA07897

▲ FDA (Food and Drugs Administrations : USA)