Modified PPE Resin

Iupiace™ LEMALLOY™

2023.07 version

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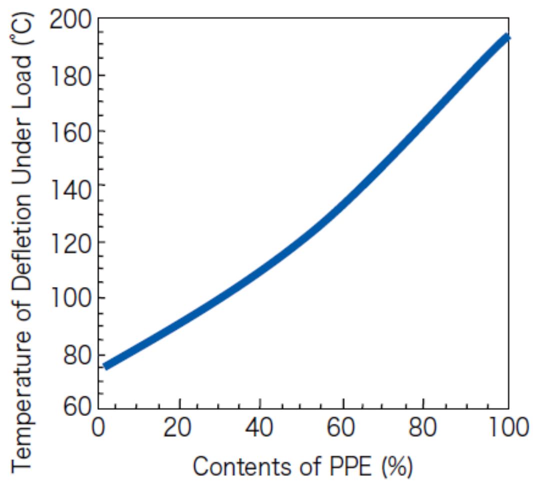
What is Iupiace ™

Iupiace (modified PPE resin) is an amorphous engineering plastic, which is developed by Mitsubishi Gas Chemical Co., Inc., with its unique technologies and whose main components are the polyphenylene ether (PPE) and polystyrene (PS). It has a good balance of electric property, flame resistance, heat resistance, dimensional stability, moldability, and other properties. Additionally, its specific gravity is the lowest among engineering plastics. It is UL-approved and is used for the mechanism parts of home appliances and in electric/electronic office automation equipment, such as the chassis of office automation equipment. It is also used for a wide range of applications, such as automotive exterior parts and water related parts, including pumps by taking advantage of its hot water resistance.

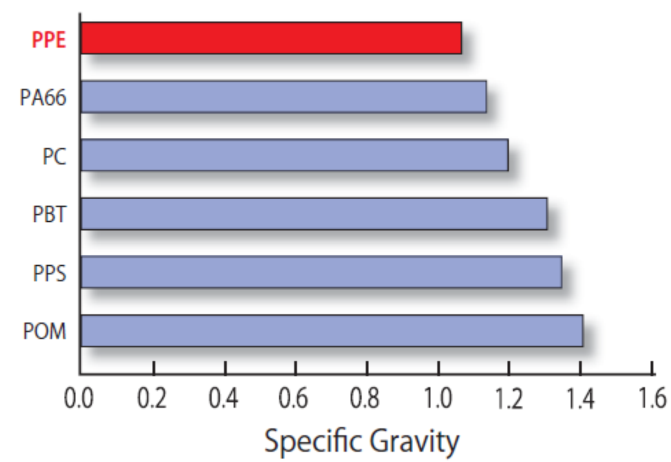
Wide range of heatproof temperature

Thermal deformation temperature can be adjusted widely by changing the mixing ratio of PPE and PS.



Low specific gravity

Iupiace has the lowest specific gravity among engineering plastics and enables weight saving.



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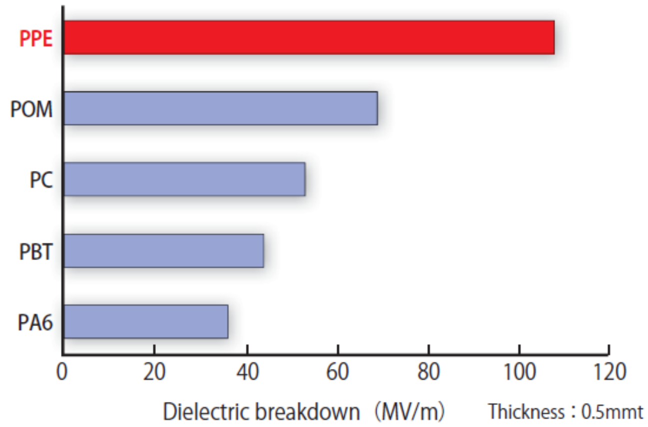
High electric property-1

The dielectric breakdown strength of Iupiace is the highest among engineering plastics and the insulation property is excellent.



High self-extinguishing property

Iupiace has a high oxygen index and is easy to add flame resistance. A wide range of frame resistance grades (HB, V-1 and V-0) is available.

Resin	Oxygen Index
POM	15 ~ 16
PA66	22 ~ 25
PC	24 ~ 25
PPE	27 ~ 29
PS	18 ~ 19

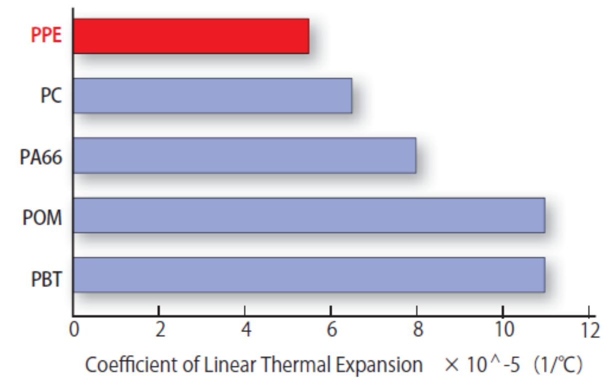
High electric property-2

The electric permittivity and dielectric tangent of Iupiace are the lowest among engineering plastics.

	PPE	POM	PC	PBT	PA6
Dielectrical Constant	2.8	3.7	2.9	3.2	3.4
Dielectric Tangent (1E-3)	6	7	9	20	20

High dimensional accuracy

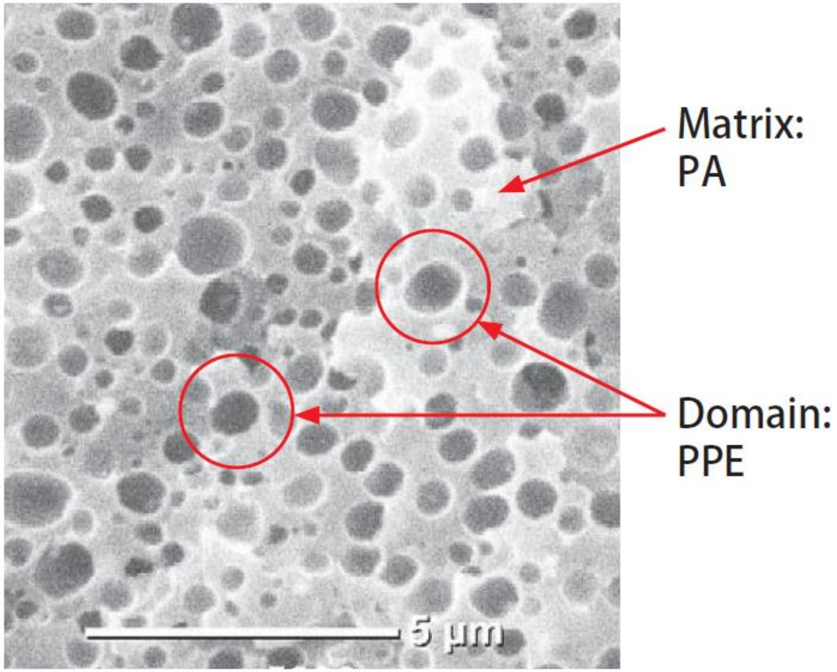
Iupiace has the lowest linear expansion coefficient among engineering plastics and offers excellent dimensional accuracy.



What is LEMALLOY ™

LEMALLOY has sea-island structure. Matrix phase is crystalline resin, such as a polyamide resin (PA) or polypropylene resin (PP) and domain structure (in the matrix phase) is polyphenylene ether resin (PPE). This resin has the chemical resistance and moldability/workability of a crystalline resin and the dimensional stability and stiffness at high temperature of an amorphous resin together. It is therefore used in various environments. In automotive applications, it is frequently used for electric components, such as the junction box and connectors in an engine compartment, by taking advantage of the chemical resistance of a crystalline resin and the characteristics of PPE, such as low specific gravity and low water absorption.

It is an alloy made of PPE and a crystalline resin, PA or PP.



Because of the sea-island structure of alloying, the alloy has a better oil resistance than PPE/PS. Its features include higher stiffness at high temperature and lower water absorption rate than PA.

		Moldability	Oil Durability	Dimensional Stability	Modulus at high-temperature
Crystalline resins(C)		◎	◎	△	△
Amorphous resins(A) lupiace		×～○	×～○	◎	◎
Alloy	(A) - (A)	△～○	△	◎	◎
	(C) - (C) LEMALLOY	○	◎	○	○

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Features

Grades for a wide range of heatproof temperature and various applications are available.

■Features of Iupiace

- Stiffness, impact resistance, fatigue resistance, and other properties are stable over a wide range of temperature.
- Because of excellent insulation property and low electric permittivity/dielectric tangent, it is optimal for electric applications that require insulation.
- It has a low water absorption rate while the change in physical properties at saturated water absorption is small.
- It has a high deflection temperature under load and excellent thermal stability while the decrease in physical properties due to heat treatment is small.
- Because of self-extinguish property and excellent flame resistance, it is optimal for electric applications.
- Weight saving is possible due to a low specific gravity.
- It is suitable for precision molding since its mold shrinkage factor is small and it is insusceptible to molding conditions.
- It covers a wide range of heatproof temperature.

■ Features of LEMALLOY

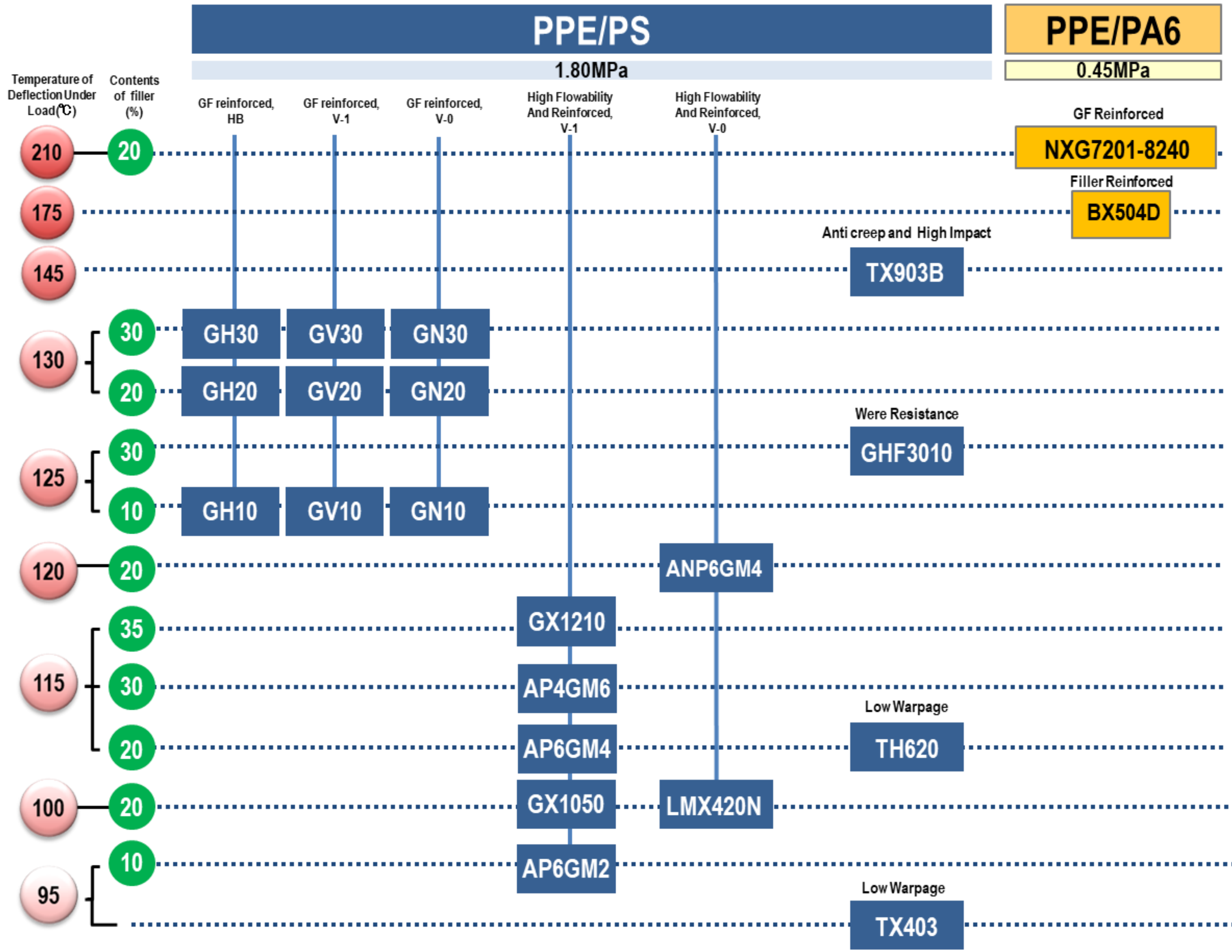
- LEMALLOY has a high deflection temperature under load of 150° C or higher (at 0.45 MPa) even for its unreinforced grade.
- It has an excellent impact resistance.
- It has a chemical resistance equivalent to that of a polyamide resin or polypropylene resin.
- LEMALLOY have better dimensional stability compare to polyamide.
- It has an excellent flow property.
- When compared to those of a polyamide resin, it has lower water absorption rate and specific gravity.

General Purpose Grades

Temperature of Deflection Under Load(℃)	PPE/PS 1.80MPa: General purpose HB Grades	PPE/PS 1.80MPa: General purpose V-1 Grades	PPE/PS 1.80MPa: General purpose V-0 Grades	Anti-Static	PPE/PA 0.45MPa: PA6	PPE/PA 0.45MPa: PA66
190						NX9000
180					NX7000	C61HL
165					BX528A-3	C82HL
160				EHM1000 -9905M		
155				EHM1010A	BX505	
150				EHM103R		
145	AH91	AV90	LN91			
135	AH80					
130			JBS70			

Temperature of Deflection Under Load(℃)	PPE/PS 1.80MPa: General purpose HB Grades	PPE/PS 1.80MPa: General purpose V-1 Grades	PPE/PS 1.80MPa: General purpose V-0 Grades	High Dielectric constant / Wear Resistance / High Flowability	PPE/PA 0.45MPa: PA6	PPE/PA 0.45MPa: PA66
125	AH70		LN80	HD7007 (High Dielectric constant)		
120						
115	AH60	LV60	LN60			
110				AHF6010B (Wear Resistance)		
100		LV40	LN40			
95	AH40					
90			LN30			
85				AH8P (High Flowability)		
80			LN23	AP4		

Reinforced Grades



Applications

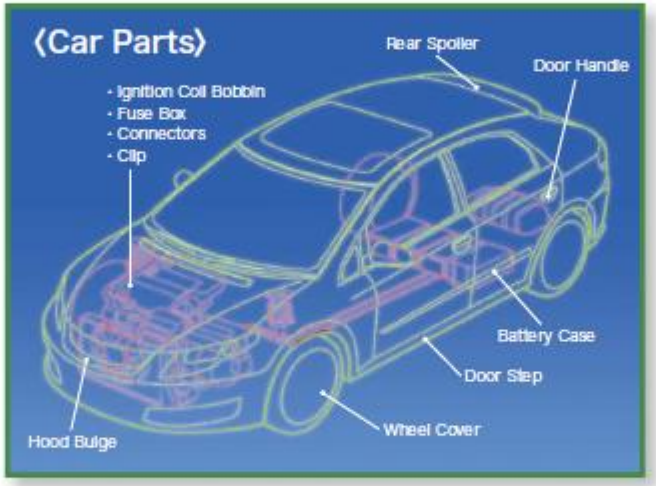
Iupiace and LEMALLOY are used in various fields from automobile parts to electric/electronic parts and medical devices.

For housing equipment
- Photovoltaic parts
- Boiler parts
- Battery parts
- Water meter parts
- Piping parts
- Floor heating parts
- Washing toilet seat parts

For household use
- Lighting parts
- TV housing
- Air conditioner parts
- Gaming machine parts
- Refrigerator parts
- Smartphone
- Air purification device parts
- NB personal computer parts
- AC adaptor
- Tablet
- Battery charger parts

For infrastructure/installation
- Underground piping parts
- Tunnel parts
- Road security parts
- Water purification equipment parts
- Automatic vending machine parts
- Elevator parts
- Medical device parts
- Semiconductor equipment parts
- Battery manufacturing facility parts
- Money changer parts
- Control instrument parts

For other applications
- Copier parts
- Printer parts
- Connector
- IC tray
- Insulating film
- Terminal block
- Sensor
- Motorboat parts
- Wire coating
- Inverter
- Pump parts
- Dish tray
- PC parts
- Inlet
- Scanner parts
- LED frame



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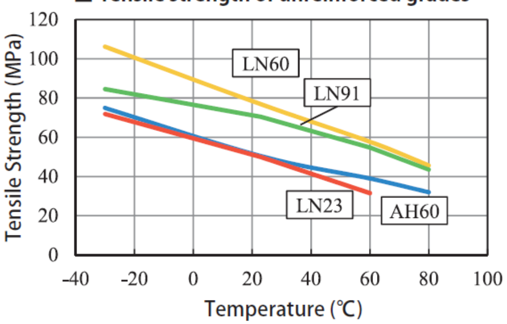
Properties of Iupiace ™

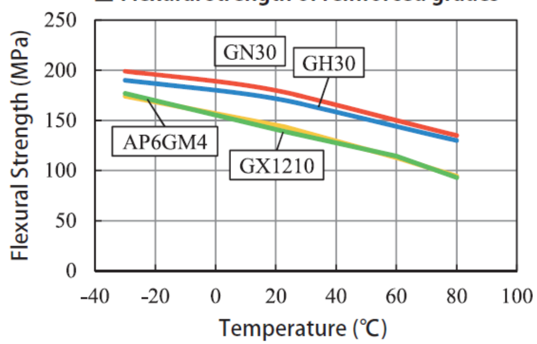
Temperature dependence of Iupiace

The physical properties of Iupiace were measured at a temperature range of -30°C and 80°C and the results are shown below.
The unreinforced grades show reduction in stiffness, such as tensile strength and elastic modulus at high temperature; however, they show increase in toughness such as elongation (tensile breaking strain) and impact strength.
Additionally, the reinforced grades have a lower temperature dependence of various physical properties when compared to the unreinforced grades.

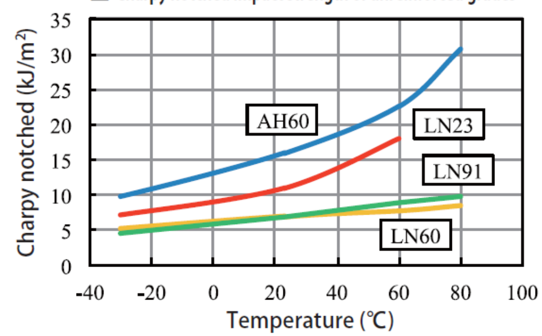
■ Tensile strength of unreinforced grades



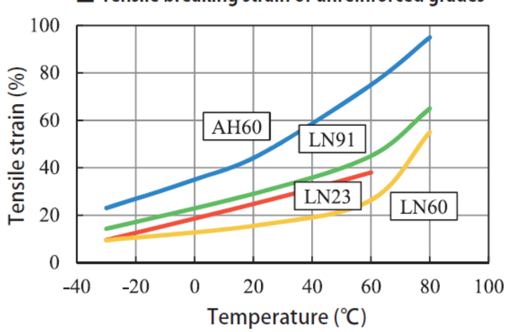
■ Flexural strength of reinforced grades



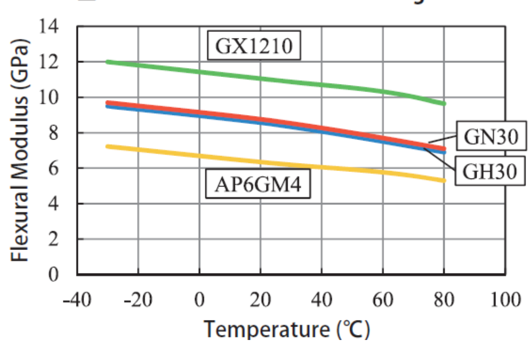
■ Charpy notched impact strength of unreinforced grades



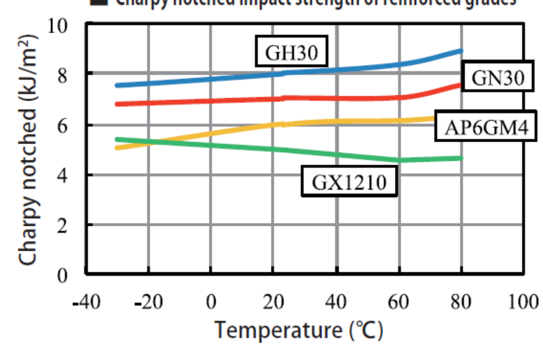
■ Tensile breaking strain of unreinforced grades



■ Flexural modulus of reinforced grades



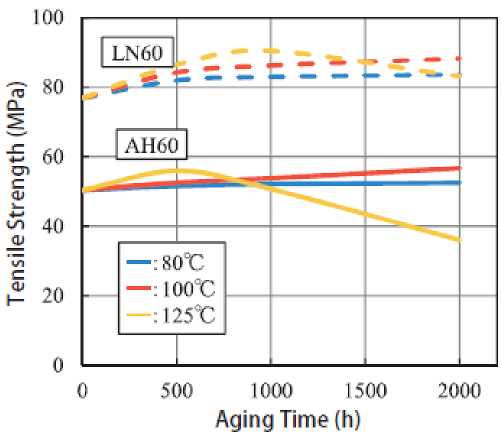
■ Charpy notched impact strength of reinforced grades



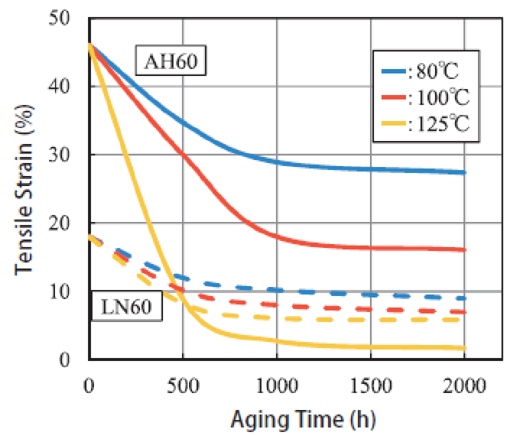
Heat and aging resistance property of Iupiace (1) (Unreinforced grade)

The unreinforced grades of Iupiace were heat treated under high-temperature atmosphere and their physical property values are shown below. The tensile strengths show no decrease due to heat treatment at 100°C or lower. The tensile elongations (tensile breaking strains) show decrease temporarily due to heat treatment and stabilize after that. Additionally, there is no substantial decrease in impact strength at 100°C or lower. Finally, the dimensional shrinkage factors due to heat treatment are shown below. The dimensional shrinkage factor at 125°C or higher is 1% or lower and it can be seen that the dimensional change is small even under high temperature.

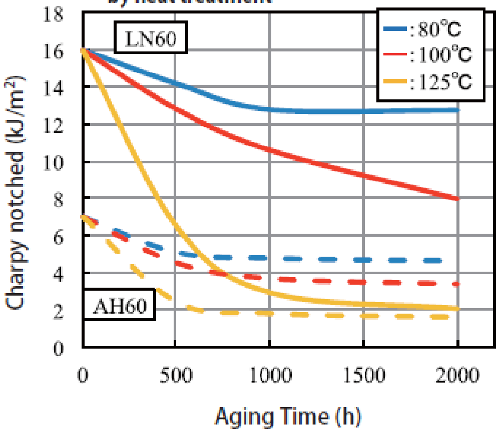
■ Changes in tensile strength by heat treatment



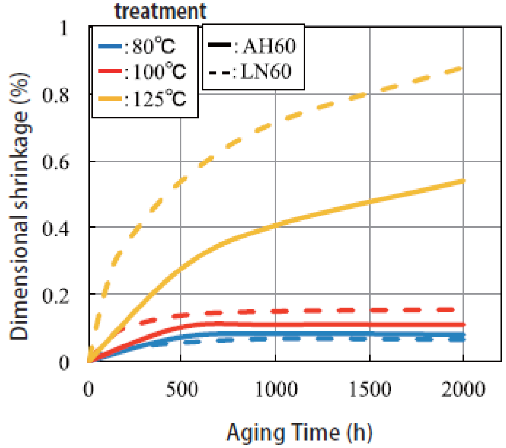
■ Changes in tensile breaking strain by heat treatment



■ Changes in charpy notched impat strength by heat treatment



■ Changes in dimensional shrinkage by heat treatment



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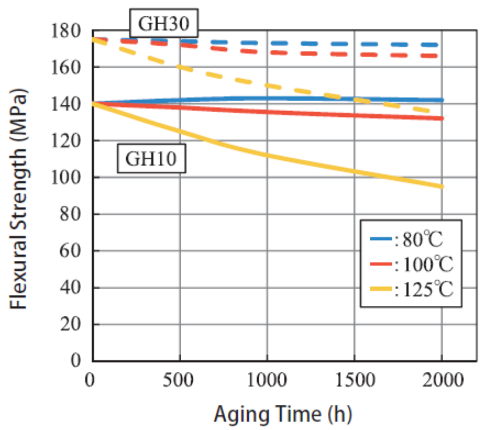
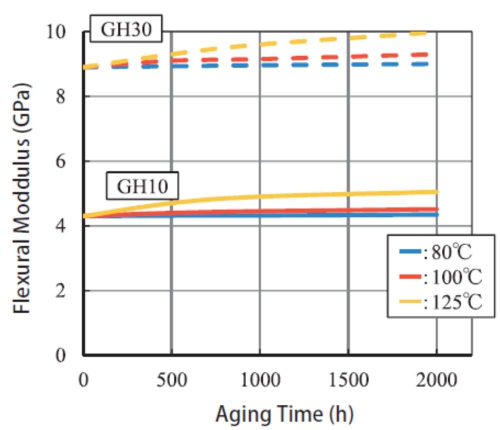
Heat and aging resistance property of Iupiace (2) (Reinforced grade)

The reinforced grades of Iupiace were heat treated under high-temperature atmosphere and their physical property values are shown below. The reinforced grades of Iupiace have very small change in flexural strength, elastic modulus, and impact strength and show excellent heat resistance. Additionally, although the change in the dimensional shrinkage factor is small, anisotropy of the dimensional shrinkage factors occurs in the MD direction and TD direction.

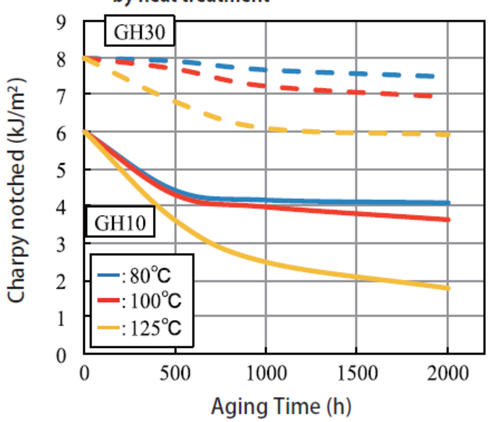
■ Changes in flexural strength by heat treatment



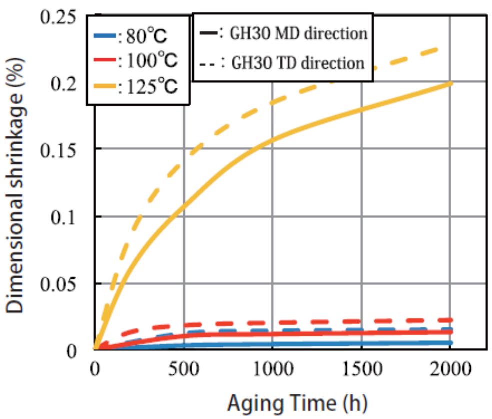
■ Changes in flexural modulus by heat treatment



■ Changes in charpy notched impat strength by heat treatment



■ Changes in dimensional shrinkage by heat treatment



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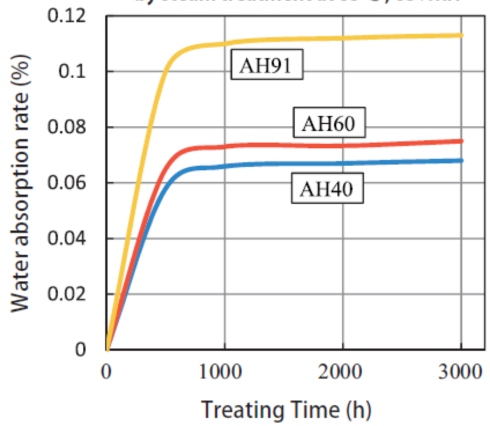
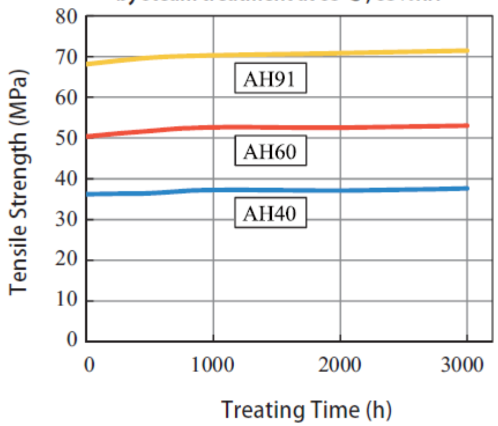
Hygrothermal property of Iupiace (1) (Unreinforced grade)

The unreinforced grades of Iupiace were kept at high temperature and humidity (85°C and 85% RH) for a prolonged time, and the changes in water absorption rate and physical properties are shown below. The unreinforced grades of Iupiace show low water absorption rates. The saturated water absorption rates are below 0.12% and they absorb almost no water. Although the tensile elongations (tensile breaking strains) show decrease temporarily, they stabilize after that. There is no decrease in tensile strength and the Charpy impact strengths are stable. They also have high humidity and heat resistance.

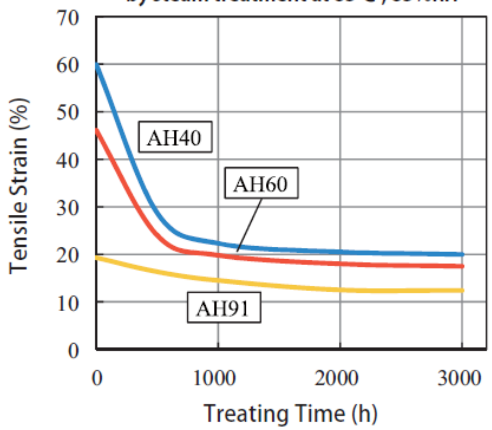
■ Changes in water absorption rate by steam treatment at 85℃ , 85%RH



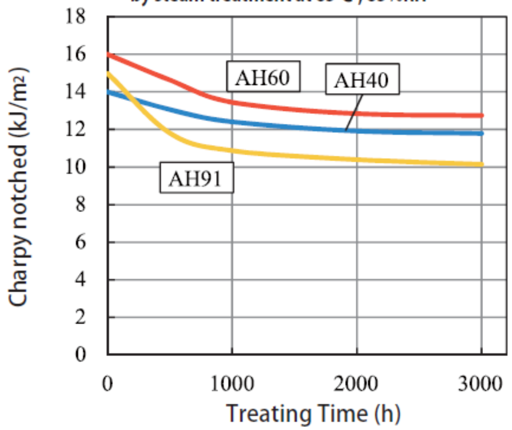
■ Changes in tensile strength by steam treatment at 85℃ , 85%RH



■ Changes in tensile breaking strain by steam treatment at 85℃ , 85%RH

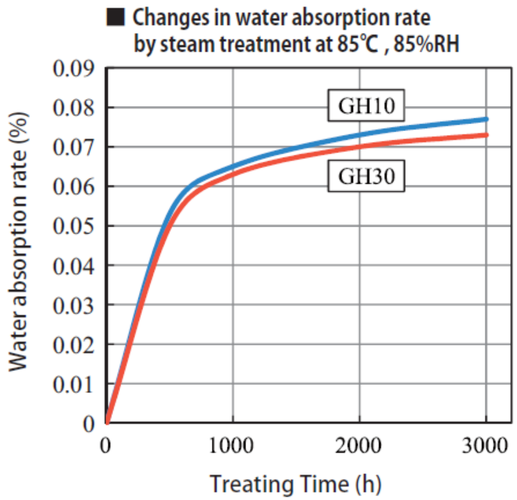


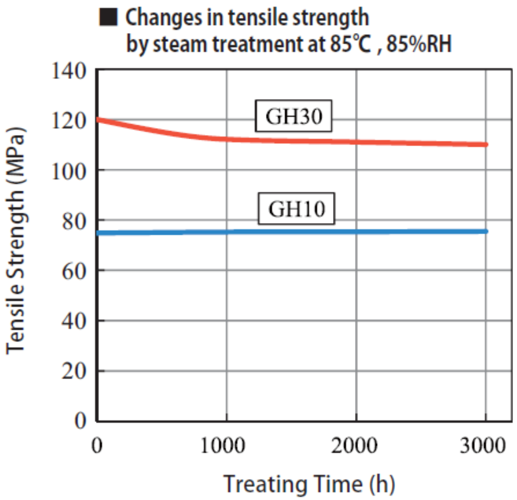
■ Changes in charpy notched impact strength by steam treatment at 85℃ , 85%RH

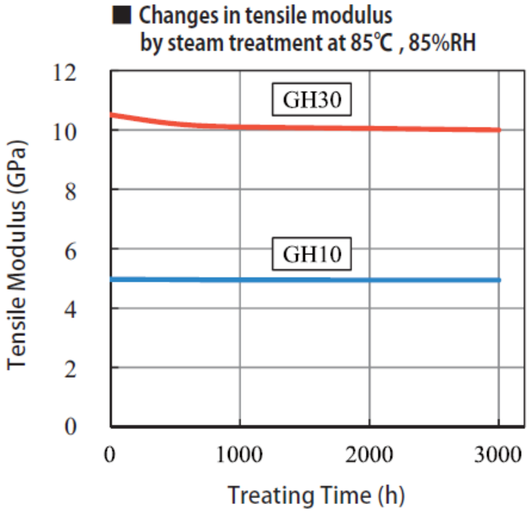


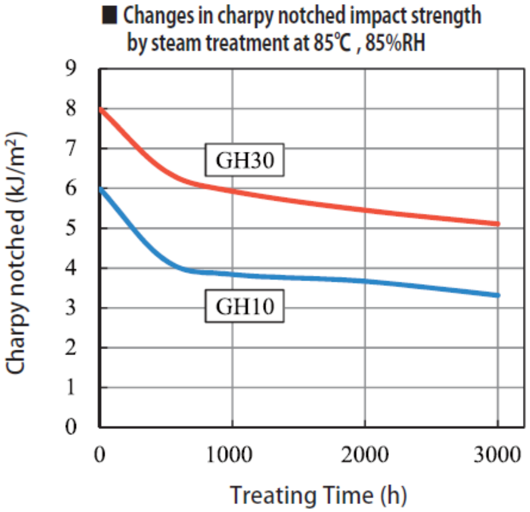
Hygrothermal property of Iupiace (2) (Reinforced grade)

The reinforced grades of Iupiace were kept at high temperature and humidity (85°C and 85% RH) for a prolonged time and the changes in water absorption rate and physical properties are shown below. Similar to the unreinforced grades, the reinforced grades of Iupiace show very low absorption rates and have stable mechanical properties even under high temperature and humidity.









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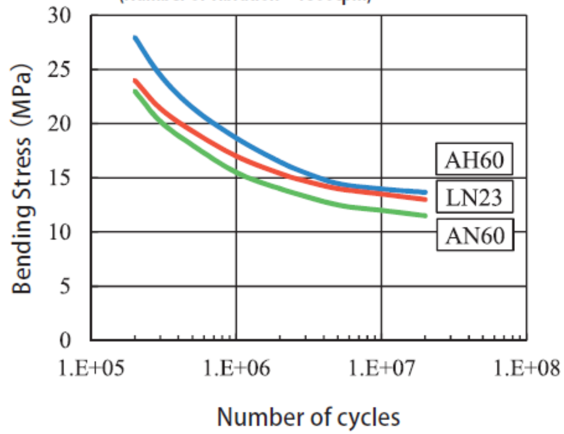
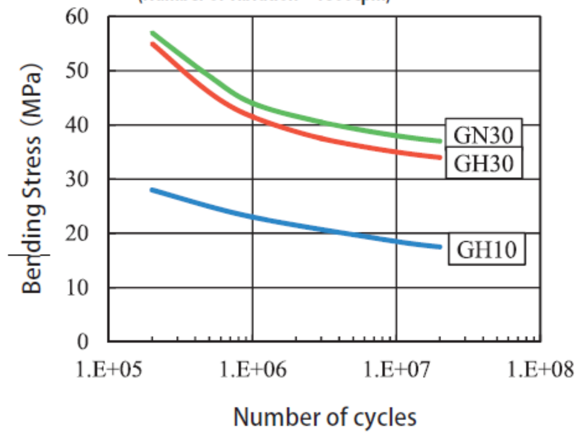
Fatigue property and creep property of Iupiace

The bending fatigue property and bending creep property of Iupiace are shown below.
In general, the fatigue limit stress is defined as the stress at which the specimen breaks after applying vibration of that level for 10 to the 7th (1.E+7) times and the fatigue limit stress of the unreinforced grades are 10–15 MPa. For the reinforced grades, the fatigue limit stress becomes higher when the GF content is higher. Additionally, the change in the creep property is less for the reinforced grades.

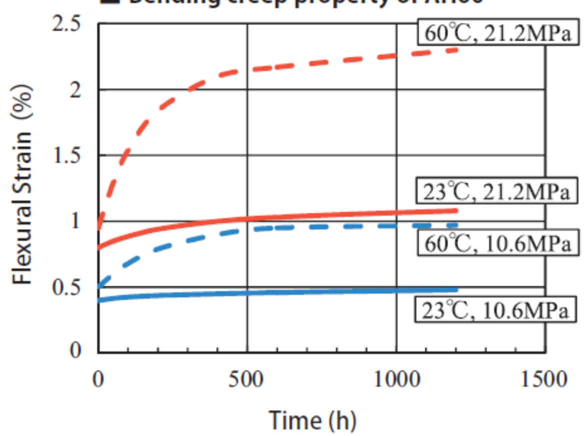
■ Bending fatigue properties of unreinforced grades
(Number of vibration：1800cpm)



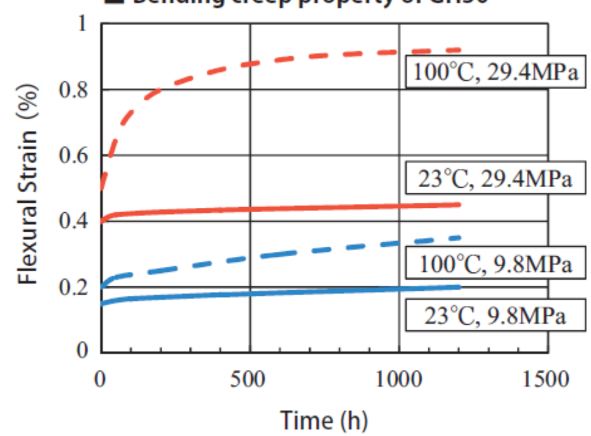
■ Bending fatigue properties of reinforced grades
(Number of vibration：1800cpm)



■ Bending creep property of AH60

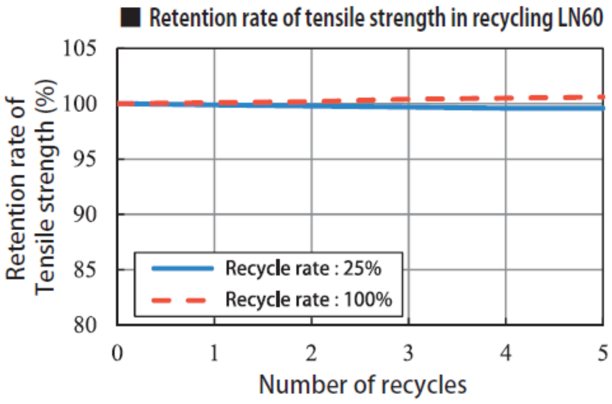


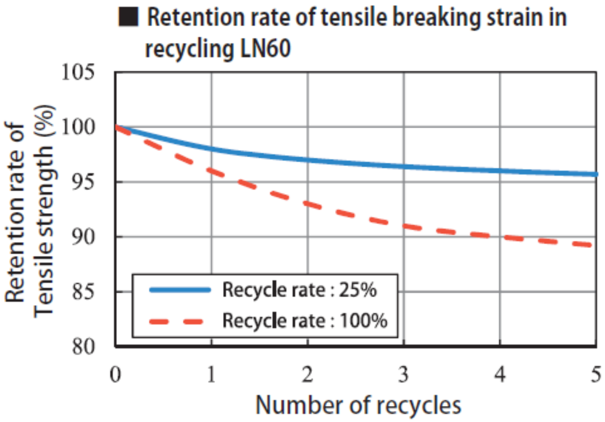
■ Bending creep property of GH30

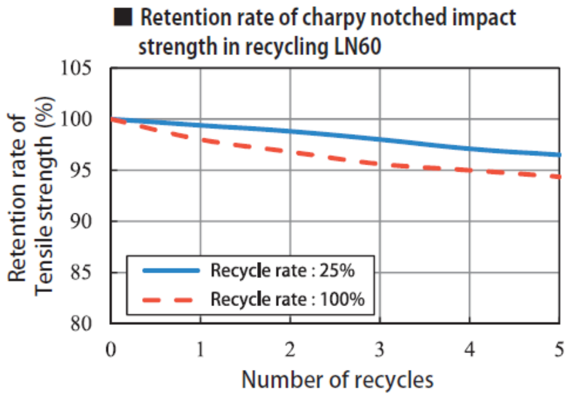


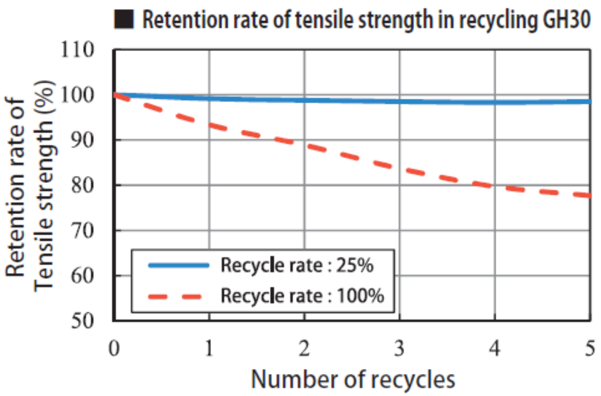
Recycling property of Iupiace

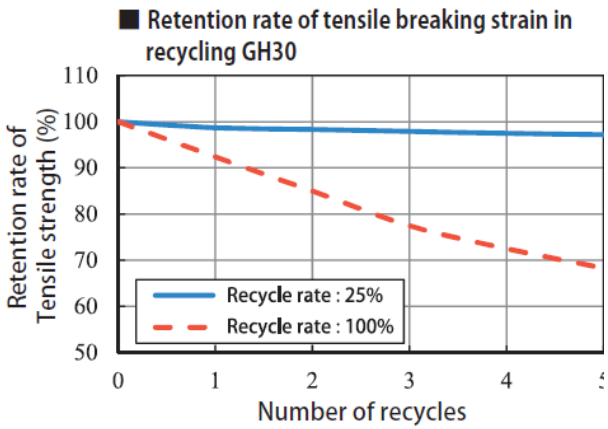
The unreinforced grades and reinforced grades of Iupiace were molded with a recycle rate of 25% and 100%. The retention rates are shown below. For the unreinforced grades, there is no decrease in the tensile strength when the recycle rate is 100%. However, the tensile elongation and impact strength becomes lower. Additionally, for the reinforced grade, the strength decreases substantially when the recycle rate is 100%.

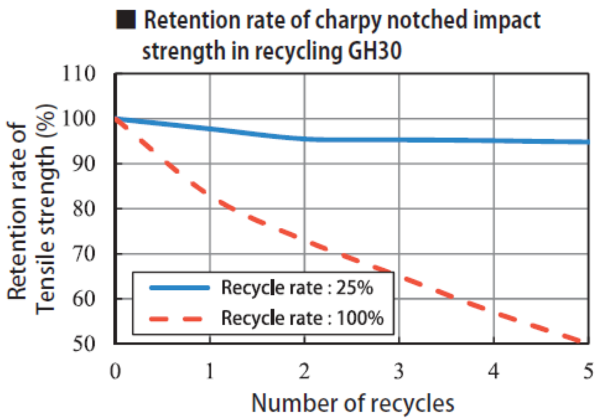






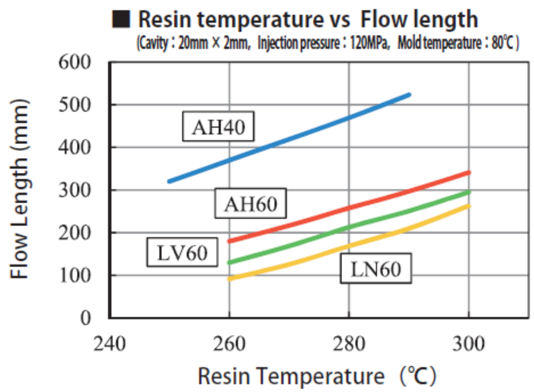


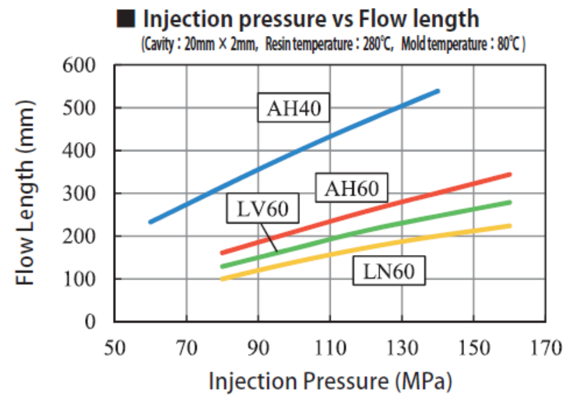


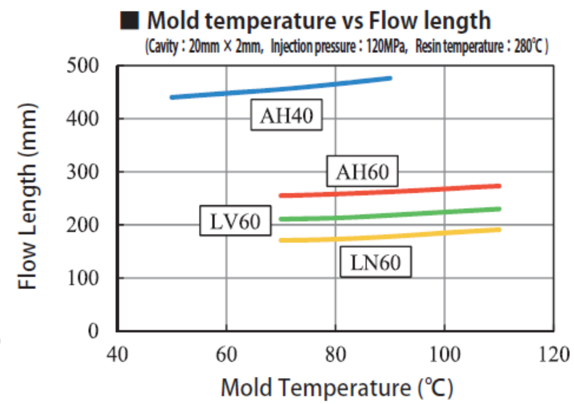


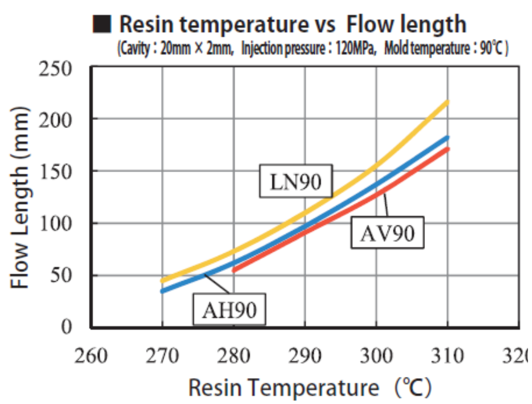
Flow property of Iupiace (1) (Unreinforced grade)

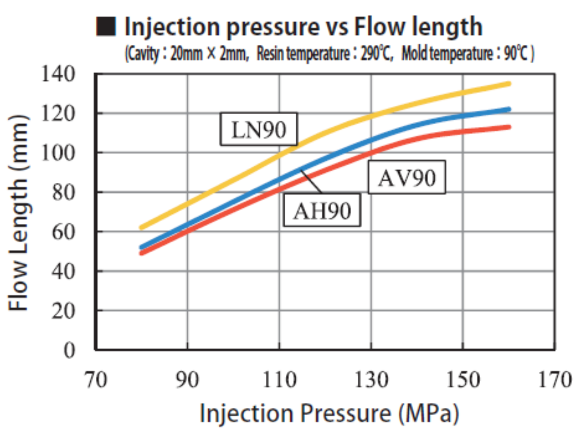
The flow properties of the unreinforced grades of Iupiace are shown below. It can be seen that the flow properties of Iupiace are influenced substantially by the resin temperature and injection pressure. Although the influence on the flow properties by the mold temperature is less than those by the factors above, various adverse influences such as increase in the residual strain in a molded product and decrease in the luster on the appearance of a molded product may occur when the mold temperature is too low. Therefore, adequate molding conditions must be set.

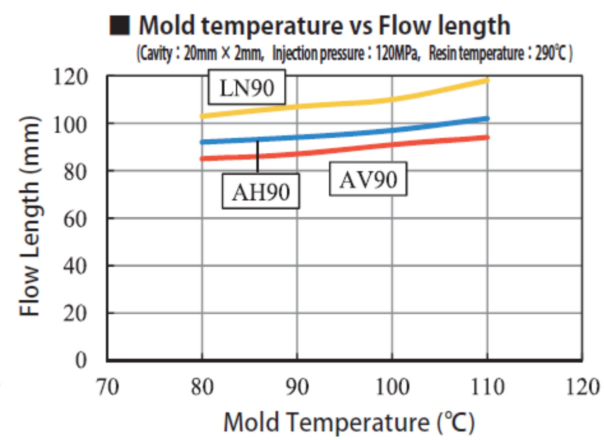












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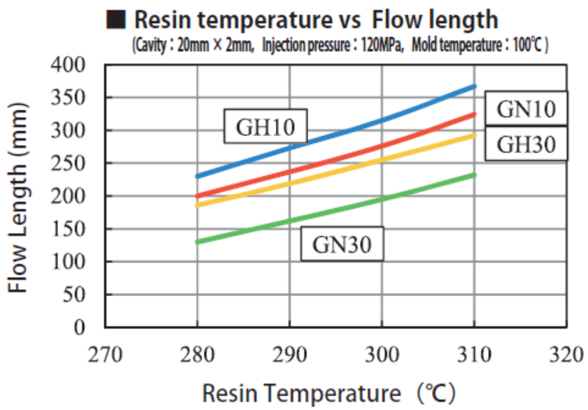
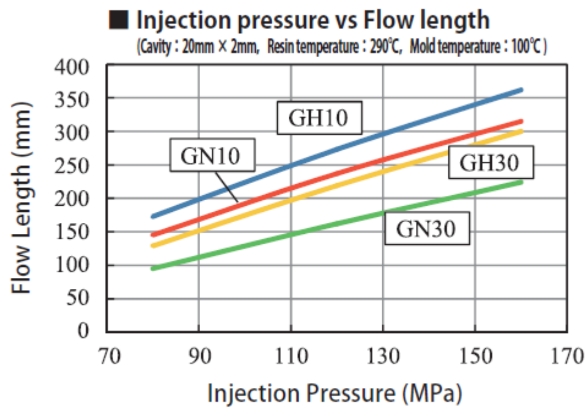
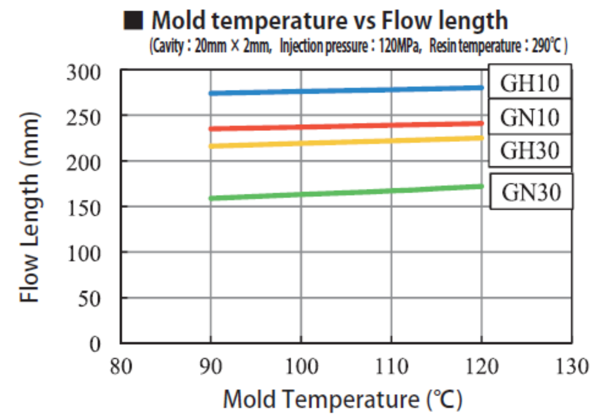
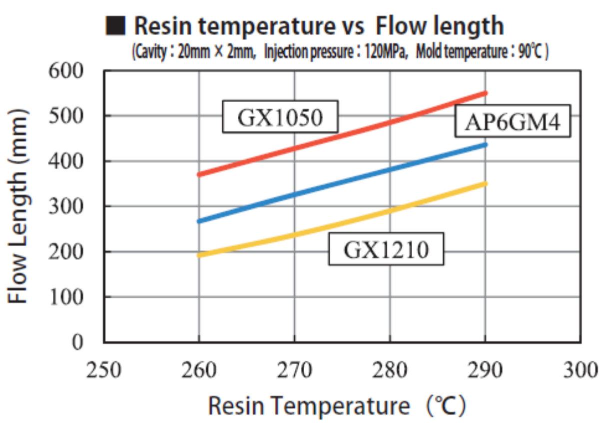
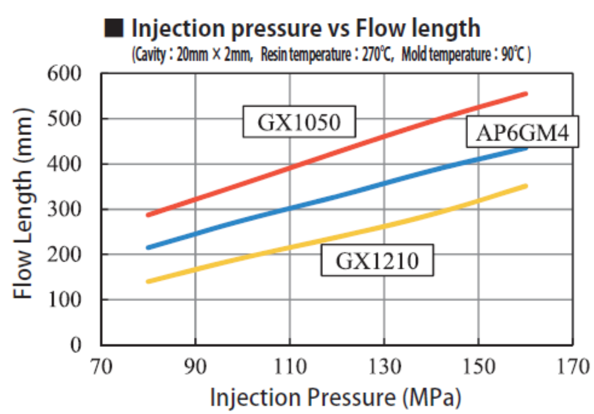
The flow properties of the reinforced grades of Iupiace are as show below. For the reinforced grades of Iupiace, as is the case with the unreinforced grades, it can also be seen that the flow properties of Iupiace are influenced substantially by the resin temperature and injection pressure.

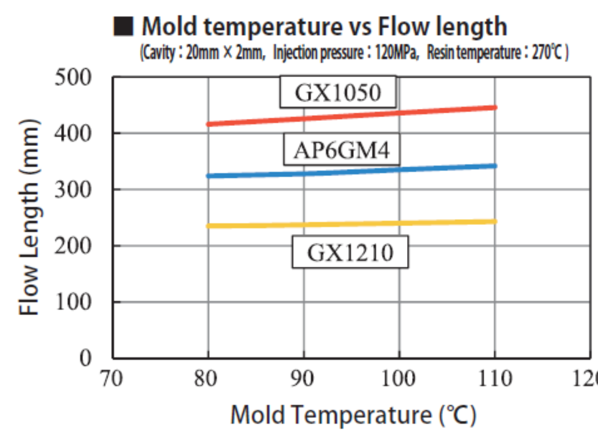










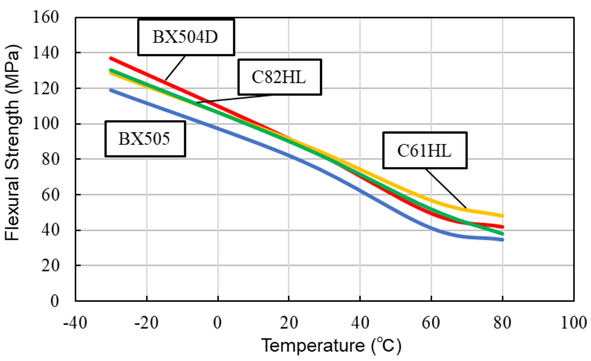


Properties of LEMALLOY ™

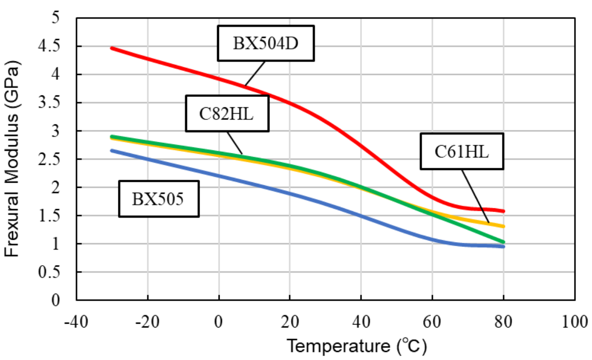
Temperature dependence of LEMALLOY

The physical properties of LEMALLOY were measured at a temperature range of -30°C and 80°C and the results are shown below. Although they show reduction in stiffness such as flexural strength and elastic modulus at high temperature, they show improvement in toughness such as elongation and impact strength.

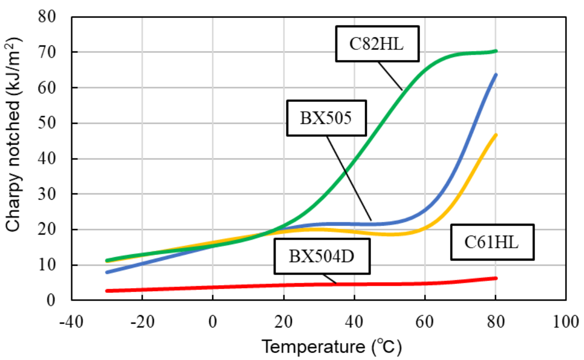
■Flexural strength



■Flexural modulus



■Charpy notched impact strength



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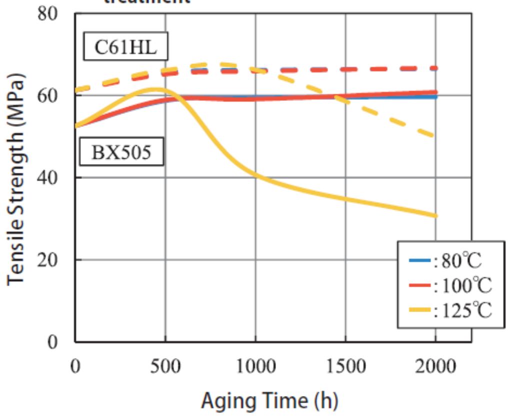
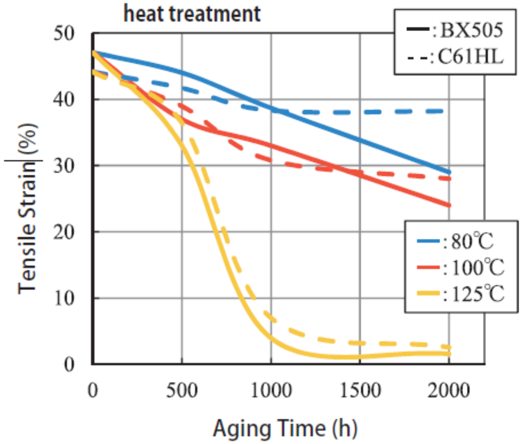
Heat and aging resistance property of LEMALLOY

LEMALLOY resins were heat treated under high-temperature atmosphere and their physical property values are shown below. Although the tensile strengths and tensile elongations (tensile breaking strains) show no substantial decrease at 100°C or lower, they show substantial decrease at 125°C. Additionally, the dimensional shrinkage factors due to heat treatment are shown below. Crystallization progresses around 80°C and the dimensional shrinkage factors increase, but there is almost no dimensional change after that.

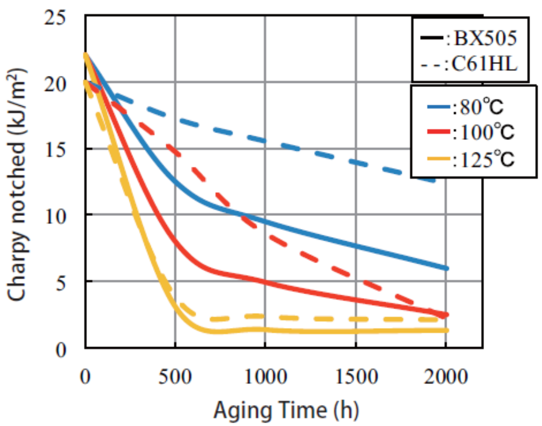
■ Changes in tensile strength by heat treatment



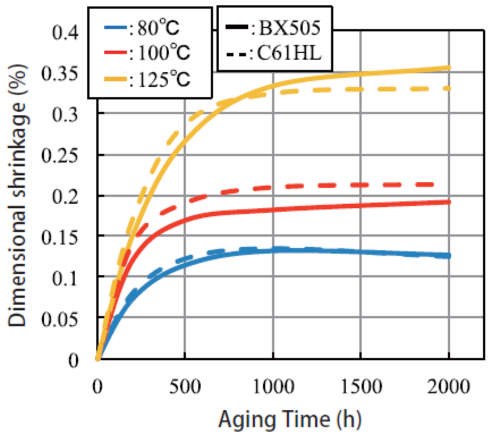
■ Changes in tensile breaking strain by heat treatment



■ Changes in charpy notched impact strength by heat treatment



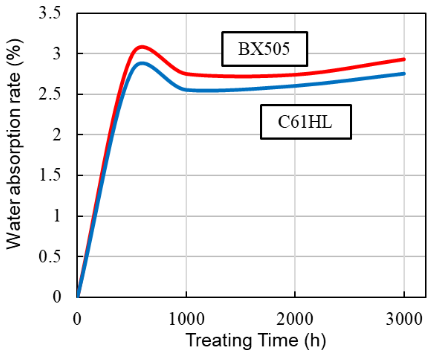
■ Changes in dimensional shrinkage by heat treatment (φ 100mm x 3mmt specimen)



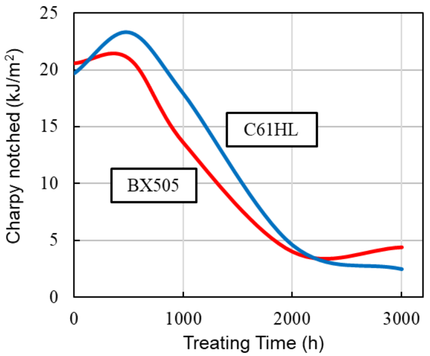
Hygrothermal property of LEMALLOY

LEMALLOY resins were kept at high temperature and humidity (85°C and 85%RH) for a prolonged time, and the changes in water absorption rate and physical properties are shown below. LEMALLOY is an alloy material of polyphenylene ether and polyamide resin. Therefore, its water absorption rate is high because the polyamide part absorbs water.
Additionally, when LEMALLOY is placed at higher temperature for a prolonged time, it shows degradation in the physical properties. Therefore, use of LEMALLOY at high temperature and humidity requires attention.

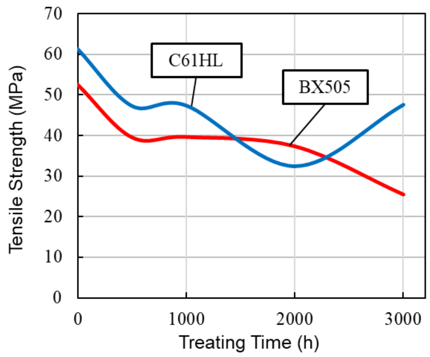
■Changes in water absorption rate by steam treatment at 85°C, 85%RH



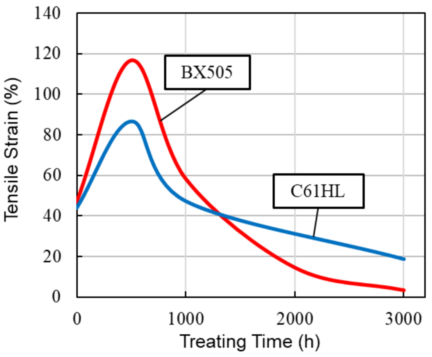
■Changes in charpy notched impact strength by steam treatment at 85°C, 85%RH



■Changes in tensile strength by steam treatment at 85°C, 85%RH

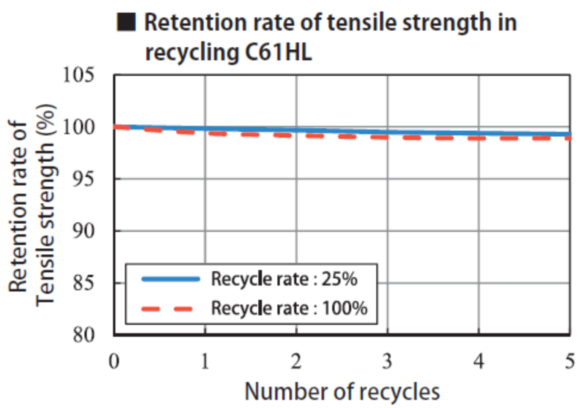


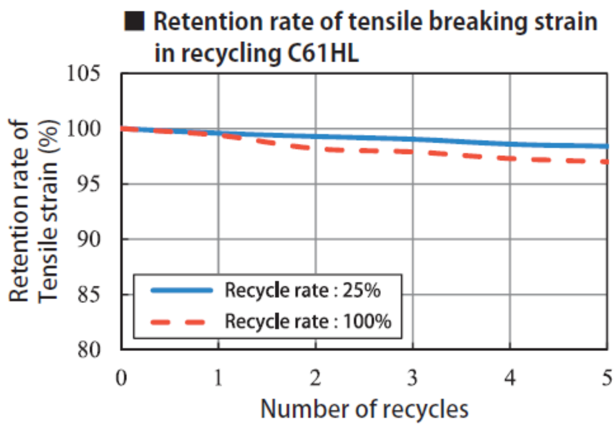
■Changes in tensile breaking strain by steam treatment at 85°C, 85%RH

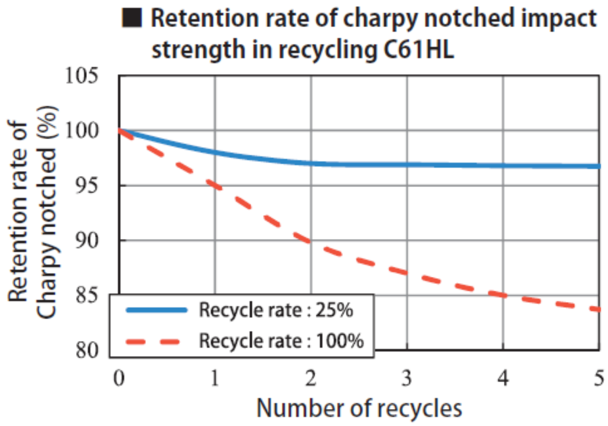


Recycling property of LEMALLOY

The unreinforced grades and reinforced grades of LEMALLOY were recycled and molded. The retention rates are shown below. As is the case with Iupiace, LEMALLOY has excellent recycling property and the physical property values such as strength and elastic modulus show almost no change with a recycle rate of 25% or 100%. Note that the impact resistance decreases substantially when the recycle rate is 100%.



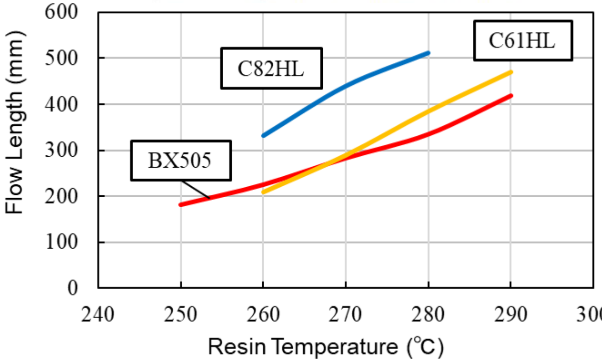




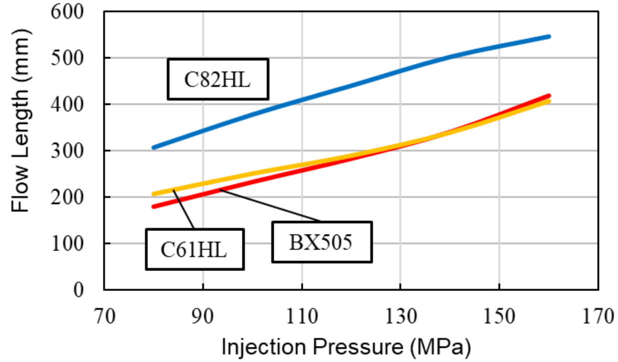
Flow property of LEMALLOY

The flow properties of LEMALLOY are shown below. As is the case with Iupiace, the flow properties of LEMALLOY are influenced strongly by the resin temperature and injection pressure.

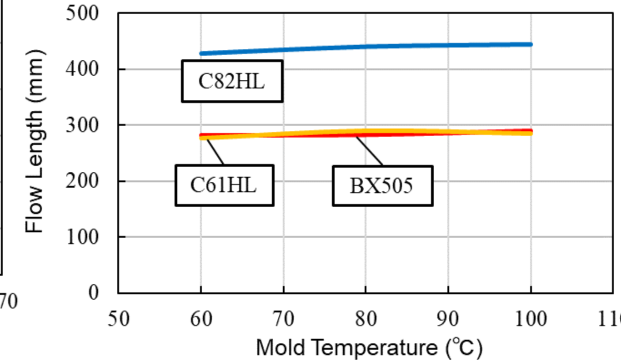
■ Resin temperature vs Flow length
(Cavity : 20mm × 2mm, Injection pressure : 120MPa, Mold temperature : 80℃)



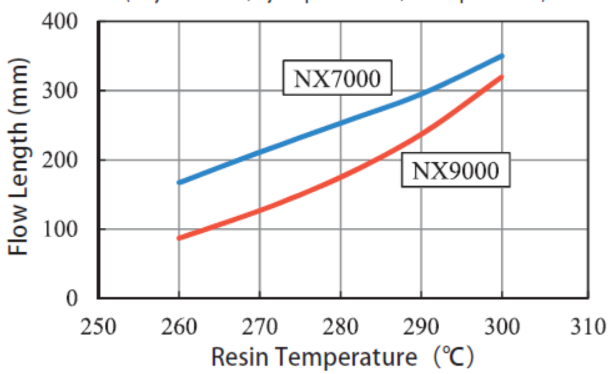
■ Injection pressure vs Flow length
(Cavity : 20mm × 2mm, Resin temperature : 270℃, Mold temperature : 80℃)



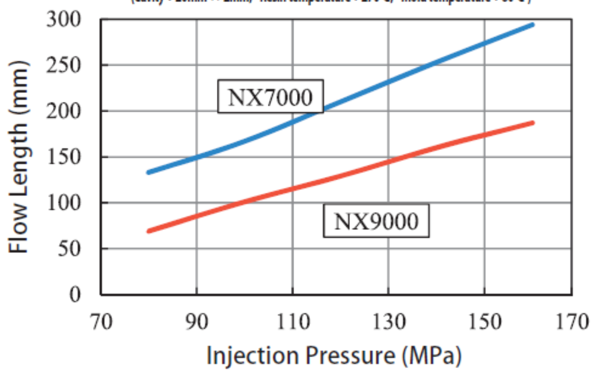
■ Mold temperature vs Flow length
(Cavity : 20mm × 2mm, Injection pressure : 120MPa, Resin temperature : 270℃)



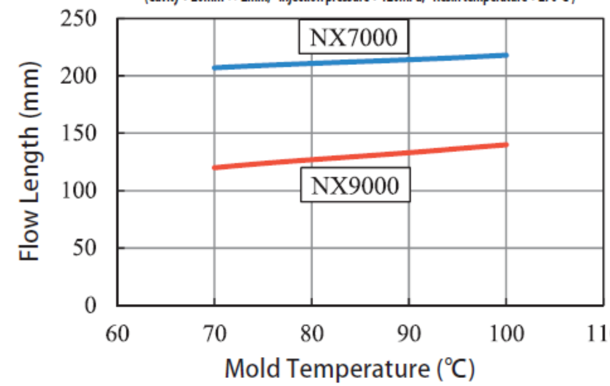
■ Resin temperature vs Flow length
(Cavity : 20mm × 2mm, Injection pressure : 120MPa, Mold temperature : 80℃)



■ Injection pressure vs Flow length
(Cavity : 20mm × 2mm, Resin temperature : 270℃, Mold temperature : 80℃)



■ Mold temperature vs Flow length
(Cavity : 20mm × 2mm, Injection pressure : 120MPa, Resin temperature : 270℃)



Chemical resistance property

Chemical resistance (stress corrosion resistance) of Iupiace and LEMALLOY

In order to investigate the chemical resistances of Iupiace and LEMALLOY, they were immersed in a chemical agent while applying a bending stress of 0 MPa and 20 MPa at 23°C for 48 hours. The results are shown in the table below. The followings can be seen from this table.

- Iupiace is stable against acids, alkalis, alcohol, inorganic salt solutions, and glycols.
- When stress is high due to oils, halogenated hydrocarbon, etc., cracks or breakage will occur. Additionally, cracks or breakage will occur due to ketones, esters, etc. even if stress is not applied. Therefore, material selection must be considered when there is a possibility of contacting with these chemicals.
- LEMALLOY is stable against chemicals other than acids. But cracks or breakage will occur due to acids. Therefore, material selection must be considered when there is a possibility of contacting with acids.

Chemical agent	Sample	Iupiace		LEMALLOY	
	Flexural stress	0MPa	20MPa	0MPa	20MPa
Gasoline, Kerosene		B	C	A	A
Mineral oil		B	C	A	A
Methanol, Ethanol		A	A	A	A
Ethylene glycol		A	A	A	A
Chroroform		B	C	A	A
Ethyl acetate		C	C	A	A
Methylethylketone		C	C	A	A
Sodium hydroxide 15% aqueous solution		A	A	A	A
Sulfuric acid 15% aqueous solution		A	A	C	C
Sodium chloride saturated aqueous solution		A	A	A	A
Hypochlorous acid		A	A	A	A
Dish liquid		A	A	A	A
90degC water		A	-	A	-

A: No change external appearance
B: Expansion or dissolution
C: Creases or cracks generated

About molding

1. Molding condition

(1) Pre-drying

Pre-drying of Iupiace is easy because its water absorption rate is smaller and its hydrolysis resistance is superior when compared to other engineering plastics.

LEMALLOY requires sufficient pre-drying since its water absorption rate is high.

For pre-drying of typical Iupiace and LEMALLOY using a hot air circulating drying machine, the thickness of the pellet layer should be 30 mm or less and the specified temperature should be kept for 2–4 hours.

When using a hopper dryer, use one with a capacity that allows the pellets to be retained for 2–4 hours at the specified temperature.

Note that discoloration and resin deterioration may occur if the drying time is extremely long.

(2) Resin temperature

Since the optimum molding temperature of Iupiace or LEMALLOY depends on each grade, use the “Table of Molding Condition by Grade” on the next page as a reference to determine the temperature.

In general, the resin temperature is often higher than the nozzle set temperature by 10° C to 20° C.

Therefore, before actual molding, it is recommended to measure the temperature of the molten resin by a test injection and investigate the relationship between the set temperature (resin temperature) of your molding machine and the resin temperature.

(3) Mold temperature

Since the optimum mold temperature of Iupiace or LEMALLOY depend on each grade, use the “Table of Molding Condition by Grade” on the next page as a reference to determine the temperature.

When the mold temperature is too low, it causes poor luster of the mold product, defective fusion at the weld portion, large residual strain, etc.

Conversely, when the mold temperature is too high and the molding cycle is short, mold release may be difficult due to insufficient cooling or deformation may occur after mold release.

(4) Injection pressure (primary pressure) and holding pressure (secondary pressure)

Good mold products can be produced with an injection pressure range of 40–150 MPa.

Additionally, mold products with smaller residual strain can be produced by switching to the pressure control to inject the resin under a pressure of a level that does not cause sink when the cavity is injected to a certain level.

2 . Action in the case of molding interruption and after completion

When molding of Iupiace or LEMALLOY is interrupted or stopped, please take one of the following measures.

(1) When molding is resumed within 60 minutes

Leave the cylinder temperature as of the time of molding, replace the resin in the cylinder before resuming the molding.

(2) When molding is interrupted for 60 minutes or longer

Replace Iupiace or LEMALLOY in the cylinder with polystyrene and then decrease the cylinder temperature to 200° C or lower.

(3) When molding is completed

Normally, replace the resin with polystyrene. Additionally, a commercially available screw cleaning agent (such as Tieclean) can be used as the purge agent for Iupiace.

For the information on the use of a screw cleaning agent, please refer to the technical document provided by each cleaning agent manufacturer.

Drying and molding condition for each grades

Grade	Pre-Dring 2-4hrs (℃)	Mold Temp. (℃)	Cylinder Setting Temp.			
			Nozzle (℃)	Front (℃)	Middle (℃)	Rear (℃)
LN23, LN30, LN40, LV40, AH40	70-80	50-90	240-260	250-280	250-280	230-260
LN60, LV60, AH60	90-100	80-110	260-290	270-290	260-290	240-270
LN80, LN91, AV90	100-120	80-110	270-300	270-300	270-300	250-280
JBS70, AH70, AH80, AH91	100-120	80-110	270-310	270-310	270-310	250-290
GN10, GN20, GN30 GV10, GV20, GV30 GH10, GH20, GH30	100-120	90-125	270-310	280-310	280-310	260-290
AP4, AH8P	50-90	70-90	240-260	250-280	250-280	230-260
AP6GM2, AP6GM4, AP4GM6, ANP6GM4 CTGM6, HCT20V, LGX420N, GX1050, TH620	60-100	80-100	250-280	250-290	250-290	240-270
GX1210	100-120	60-90	280-300	280-300	270-290	260-280
AHF6010B	80-120	80-110	260-280	260-280	260-280	240-260
GHF3010	80-110	80-120	270-310	270-310	270-310	250-290
EHM1010A, EHM1000-9905M EHM103R, HD7007	100-120	110-130	310-330	310-330	310-330	290-310
PX603Y	70-90	50-80	240-270	240-270	240-270	240-250
Grade	Pre-Dring 2-4hrs (℃)	Mold Temp. (℃)	Cylinder Setting Temp.			
			Nozzle (℃)	Front (℃)	Middle (℃)	Rear (℃)
NX7000, NXG7201-8240, NX9000	120-130	80-100	270-300	270-300	270-300	250-280
BX505, BX528A-3	110-120	60-100	250-290	250-290	250-290	240-270
BX504D	110-120	70-110	260-300	260-300	260-300	250-290

Property table of unreinforced UL V-0 grades

Iupiace™

Properties	Test Method	Terms	Units	UL V-0 Grade						
				LN23	**LN30**	**LN40**	**LN60**	**JBS70**	**LN80**	**LN91**
Physical properties										
Density	ISO 1183	-	g/cm^3	1.10	1.10	1.10	1.10	1.10	1.11	1.10
Water absorption	-	23degC, Underwater	%	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Rheological properties										
Melt Volume-flow Rate	ISO1133	-	cm^3/10min	32	16	14	9.5	7.5	6.5	4.0
		Temperature	degC	300	300	300	300	300	300	300
		Load	kg	2.16	2.16	2.16	2.16	2.16	2.16	2.16
Molding shirinkage (3.0mmt)	MEP method	MD	%	0.5 - 0.7	0.5 - 0.7	0.5 - 0.7	0.5 - 0.7	0.5 - 0.7	0.5 - 0.7	0.5 - 0.7
		TD		0.5 - 0.7	0.5 - 0.7	0.5 - 0.7	0.5 - 0.7	0.5 - 0.7	0.5 - 0.7	0.5 - 0.7
Mechanical properties										
Tensile modulus	ISO 527-1, 527-2	23degC	MPa	-	-	-	-	2400	2400	-
Yield stress				47	55	65	73	70	79	70
Yield strain			%	-	-	-	-	5.0	-	-
Nominal strain at break				25	25	25	25	20	20	55
Stress at break			MPa	-	-	-	-	-	-	-
Strain at break			%	-	-	-	-	-	-	-
Flexural strength	ISO 178	23degC	MPa	80	90	95	105	105	115	105
Flexural modulus				2400	2400	2500	2380	2400	2400	2700
Charpy impact strength	ISO 179-1, 179-2	23degC	kJ/m^2	-	-	-	-	-	-	-
Charpy notched impact strength		23degC	kJ/m^2	11	13	12	7	26	6	7
Thermal properties										
Temperature of deflection under load	ISO 75-1, 75-2	1.80MPa	degC	80	90	100	115	130	127	145
		0.45MPa		95	105	115	130	145	140	160
Coefficient of Linear thermal expansion	ISO 11359-2	MD	1/degC	5.5E-05	5.5E-05	5.5E-05	5.5E-05	5.5E-05	5.5E-05	5.5E-05
		TD		5.8E-05	5.8E-05	5.8E-05	5.8E-05	5.8E-05	5.8E-05	5.8E-05
Flammability	UL94	0.75mmt	-	-	V-0	V-0	V-0	V-0	V-0	V-0
		1.5mmt	-	V-0	-	-	-	-	-	-
		2.0mmt	-	-	-	-	-	5VA	-	-
		3.0mmt	-	-	5VA	5VA	5VA		-	-
Electrical properties										
Relative permittivity	IEC 60250	100Hz	-	-	-	-	-	-	-	-
		1MHz	-	-	-	-	-	-	-	-
Dissipation factor	IEC 60250	100Hz	-	-	-	-	-	-	-	-
		1MHz	-	-	-	-	-	-	-	-
Volume resistivity	IEC 60093	-	Ω・m	3.E+14	3.E+14	3.E+14	3.E+14	3.E+14	3.E+14	3.E+14
Surface resistivity	IEC 60093	-	Ω	2.E+15	2.E+15	2.E+15	2.E+15	2.E+15	2.E+15	2.E+15
Electric strength	IEC 60243-1	1mmt	MV/m	-	-	-	-	-	-	-
		3mmt		-	-	-	-	-	-	-
Comparative tracking index	IEC 60112	-	-	-	-	-	-	250<	-	-

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Property table of unreinforced UL V-1 grades

Iupiace™

				UL V-1 Grade		
Properties	**Test Method**	**Terms**	**Units**	**LV40**	**LV60**	**AV90**
Physical properties						
Density	ISO 1183	-	g/cm^3	1.10	1.09	1.08
Water absorption	-	23degC, Underwater	%	0.07	0.07	0.07
Rheological properties						
Melt Volume-flow Rate	ISO1133	-	cm^3/10min	16	8.5	2.8
		Temperature	degC	300	300	300
		Load	kg	2.16	2.16	2.16
Molding shirinkage (3.0mmt)	MEP method	MD	%	0.5 - 0.7	0.5 - 0.7	0.5 - 0.7
		TD		0.5 - 0.7	0.5 - 0.7	0.5 - 0.7
Mechanical properties						
Tensile modulus	ISO 527-1 , 527-2	23degC	MPa	-	-	2600
Yield stress				60	60	70
Yield strain			%	-	-	5.6
Nominal strain at break				20	25	30
Stress at break			MPa	-	-	-
Strain at break			%	-	-	-
Flexural strength	ISO 178	23degC	MPa	97	100	103
Flexural modulus				2550	2650	2600
Charpy impact strength	ISO 179-1 , 179-2	23degC	kJ/m^2	-	-	-
Charpy notched impact strength		23degC	kJ/m^2	12	12	9
Thermal properties						
Temperature of deflection under load	ISO 75-1 , 75-2	1.80MPa	degC	100	115	145
		0.45MPa		115	130	160
Coefficient of Linear thermal expansion	ISO 11359-2	MD	1/degC	6.3E-05	6.3E-05	6.0E-05
		TD		6.6E-05	6.6E-05	6.3E-05
Flammability	UL94	0.75mmt	-	V-1	V-1	V-1
		1.5mmt	-	-	-	-
		2.0mmt	-	-	-	-
		3.0mmt	-	-	-	-
Electrical properties						
Relative permittivity	IEC 60250	100Hz	-	-	-	-
		1MHz	-	-	-	-
Dissipation factor	IEC 60250	100Hz	-	-	-	-
		1MHz	-	-	-	-
Volume resistivity	IEC 60093	-	Ω・m	3.E+14	3.E+14	3.E+14
Surface resistivity	IEC 60093	-	Ω	2.E+15	2.E+15	2.E+15
Electric strength	IEC 60243-1	1mmt	MV/m	-	-	-
		3mmt		-	-	-
Comparative tracking index	IEC 60112	-	-	-	-	-

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Property table of unreinforced UL HB grades

Iupiace™

Properties	Test Method	Terms	Units	AH40	AH60	AH70	AH80	AH91
				UL HB Grade				
Physical properties								
Density	ISO 1183	-	g/cm^3	1.06	1.06	1.07	1.07	1.07
Water absorption	-	23degC, Underwater	%	0.07	0.07	0.07	0.07	0.07
Rheological properties								
Melt Volume-flow Rate	ISO1133	-	cm^3/10min	13	8.1	5.9	4.0	3.0
		Temperature	degC	300	300	300	300	300
		Load	kg	2.16	2.16	2.16	2.16	2.16
Molding shirinkage (3.0mmt)	MEP method	MD	%	0.5 - 0.7	0.5 - 0.7	0.5 - 0.7	0.5 - 0.7	0.5 - 0.7
		TD		0.5 - 0.7	0.5 - 0.7	0.5 - 0.7	0.5 - 0.7	0.5 - 0.7
Mechanical properties								
Tensile modulus	ISO 527-1 , 527-2	23degC	MPa	2500	2500	2500	2600	2700
Yield stress				40	50	58	63	70
Yield strain			%	3.2	5.0	5.4	5.5	5.5
Nominal strain at break				34	30	24	25	25
Stress at break			MPa	-	-	-	-	-
Strain at break			%	-	-	-	-	-
Flexural strength	ISO 178	23degC	MPa	76	95	102	110	118
Flexural modulus				2500	2500	2500	2600	2700
Charpy impact strength	ISO 179-1 , 179-2	23degC	kJ/m^2	153	119	NB	150	140
Charpy notched impact strength		23degC	kJ/m^2	14	16	20	18	15
Thermal properties								
Temperature of deflection under load	ISO 75-1 , 75-2	1.80MPa	degC	95	115	125	135	145
		0.45MPa		110	130	140	150	160
Coefficient of Linear thermal expansion	ISO 11359-2	MD	1/degC	6.7E-05	6.6E-05	6.6E-05	6.6E-05	6.6E-05
		TD		7.1E-05	6.9E-05	6.9E-05	6.9E-05	6.9E-05
Flammability	UL94	0.75mmt	-	HB	HB	HB	HB	HB
		1.5mmt	-	-	-	-	-	-
		2.0mmt	-	-	-	-	-	-
		3.0mmt	-	-	-	-	-	-
Electrical properties								
Relative permittivity	IEC 60250	100Hz	-	-	-	-	-	-
		1MHz	-	-	-	-	-	-
Dissipation factor	IEC 60250	100Hz	-	-	-	-	-	-
		1MHz	-	-	-	-	-	-
Volume resistivity	IEC 60093	-	Ω・m	3.E+14	3.E+14	3.E+14	3.E+14	3.E+14
Surface resistivity	IEC 60093	-	Ω	2.E+15	2.E+15	2.E+15	2.E+15	2.E+15
Electric strength	IEC 60243-1	1mmt	MV/m	38	-	44	-	-
		3mmt		20	-	>65	-	-
Comparative tracking index	IEC 60112	-	-	-	275	-	-	-

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Property table of high flowability UL V-0 grades

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Properties	Test Method	Terms	Units	High Flowability Grade (V-0)	
				AP4	**AH8P**
				Uninforced	Uninforced
Physical properties					
Density	ISO 1183	-	g/cm^3	1.11	1.10
Water absorption	-	23degC, Underwater	%	0.07	0.06
Rheological properties					
Melt Volume-flow Rate	ISO1133	-	$cm^3/10min$	85	18
		Temperature	degC	280	280
		Load	kg	5	5
Molding shirinkage (3.0mmt)	MEP method	MD	%	0.5 - 0.7	0.5 - 0.7
		TD		0.5 - 0.7	0.5 - 0.7
Mechanical properties					
Tensile modulus	ISO 527-1, 527-2	23degC	MPa	2000	2600
Yield stress				49	56
Yield strain			%	3.2	3.2
Nominal strain at break				45	20
Stress at break			MPa	-	-
Strain at break			%	-	-
Flexural strength	ISO 178	23degC	MPa	82	93
Flexural modulus				2000	2400
Charpy impact strength	ISO 179-1, 179-2	23degC	kJ/m^2	-	-
Charpy notched impact strength		23degC	kJ/m^2	9	7
Thermal properties					
Temperature of deflection under load	ISO 75-1, 75-2	1.80MPa	degC	80	85
		0.45MPa		90	95
Coefficient of Linear thermal expansion	ISO 11359-2	MD	1/degC	-	6.0E-05
		TD		-	6.0E-05
Flammability	UL94	0.75mmt	-	-	-
		1.5mmt	-	V-0	V-0
		2.0mmt	-	-	-
		3.0mmt	-	-	-
Electrical properties					
Relative permittivity	IEC 60250	100Hz	-	-	-
		1MHz	-	-	-
Dissipation factor	IEC 60250	100Hz	-	-	-
		1MHz	-	-	-
Volume resistivity	IEC 60093	-	Ω・m	3.E+14	3.E+14
Surface resistivity	IEC 60093	-	Ω	2.E+15	2.E+15
Electric strength	IEC 60243-1	1mmt	MV/m	-	-
		3mmt		-	-
Comparative tracking index	IEC 60112	-	-	-	-

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Property table of fiber reinforced UL V-0 grades

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Properties	Test Method	Terms	Units	Fiber Reinforced V-0 GN10 GF 10%	GN20 GF 20%	GN30 GF 30%
Physical properties						
Density	ISO 1183	-	g/cm³	1.17	1.24	1.33
Water absorption	-	23degC, Underwater	%	0.06	0.06	0.06
Rheological properties						
Melt Volume-flow Rate	ISO1133	-	cm³/10min	7.0	5.0	2.9
		Temperature	degC	300	300	300
		Load	kg	2.16	2.16	2.16
Molding shirinkage (3.0mmt)	MEP method	MD	%	0.2 - 0.4	0.1 - 0.3	0.1 - 0.2
		TD		0.3 - 0.5	0.2 - 0.4	0.2 - 0.4
Mechanical properties						
Tensile modulus	ISO 527-1 , 527-2	23degC	MPa	4200	6700	9000
Yield stress				-	-	-
Yield strain			%	-	-	-
Nominal strain at break				-	-	-
Stress at break			MPa	83	99	110
Strain at break			%	2.5	2.5	1.5
Flexural strength	ISO 178	23degC	MPa	140	160	180
Flexural modulus				4000	6200	8500
Charpy impact strength	ISO 179-1 , 179-2	23degC	kJ/m²	-	-	-
Charpy notched impact strength		23degC	kJ/m²	7	7	7
Thermal properties						
Temperature of deflection under load	ISO 75-1 , 75-2	1.80MPa	degC	125	130	130
		0.45MPa		130	135	137
Coefficient of Linear thermal expansion	ISO 11359-2	MD	1/degC	4.5E-05	3.0E-05	2.5E-05
		TD		7.5E-05	6.8E-05	6.0E-05
Flammability	UL94	0.75mmt	-	V-0	V-1	V-1
		1.5mmt	-	-	V-0	V-0
		2.0mmt	-	5VA	5VA	5VA
		3.0mmt	-	-	-	-
Electrical properties						
Relative permittivity	IEC 60250	100Hz	-	-	3.4	-
		1MHz	-	-	3.3	-
Dissipation factor	IEC 60250	100Hz	-	-	0.0045	-
		1MHz	-	-	0.0055	-
Volume resistivity	IEC 60093	-	Ω・m	3.E+14	3.E+14	3.E+14
Surface resistivity	IEC 60093	-	Ω	2.E+15	2.E+15	2.E+15
Electric strength	IEC 60243-1	1mmt	MV/m	-	25	-
		3mmt		-	17	-
Comparative tracking index	IEC 60112	-	-	200	225	200

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Property table of fiber reinforced UL V-1 grades

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Properties	Test Method	Terms	Units	Fiber Reinforced V-1 GV10 GF 10%	Fiber Reinforced V-1 GV20 GF 20%	Fiber Reinforced V-1 GV30 GF 30%
Physical properties						
Density	ISO 1183	-	g/cm³	1.15	1.22	1.31
Water absorption	-	23degC, Underwater	%	0.06	0.06	0.06
Rheological properties						
Melt Volume-flow Rate	ISO1133	-	cm³/10min	5.5	3.6	3.0
		Temperature	degC	300	300	300
		Load	kg	2.16	2.16	2.16
Molding shirinkage (3.0mmt)	MEP method	MD	%	0.2 - 0.4	0.1 - 0.3	0.1 - 0.2
		TD		0.3 - 0.5	0.2 - 0.4	0.2 - 0.4
Mechanical properties						
Tensile modulus	ISO 527-1 , 527-2	23degC	MPa	4200	6500	8400
Yield stress				-	-	-
Yield strain			%	-	-	-
Nominal strain at break				-	-	-
Stress at break			MPa	83	103	110
Strain at break			%	2.5	2.5	1.5
Flexural strength	ISO 178	23degC	MPa	135	161	170
Flexural modulus				4100	6300	8300
Charpy impact strength	ISO 179-1 , 179-2	23degC	kJ/m²	-	-	-
Charpy notched impact strength		23degC	kJ/m²	8	7	9
Thermal properties						
Temperature of deflection under load	ISO 75-1 , 75-2	1.80MPa	degC	125	130	130
		0.45MPa		135	137	140
Coefficient of Linear thermal expansion	ISO 11359-2	MD	1/degC	4.5E-05	3.0E-05	2.5E-05
		TD		7.5E-05	6.8E-05	6.0E-05
Flammability	UL94	0.75mmt	-	V-1	V-1	V-1
		1.5mmt	-	-	-	-
		2.0mmt	-	-	-	-
		3.0mmt	-	-	-	-
Electrical properties						
Relative permittivity	IEC 60250	100Hz	-	-	3.2	-
		1MHz	-	-	3.2	-
Dissipation factor	IEC 60250	100Hz	-	-	0.0021	-
		1MHz	-	-	0.0027	-
Volume resistivity	IEC 60093	-	Ω・m	3.E+14	3.E+14	3.E+14
Surface resistivity	IEC 60093	-	Ω	2.E+15	6.E+15	6.E+15
Electric strength	IEC 60243-1	1mmt	MV/m	-	26	-
		3mmt		-	17	-
Comparative tracking index	IEC 60112	-	-	200	200	200

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Property table of fiber reinforced UL HB grades

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Properties	Test Method	Terms	Units	Fiber Reinforced HB		
				GH10	GH20	GH30
				GF	GF	GF
				10%	20%	30%
Physical properties						
Density	ISO 1183	-	g/cm^3	1.14	1.22	1.31
Water absorption	-	23degC, Underwater	%	0.06	0.06	0.06
Rheological properties						
Melt Volume-flow Rate	ISO1133	-	cm^3/10min	5.0	4.4	2.7
		Temperature	degC	300	300	300
		Load	kg	2.16	2.16	2.16
Molding shirinkage (3.0mmt)	MEP method	MD	%	0.2 - 0.4	0.1 - 0.3	0.1 - 0.2
		TD		0.3 - 0.5	0.2 - 0.4	0.2 - 0.4
Mechanical properties						
Tensile modulus	ISO 527-1 , 527-2	23degC	MPa	4500	6600	8900
Yield stress				-	-	-
Yield strain			%	-	-	-
Nominal strain at break				-	-	-
Stress at break			MPa	75	89	103
Strain at break			%	2.6	1.5	1.3
Flexural strength	ISO 178	23degC	MPa	130	154	170
Flexural modulus				4000	6400	8400
Charpy impact strength	ISO 179-1 , 179-2	23degC	kJ/m^2	-	-	-
Charpy notched impact strength		23degC	kJ/m^2	6	7	8
Thermal properties						
Temperature of deflection under load	ISO 75-1 , 75-2	1.80MPa	degC	125	130	130
		0.45MPa		135	140	142
Coefficient of Linear thermal expansion	ISO 11359-2	MD	1/degC	4.5E-05	3.0E-05	2.5E-05
		TD		7.5E-05	6.8E-05	6.0E-05
Flammability	UL94	0.75mmt	-	HB	HB	HB
		1.5mmt	-	-	-	-
		2.0mmt	-	-	-	-
		3.0mmt	-	-	-	-
Electrical properties						
Relative permittivity	IEC 60250	100Hz	-	-	-	-
		1MHz	-	-	-	-
Dissipation factor	IEC 60250	100Hz	-	-	-	-
		1MHz	-	-	-	-
Volume resistivity	IEC 60093	-	Ω・m	3.E+14	3.E+14	3.E+14
Surface resistivity	IEC 60093	-	Ω	6.E+15	6.E+15	6.E+15
Electric strength	IEC 60243-1	1mmt	MV/m	34	32	30
		3mmt		20	17	17
Comparative tracking index	IEC 60112	-	-	175	175	150

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Property table of filler reinforced grades

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Properties	Test Method	Terms	Units	Filler Reinforced TX403 Low Warpage	Filler Reinforced TX903B Anticreep High impact	Filler Reinforced TH620 Low Warpage
Physical properties						
Density	ISO 1183	-	g/cm³	1.09	1.09	1.20
Water absorption	-	23degC, Underwater	%	0.06	0.06	0.06
Rheological properties						
Melt Volume-flow Rate	ISO1133	-	cm³/10min	16	2.5	12.0
		Temperature	degC	280	300	300
		Load	kg	5	2.16	2.16
Molding shirinkage (3.0mmt)	MEP method	MD	%	0.5 - 0.7	-	0.3 - 0.4
		TD		0.5 - 0.7	-	0.3 - 0.4
Mechanical properties						
Tensile modulus	ISO 527-1 , 527-2	23degC	MPa	2600	2400	5200
Yield stress				51	60	-
Yield strain			%	2.6	-	-
Nominal strain at break				24	40	12
Stress at break			MPa	-	-	50
Strain at break			%	-	-	-
Flexural strength	ISO 178	23degC	MPa	80	90	100
Flexural modulus				2500	2350	5100
Charpy impact strength	ISO 179-1 , 179-2	23degC	kJ/m²	NB	NB	-
Charpy notched impact strength		23degC	kJ/m²	20	32	4
Thermal properties						
Temperature of deflection under load	ISO 75-1 , 75-2	1.80MPa	degC	95	145	115
		0.45MPa		100	-	-
Coefficient of Linear thermal expansion	ISO 11359-2	MD	1/degC	6.0E-05	-	-
		TD		6.0E-05	-	-
Flammability	UL94	0.75mmt	-	HB	-	HB
		1.5mmt	-	-	-	-
		2.0mmt	-	-	-	-
		3.0mmt	-	-	-	-
Electrical properties						
Relative permittivity	IEC 60250	100Hz	-	-	-	-
		1MHz	-	-	-	-
Dissipation factor	IEC 60250	100Hz	-	-	-	-
		1MHz	-	-	-	-
Volume resistivity	IEC 60093	-	Ω・m	3.E+14	-	-
Surface resistivity	IEC 60093	-	Ω	2.E+15	-	-
Electric strength	IEC 60243-1	1mmt	MV/m	-	-	-
		3mmt		-	-	-
Comparative tracking index	IEC 60112	-	-	-	-	-

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Property table of high flowability and reinforced grades

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Properties	Test Method	Terms	Units	High Flowability and reinforced Grade (V-1)							High Flowability and reinforced Grade (V-0)	
				GX1050	GX1210	AP6GM2	AP6GM4	AP4GM6	CTGM6	HCT20V	ANP6GM4	LGX420N
				GF+Filler	GF+Filler	GF+Filler	GF+Filler	GF+Filler	GF+Filler	GF+Filler	GF+Filler	GF
				20%	35%	10%	20%	30%	30%	20%	20%	20%
Physical properties												
Density	ISO 1183	-	g/cm^3	1.25	1.38	1.16	1.23	1.32	1.38	1.22	1.27	1.30
Water absorption	-	23degC, Underwater	%	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Rheological properties												
Melt Volume-flow Rate	ISO1133	-	cm^3/10min	24	9	28	31	25	27	26	29	50
		Temperature	degC	300	300	280	280	280	280	280	280	280
		Load	kg	2.16	2.16	5	5	5	5	5	5	5
Molding shirinkage (3.0mmt)	MEP method	MD	%	0.2 - 0.4	0.1 - 0.3	0.3 - 0.5	0.2 - 0.4	0.1 - 0.3	0.3	0.5	0.2 - 0.4	0.2-0.4
		TD		0.3 - 0.5	0.2 - 0.4	0.3 - 0.5	0.3 - 0.5	0.2 - 0.4	0.4	0.7	0.3 - 0.5	0.2-0.4
Mechanical properties												
Tensile modulus	ISO 527-1 , 527-2	23degC	MPa	6100	10500	4000	5700	7800	-	-	6100	6200
Yield stress				-	-	-	-	-	-	-	-	-
Yield strain			%	-	-	-	-	-	-	-	-	-
Nominal strain at break				-	-	-	-	-	-	-	-	-
Stress at break			MPa	75	115	65	80	91	86	68	94	67
Strain at break			%	2.7	2.0	2.9	2.7	3.1	3.0	5.0	2.7	4.0
Flexural strength	ISO 178	23degC	MPa	122	175	116	132	145	140	108	140	120
Flexural modulus				6000	10500	3800	5500	7300	8000	3400	5800	6000
Charpy impact strength	ISO 179-1 , 179-2	23degC	kJ/m^2	-	-	-	-	-	-	-	-	-
Charpy notched impact strength		23degC	kJ/m^2	5	5	6	6	6	5	6	5	3
Thermal properties												
Temperature of deflection under load	ISO 75-1 , 75-2	1.80MPa	degC	105	115	95	115	115	109	117	121	103
		0.45MPa		-	-	-	-	-	-	-	-	-
Coefficient of Linear thermal expansion	ISO 11359-2	MD	1/degC	3.7E-05	-	4.7E-05	3.7E-05	2.6E-05	2.1E-05	4.5E-05	3.7E-05	4.0E-05
		TD		6.8E-05	-	5.8E-05	6.8E-05	6.1E-05	4.0E-05	6.5E-05	6.8E-05	5.5E-05
Flammability	UL94	0.75mmt	-	-	-	-	-	-	-	-	-	-
		1.5mmt	-	V-1	V-1(1.0mm)	V-1	V-1	V-1	V-1	V-1	V-0	V-0
		2.0mmt	-	-	-	-	-	-	-	-	-	-
		3.0mmt	-	5VB	5VB(2.7mm)	-	-	-	-	-	-	-
Electrical properties												
Relative permittivity	IEC 60250	100Hz	-	-	-	-	3.2	3.5	3.5	3.2	3.2	-
		1MHz	-	-	-	-	3.1	3.3	3.3	3.1	3.1	-
Dissipation factor	IEC 60250	100Hz	-	-	-	-	0.0057	0.0092	0.0130	0.0090	0.0057	-
		1MHz	-	-	-	-	0.0067	0.0077	0.0049	0.0039	0.0067	-
Volume resistivity	IEC 60093	-	Ω・m	5.E+13	-	5.E+13	5.E+13	2.E+13	4.E+13	2.E+14	5.E+13	2.E+14
Surface resistivity	IEC 60093	-	Ω	1.E+15	-	1.E+15	1.E+15	3.E+15	7.E+14	1.E+16	1.E+15	2.E+15
Electric strength	IEC 60243-1	1mmt	MV/m	-	-	-	35	34	47	49	35	-
		3mmt		-	-	-	18	17	19	24	18	-
Comparative tracking index	IEC 60112	-	-	175	-	200	200	150	175	600	200	-

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Property table of anti-static grades

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Properties	Test Method	Terms	Units	Anti-static		
				EHM1010A	EHM1000 9905M	EHM103R
				CB	CB	CB
Physical properties						
Density	ISO 1183	-	g/cm^3	1.16	1.14	1.16
Water absorption	-	23degC, Underwater	%	-	-	-
Rheological properties						
Melt Volume-flow Rate	ISO1133	-	$cm^3/10min$	-	9.0	-
		Temperature	degC	-	320	-
		Load	kg	-	5	-
Molding shirinkage (3.0mmt)	MEP method	MD	%	0.5 - 0.7	0.7 - 0.9	0.9 - 1.1
		TD		0.5 - 0.7	0.7 - 0.9	0.9 - 1.1
Mechanical properties						
Tensile modulus	ISO 527-1 , 527-2	23degC	MPa	3700	2500	2600
Yield stress				-	-	-
Yield strain			%	-	-	-
Nominal strain at break				-	-	-
Stress at break			MPa	64	60	62
Strain at break			%	2.2	9.0	8.0
Flexural strength	ISO 178	23degC	MPa	110	102	105
Flexural modulus				3860	2500	2700
Charpy impact strength	ISO 179-1 , 179-2	23degC	kJ/m^2	20	100	40
Charpy notched impact strength		23degC	kJ/m^2	3	-	-
Thermal properties						
Temperature of deflection under load	ISO 75-1 , 75-2	1.80MPa	degC	155	161	150
		0.45MPa		165	-	160
Coefficient of Linear thermal expansion	ISO 11359-2	MD	1/degC	5.3E-05	-	-
		TD		5.5E-05	-	-
Flammability	UL94	0.75mmt	-	-	-	-
		1.5mmt	-	-	-	-
		2.0mmt	-	-	-	-
		3.0mmt	-	-	-	-
Electrical properties						
Relative permittivity	IEC 60250	100Hz	-	-	-	-
		1MHz	-	-	-	-
Dissipation factor	IEC 60250	100Hz	-	-	-	-
		1MHz	-	-	-	-
Volume resistivity	IEC 60093	-	Ω・m	-	-	-
Surface resistivity	IEC 60093	-	Ω	6.E+05	1.E+04	2.E+03
Electric strength	IEC 60243-1	1mmt	MV/m	-	-	-
		3mmt		-	-	-
Comparative tracking index	IEC 60112	-	-	-	-	-

Wear resistance, Antivibration, High-dielectric grade

Iupiace™

Properties	Test Method	Terms	Units	AHF6010B	GHF3010	VSG635V	HD7007
				Friction/Wear Resistance Improved		Antivibration	High dielectric
				AHF6010B	**GHF3010**	**VSG635V**	**HD7007**
				Unreinforced	Fiber Reinforced	-	-
				PTFE	PTFE+GF	GF+Filler	-
				10%	10%	35%	-
Physical properties							
Density	ISO 1183	-	g/cm^3	1.12	1.37	1.44	1.32
Water absorption	-	23degC, Underwater	%	0.06	0.10	0.06	0.10
Rheological properties							
Melt Volume-flow Rate	ISO1133	-	cm^3/10min	4.5	1.9	9.0	6.5
		Temperature	degC	300	300	280	300
		Load	kg	2.16	2.16	5	5
Molding shirinkage (3.0mmt)	MEP method	MD	%	0.5 - 0.7	0.1 - 0.2	0.1 - 0.3	-
		TD		0.5 - 0.7	0.2 - 0.4	0.2 - 0.4	-
Mechanical properties							
Tensile modulus	ISO 527-1, 527-2	23degC	MPa	2400	9000	8600	4900
Yield stress				51	-	-	-
Yield strain			%	5.0	-	-	-
Nominal strain at break				15	-	-	-
Stress at break			MPa	-	90	74	60
Strain at break			%	-	1.8	1.2	2.0
Flexural strength	ISO 178	23degC	MPa	84	140	140	95
Flexural modulus				2500	9000	8500	4800
Charpy impact strength	ISO 179-1, 179-2	23degC	kJ/m^2	-	-	-	12
Charpy notched impact strength		23degC	kJ/m^2	8	6	5	-
Thermal properties							
Temperature of deflection under load	ISO 75-1, 75-2	1.80MPa	degC	110	125	115	125
		0.45MPa		-	-	120	-
Coefficient of Linear thermal expansion	ISO 11359-2	MD	1/degC	6.0E-05	2.5E-05	2.5E-05	-
		TD		6.0E-05	6.0E-05	6.1E-05	-
Flammability	UL94	0.75mmt	-	-	-	-	-
		1.5mmt	-	HB	HB	V-1	-
		2.0mmt	-	-	-	-	-
		3.0mmt	-	-	-	-	-
Electrical properties							
Relative permittivity	IEC 60250	100Hz	-	-	-	-	-
		1MHz	-	-	-	-	8(1GHz)
Dissipation factor	IEC 60250	100Hz	-	-	-	-	-
		1MHz	-	-	-	-	0.006(1GHz)
Volume resistivity	IEC 60093	-	Ω・m	3.E+14	2.E+14	4.E+13	-
Surface resistivity	IEC 60093	-	Ω	6.E+15	2.E+15	8.E+14	-
Electric strength	IEC 60243-1	1mmt	MV/m	-	-	-	-
		3mmt		-	-	-	-
Comparative tracking index	IEC 60112	-	-	-	-	-	-

GLOBAL POLYACETAL

Property table of PA alloy grades

Iupiace™

Properties	Test Method	Terms	Units	Unreinforced PPE/PA6 Alloy	Fiber Reinforced PPE/PA6 Alloy	Unreinforced PPE/PA66 Alloy
				NX7000	NXG7201 8240	NX9000
				-	GF	-
				-	20%	-
				dry(50%RH)	dry(50%RH)	dry(50%RH)
Physical properties						
Density	ISO 1183	-	g/cm^3	1.10	1.26	1.11
Water absorption	-	23degC, Underwater	%	-	-	-
Rheological properties						
Melt Volume-flow Rate	ISO1133	-	$cm^3/10min$	5.5	6.0	2
		Temperature	degC	275	275	275
		Load	kg	2.16	2.16	2.16
Molding shirinkage (3.0mmt)	MEP method	MD	%	1.2 - 1.4	0.3 - 0.5	1.1 - 1.3
		TD		1.1 - 1.3	0.4 - 0.6	1.1 - 1.3
Mechanical properties						
Tensile modulus	ISO 527-1, 527-2	23degC	MPa	2500 (1600)	6000 (4100)	2500 (-)
Yield stress				65 (46)	- (73)	65 (-)
Yield strain			%	4.1 (9.9)	- (5.1)	4.5 (-)
Nominal strain at break				20 (143)	- (11)	50 (-)
Stress at break			MPa	-	97 (-)	-
Strain at break			%	-	2.2 (-)	-
Flexural strength	ISO 178	23degC	MPa	102 (59)	171 (73)	100 (-)
Flexural modulus				2500 (1500)	5700 (4100)	2500 (-)
Charpy impact strength	ISO 179-1, 179-2	23degC	kJ/m^2	-	-	-
Charpy notched impact strength		23degC	kJ/m^2	30 (77)	6 (9)	25 (-)
Thermal properties						
Temperature of deflection under load	ISO 75-1, 75-2	1.80MPa	degC	-	-	-
		0.45MPa		180	210	190
Coefficient of Linear thermal expansion	ISO 11359-2	MD	1/degC	9.0E-05	3.0E-05	7.0E-05
		TD		-	-	-
Flammability	UL94	0.75mmt	-	-	-	-
		1.5mmt	-	-	-	-
		2.0mmt	-	-	-	-
		3.0mmt	-	-	-	-
Electrical properties						
Relative permittivity	IEC 60250	100Hz	-	-	-	-
		1MHz	-	-	-	-
Dissipation factor	IEC 60250	100Hz	-	-	-	-
		1MHz	-	-	-	-
Volume resistivity	IEC 60093	-	Ω・m	-	-	-
Surface resistivity	IEC 60093	-	Ω	-	-	-
Electric strength	IEC 60243-1	1mmt	MV/m	-	-	-
		3mmt		-	-	-
Comparative tracking index	IEC 60112	-	-	-	-	-

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Property table of PA, PP alloy grades

LEMALLOY™

Properties	Test Method	Terms	Units	PPE/PA6 Alloy			PPE/PA66 Alloy		PPE/PP Alloy
				BX505	BX528A-3	BX504D	C61HL	C82HL	PX603Y
				Standards	High Rigidity	High Rigidity	Standards	High Flowability	-
				-	-	Filler	-	-	-
				dry(50%RH)	dry(50%RH)	dry(50%RH)	dry(50%RH)	dry(50%RH)	-
Physical properties									
Density	ISO 1183	-	g/cm³	1.09	1.15	1.22	1.10	1.13	0.98
Water absorption	-	23degC, Underwater	%	-			-	-	-
Rheological properties									
Melt Volume-flow Rate	ISO1133	- Temperature Load	cm³/10min degC kg	14 280 5	15 280 5	21 280 5	31 280 5	100 280 5	55 280 5
Molding shirinkage (3.0mmt)	MEP method	MD TD	%	1.2 - 1.4 1.1 - 1.3	1.2 - 1.4 1.0 - 1.2	0.7 - 0.9 0.6 - 0.8	1.1 - 1.3 1.1 - 1.3	1.1 - 1.3 1.1 - 1.3	1.0 - 1.2 1.1 - 1.3
Mechanical properties									
Tensile modulus Yield stress	ISO 527-1, 527-2	23degC	MPa	2200 (1200) 54 (38)	2500 (1400) 62 (37)	4200 (2200) - (42)	2500 (1600) 66 (51)	2600 (1500) 60 (45)	1900 42
Yield strain Nominal strain at break	ISO 527-1, 527-2	23degC	%	4.2 (18.8) 41 (115)	5.0 (14.9) 57 (140)	- (8.4) - (74)	5.3 (11.4) 42 (73)	4.8 (19.2) 47 (88)	- -
Stress at break	ISO 527-1, 527-2	23degC	MPa	-	-	62 (-)	-	-	-
Strain at break	ISO 527-1, 527-2	23degC	%	-	-	6.1 (-)	-	-	-
Flexural strength Flexural modulus	ISO 178	23degC	MPa	80 (47) 2000 (1200)	91 (60) 2300 (1400)	100 (57) 3650 (2100)	90 (71) 2300 (1700)	90 (60) 2400 (1500)	59 1900
Charpy impact strength	ISO 179-1, 179-2	23degC	kJ/m²	-	-	-	NB (NB)	NB (NB)	NB
Charpy notched impact strength	ISO 179-1, 179-2	23degC	kJ/m²	22 (88)	26 (66)	6 (12)	20 (45)	20 (62)	5
Thermal properties									
Temperature of deflection under load	ISO 75-1, 75-2	1.80MPa 0.45MPa	degC	- 150	- 165	- 175	- 180	- 165	- 115
Coefficient of Linear thermal expansion	ISO 11359-2	MD TD	1/degC	9.0E-05 -	9.0E-05 -	- -	9.0E-05 -	- -	- -
Flammability	UL94	0.75mmt	-	-	-	-	-	-	-
		1.5mmt	-	-	-	-	-	-	-
		2.0mmt	-	-	-	-	-	-	-
		3.0mmt	-	-	-	-	-	-	-
Electrical properties									
Relative permittivity	IEC 60250	100Hz 1MHz	- -	- -	- -	- -	3.3 3.2	3.4 3.2	- -
Dissipation factor	IEC 60250	100Hz 1MHz	- -	- -	- -	- -	0.0040 0.0094	0.0050 0.0121	- -
Volume resistivity	IEC 60093	-	Ω・m	-	-	-	1.E+14	2.E+13	-
Surface resistivity	IEC 60093	-	Ω	-	-	-	5.E+14	7.E+14	-
Electric strength	IEC 60243-1	1mmt 3mmt	MV/m	- -	- -	- -	30 17	33 18	- -
Comparative tracking index	IEC 60112	-	-	-	-	-	-	-	-

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