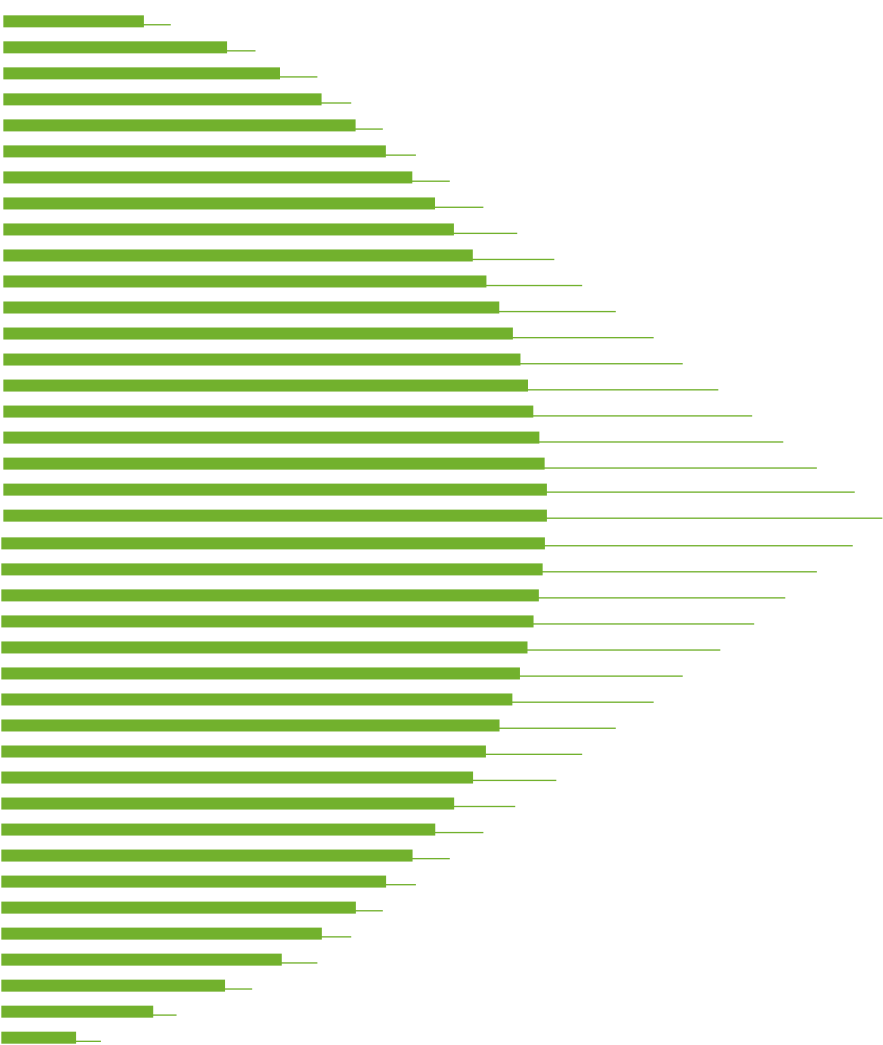




Modified PPE Resin

*Dupiacé*™ **LEMALLOY**™

2025.11 version

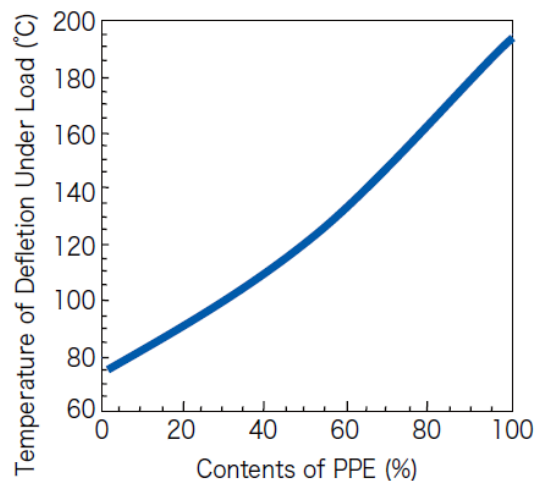
# Introduction

## What is lupiace™

lupiac (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.

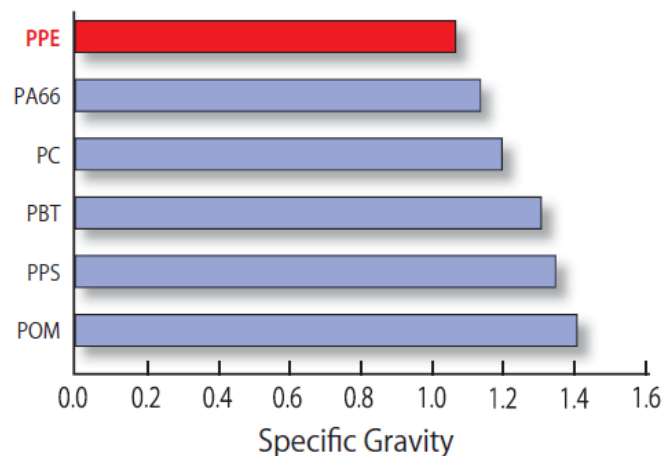
## Wide range of heatproof temperature

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



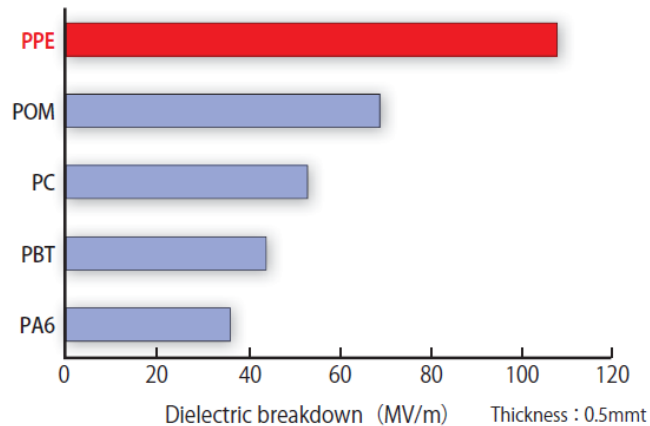
## Low specific gravity

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



### High electric property-1

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



### High electric property-2

The electric permittivity and dielectric tangent of lupiace 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  |

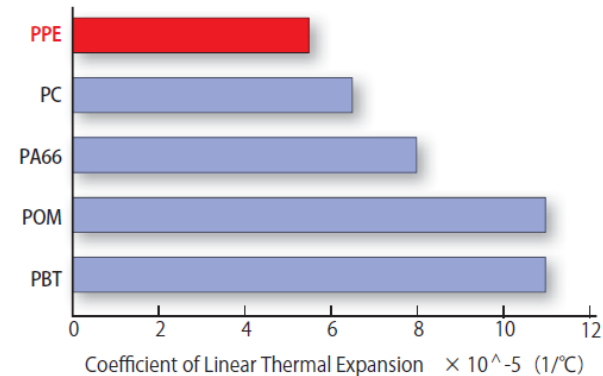
### High self-extinguishing property

lupiac has a high oxygen index and is easy to add flame resistance. A wide range of flame 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 dimensional accuracy

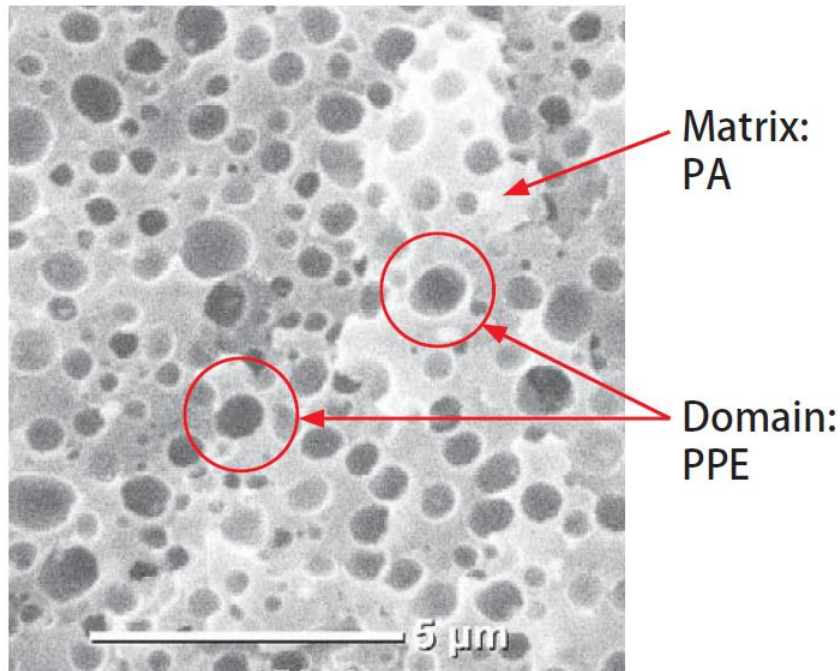
lupiac has the lowest linear expansion coefficient among engineering plastics and offers excellent dimensional accuracy.



## 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.



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

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.

# Features

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

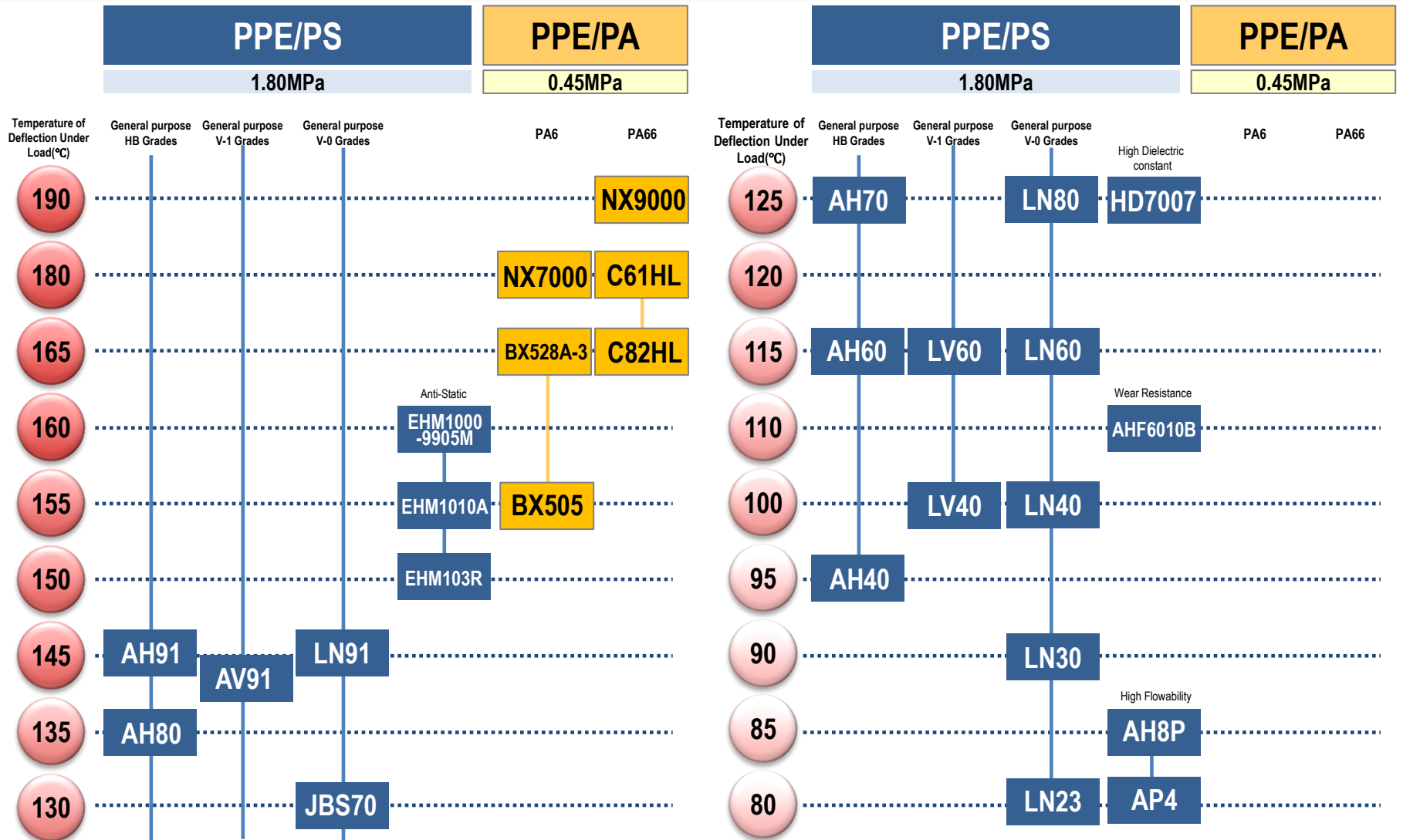
## ■ Features of Lupiace

- 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.

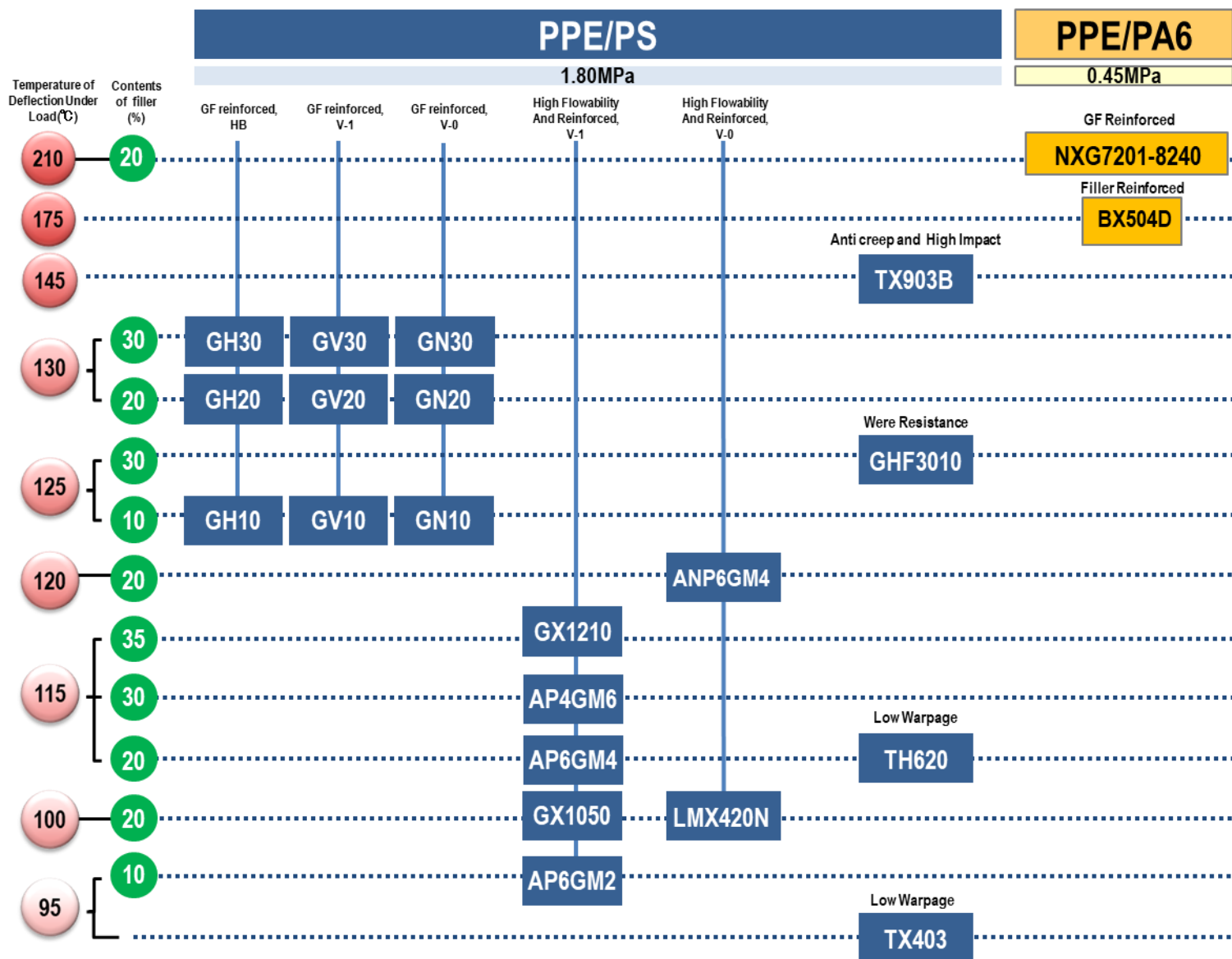
## ■ Features of LEMALLOY

- 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



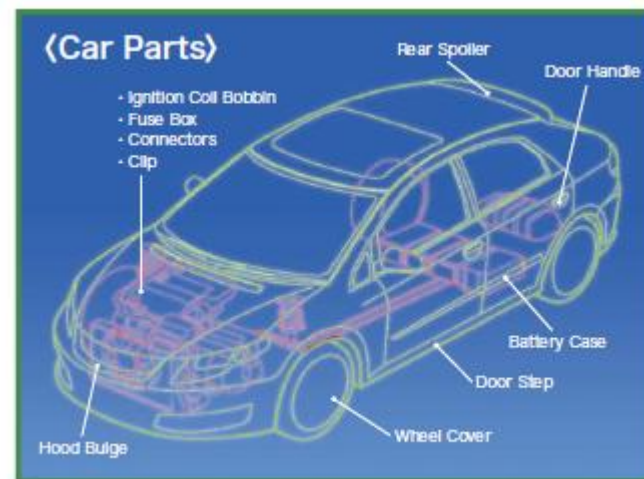
# Reinforced Grades



# Applications

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

| For housing equipment                                                                                                                                                                                                                            | For household use                                                                                                                                                                                                                                                                                                                                                     | For infrastructure/installation                                                                                                                                                                                                                                                                                                                                                                                                                    | For other applications                                                                                                                                                                                                              |                                                                                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Photovoltaic parts</li> <li>• Boiler parts</li> <li>• Battery parts</li> <li>• Water meter parts</li> <li>• Piping parts</li> <li>• Floor heating parts</li> <li>• Washing toilet seat parts</li> </ul> | <ul style="list-style-type: none"> <li>• Lighting parts</li> <li>• TV housing</li> <li>• Air conditioner parts</li> <li>• Gaming machine parts</li> <li>• Refrigerator parts</li> <li>• Smartphone</li> <li>• Air purification device parts</li> <li>• NB personal computer parts</li> <li>• AC adaptor</li> <li>• Tablet</li> <li>• Battery charger parts</li> </ul> | <ul style="list-style-type: none"> <li>• Underground piping parts</li> <li>• Tunnel parts</li> <li>• Road security parts</li> <li>• Water purification equipment parts</li> <li>• Automatic vending machine parts</li> <li>• Elevator parts</li> <li>• Medical device parts</li> <li>• Semiconductor equipment parts</li> <li>• Battery manufacturing facility parts</li> <li>• Money changer parts</li> <li>• Control instrument parts</li> </ul> | <ul style="list-style-type: none"> <li>• Copier parts</li> <li>• Printer parts</li> <li>• Connector</li> <li>• IC tray</li> <li>• Insulating film</li> <li>• Terminal block</li> <li>• Sensor</li> <li>• Motorboat parts</li> </ul> | <ul style="list-style-type: none"> <li>• Wire coating</li> <li>• Inverter</li> <li>• Pump parts</li> <li>• Dish tray</li> <li>• PC parts</li> <li>• Inlet</li> <li>• Scanner parts</li> <li>• LED frame</li> </ul> |



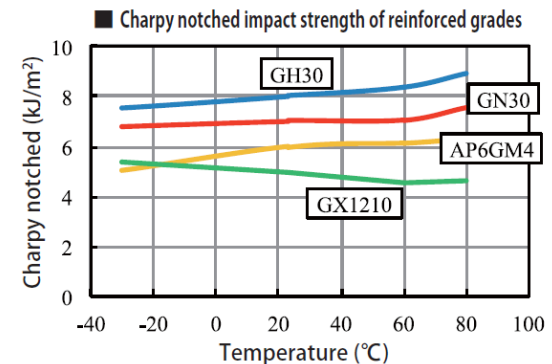
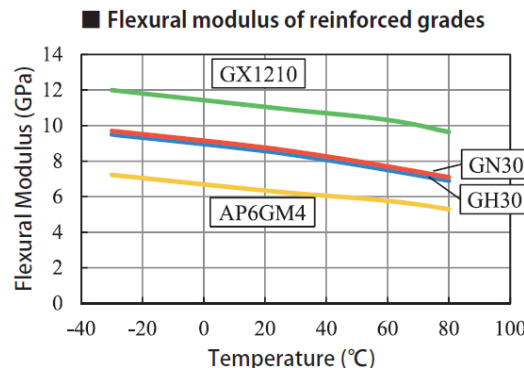
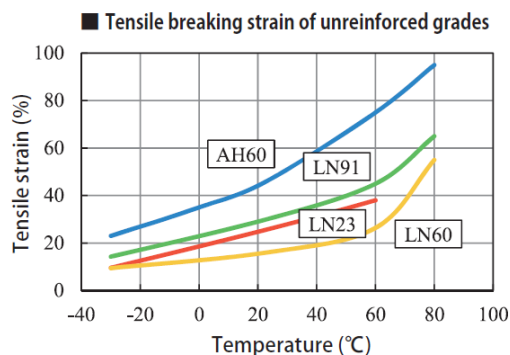
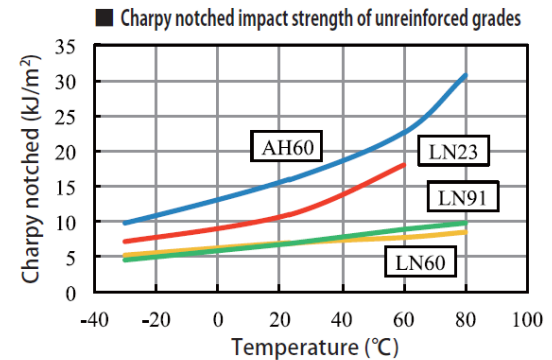
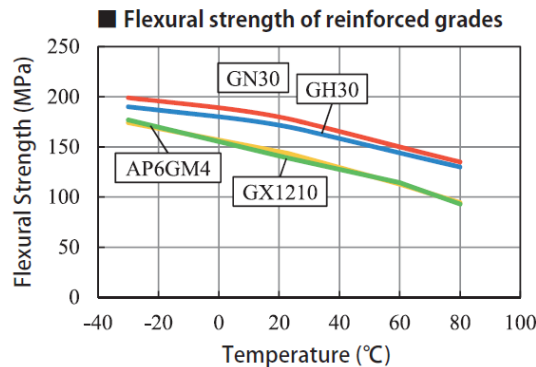
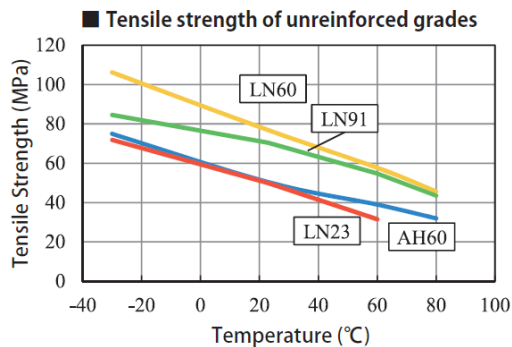
# Properties of Iupiace™

## 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.

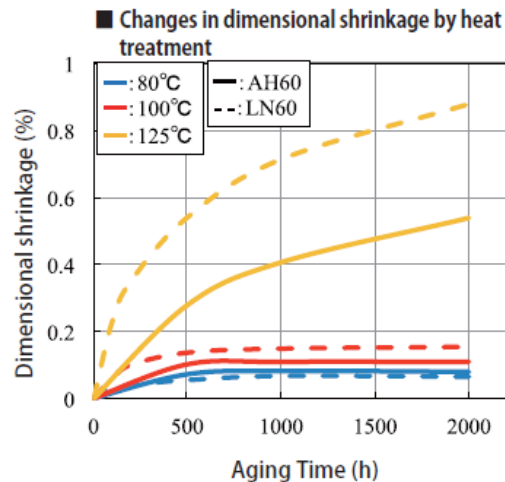
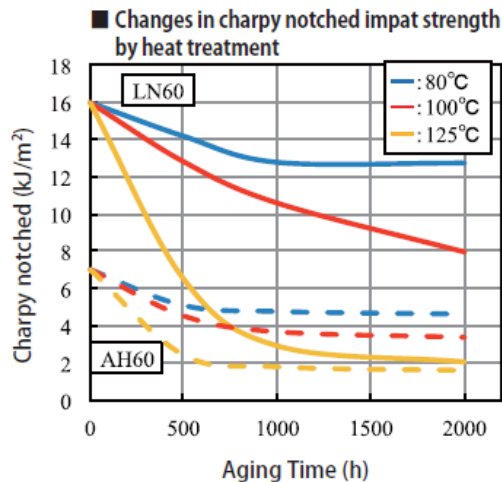
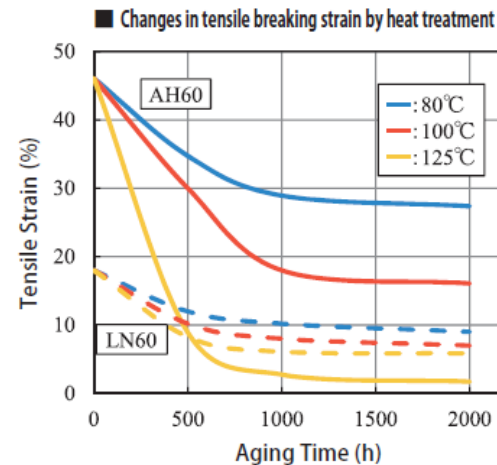
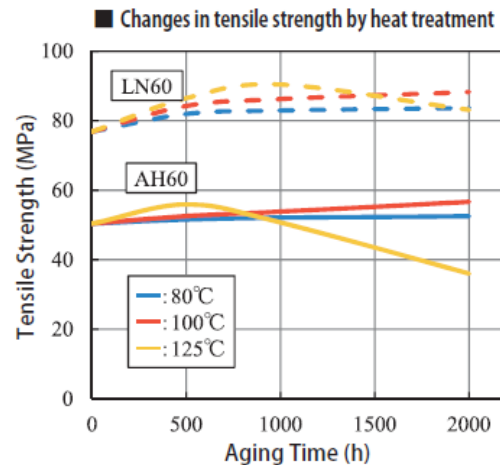
The unreinforced grades show reduction in stiffness, such as tensile strength and elastic modulus at high temperature; however, they show increase in toughness such as elongation (tensile breaking strain) and impact strength.

Additionally, the reinforced grades have a lower temperature dependence of various physical properties when compared to the unreinforced grades.



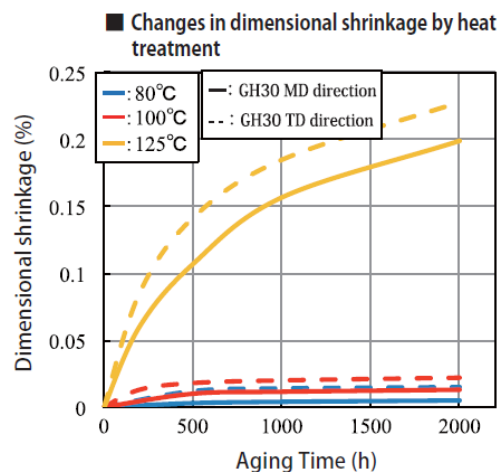
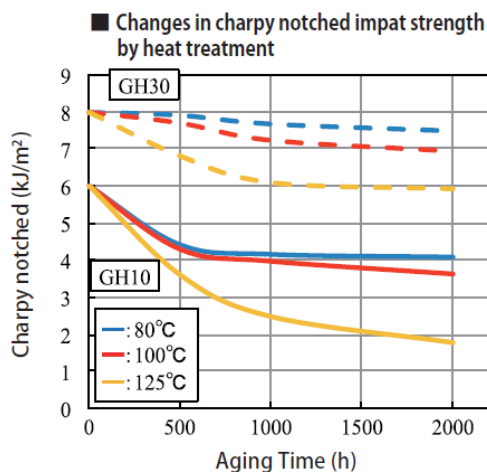
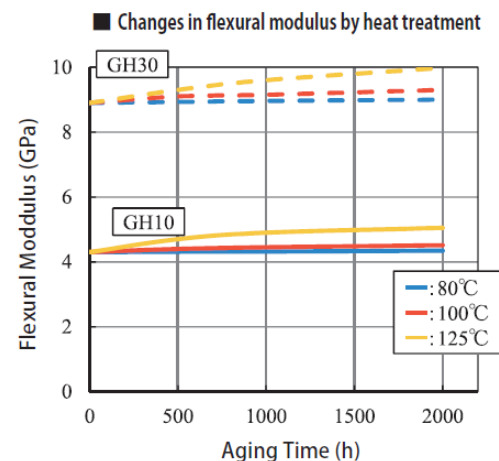
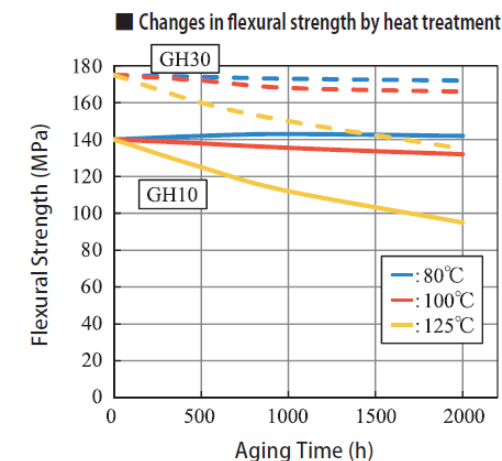
## Heat and aging resistance property of lupiace (1) (Unreinforced grade)

The unreinforced grades of lupiace 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.



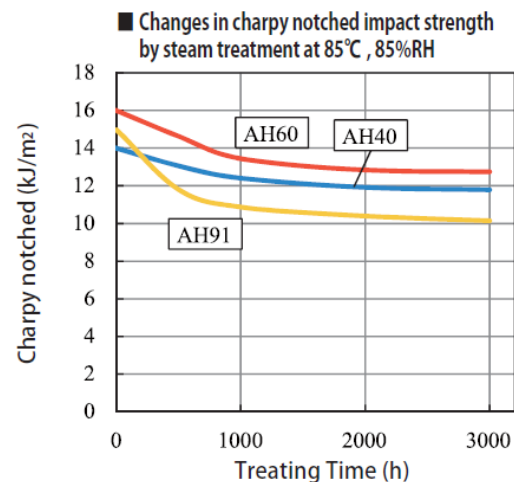
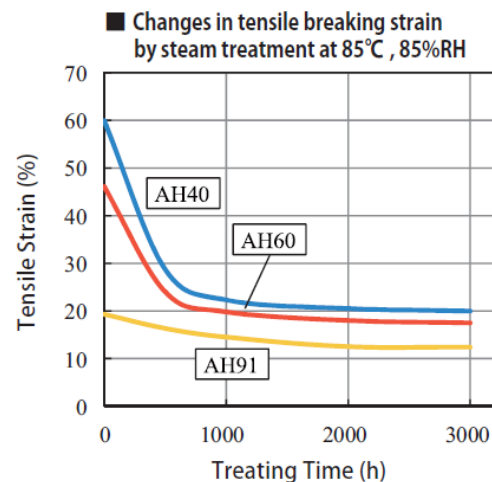
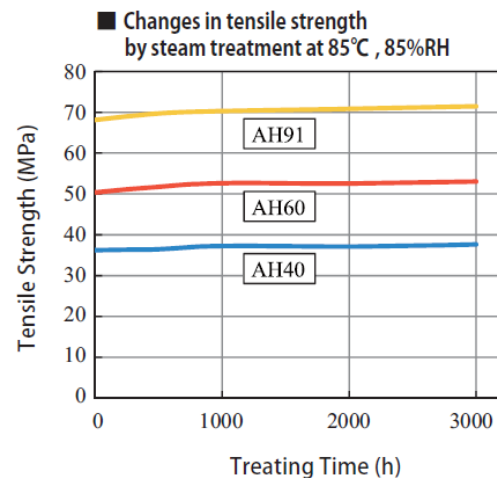
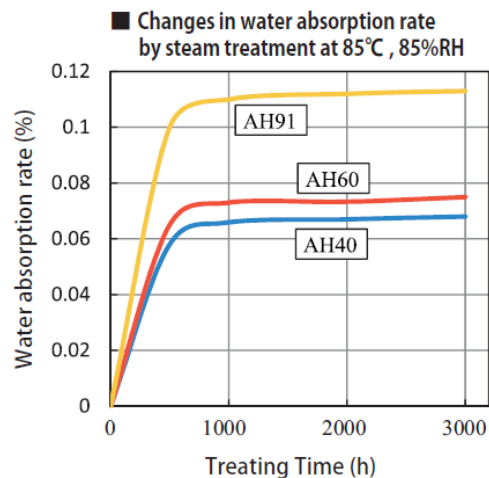
## Heat and aging resistance property of lupiace (2) (Reinforced grade)

The reinforced grades of lupiace were heat treated under high-temperature atmosphere and their physical property values are shown below. The reinforced grades of lupiace 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.



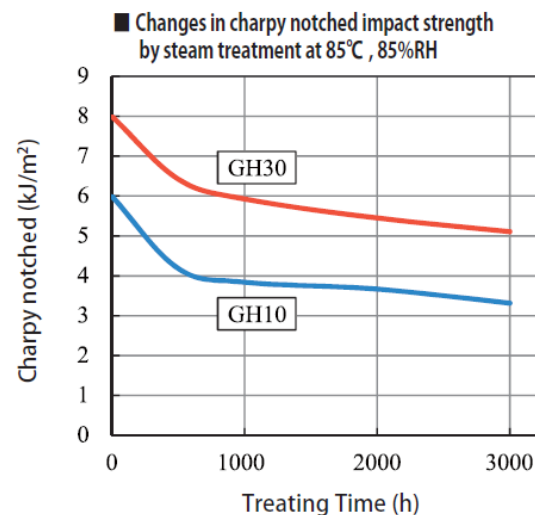
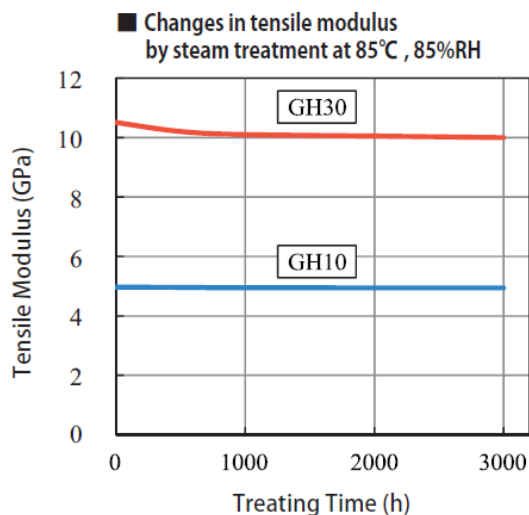
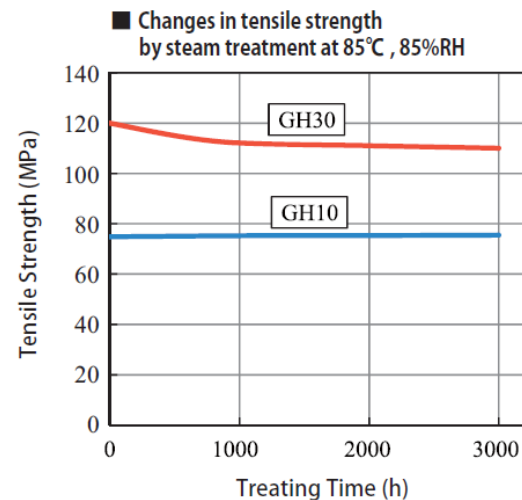
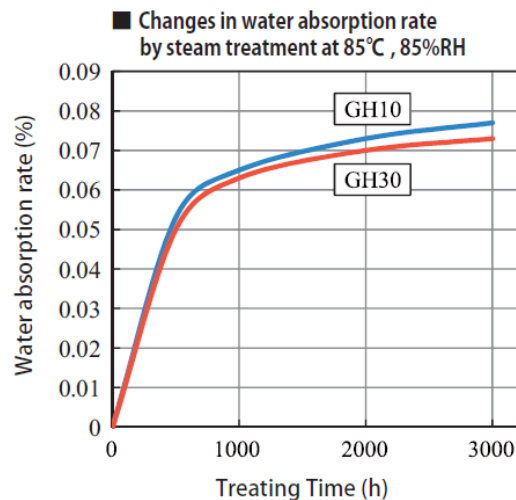
## Hygrothermal property of lupiace (1) (Unreinforced grade)

The unreinforced grades of lupiace 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 lupiace 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.



## Hygrothermal property of lupiace (2) (Reinforced grade)

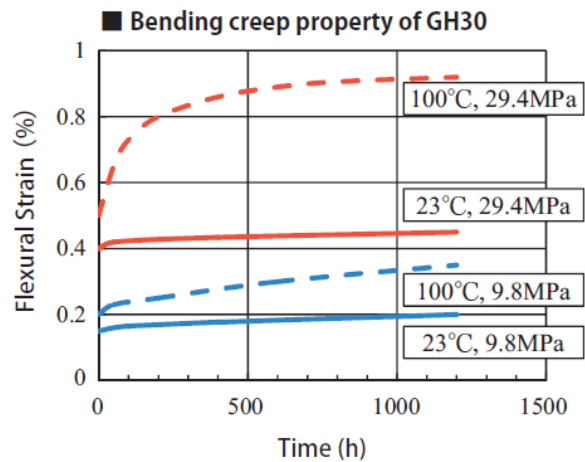
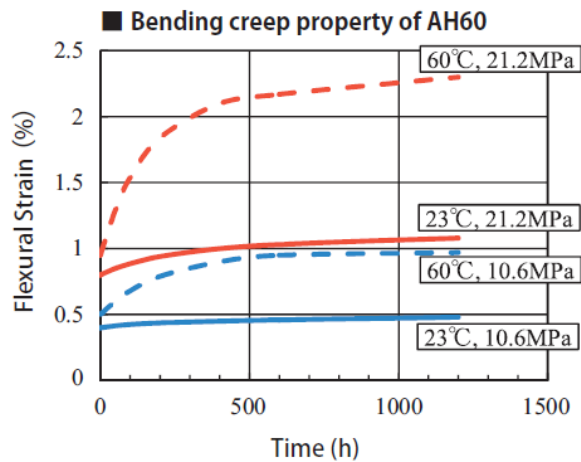
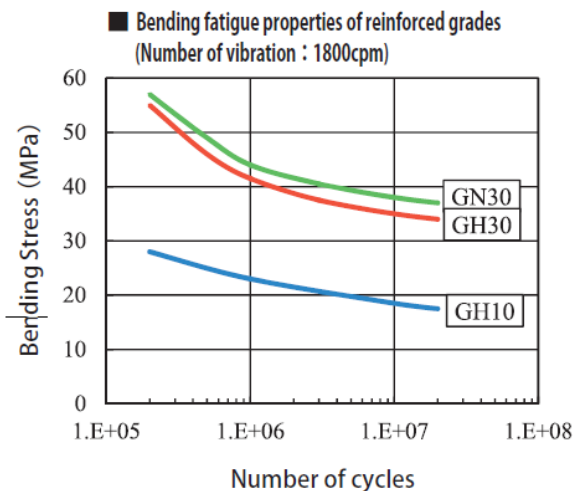
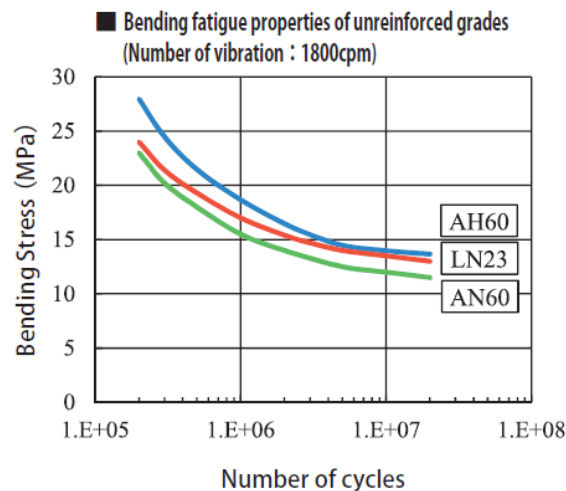
The reinforced grades of lupiace were kept at high temperature and humidity (85°C and 85% RH) for a prolonged time and the changes in water absorption rate and physical properties are shown below. Similar to the unreinforced grades, the reinforced grades of lupiace show very low absorption rates and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



## Fatigue property and creep property of lupiace

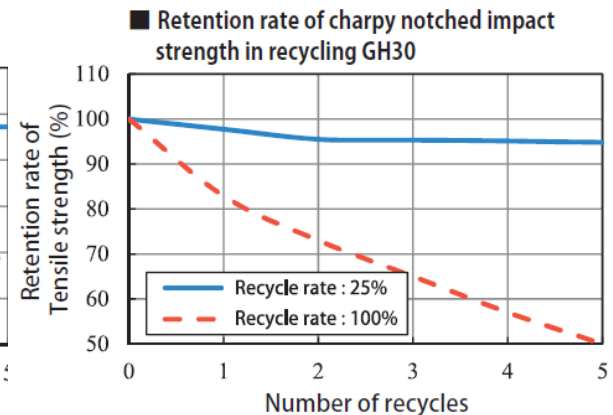
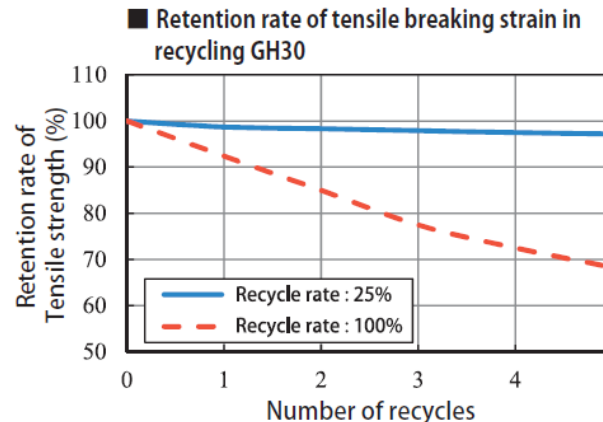
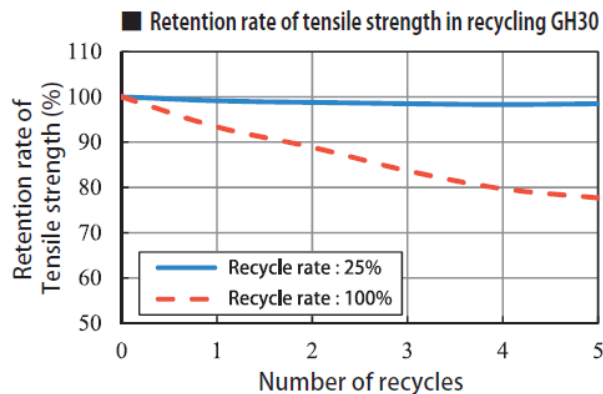
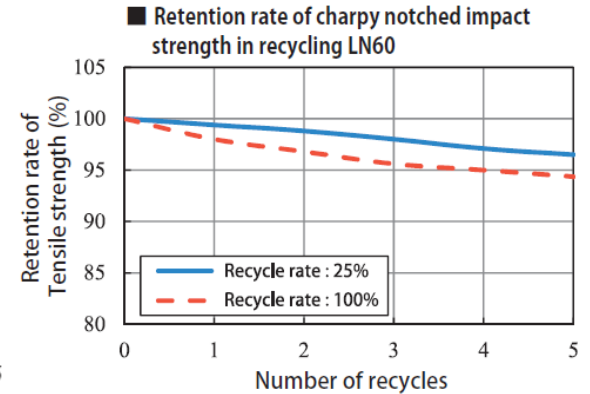
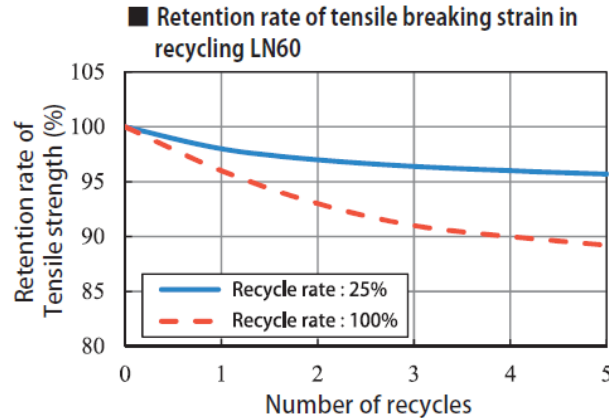
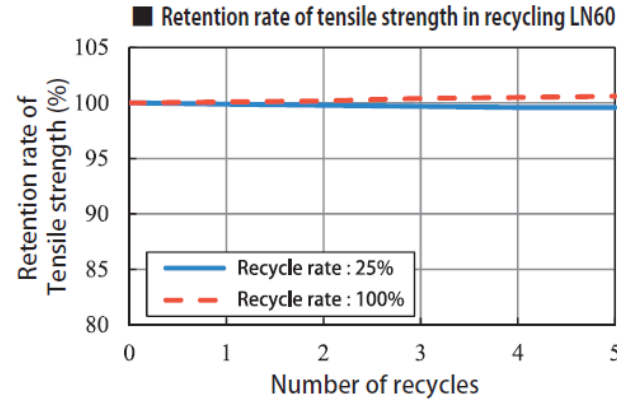
The bending fatigue property and bending creep property of lupiace are shown below.

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.



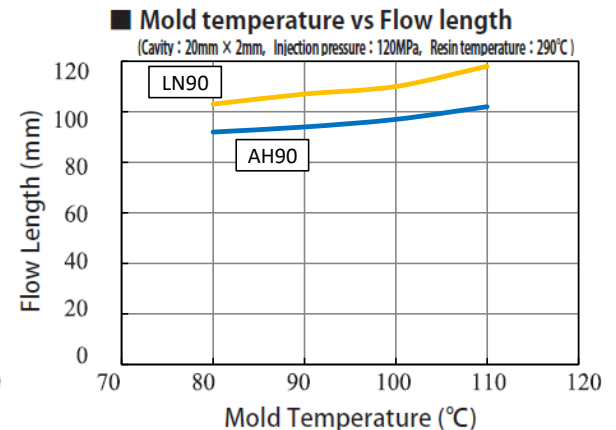
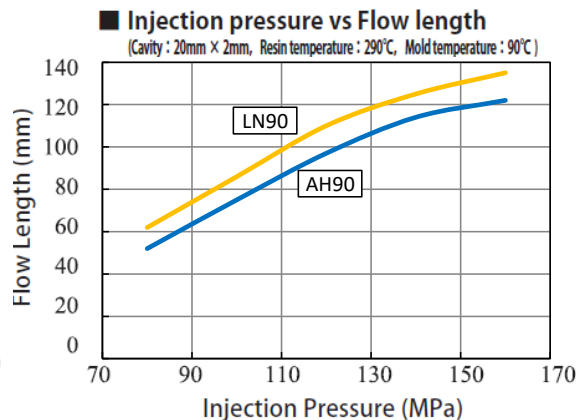
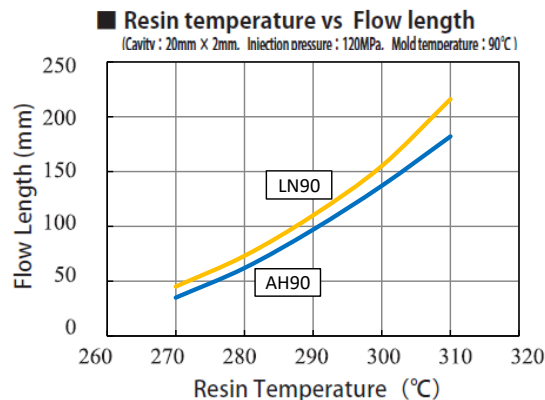
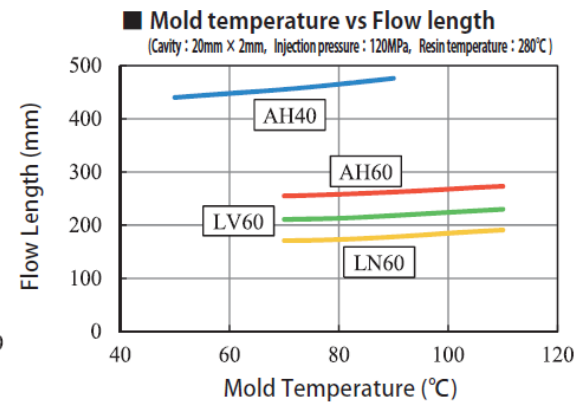
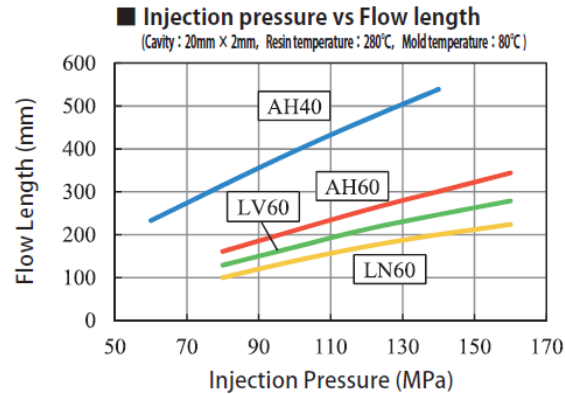
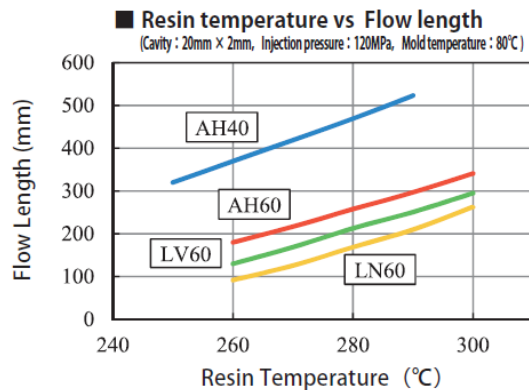
## Recycling property of lupiace

The unreinforced grades and reinforced grades of lupiace 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%.



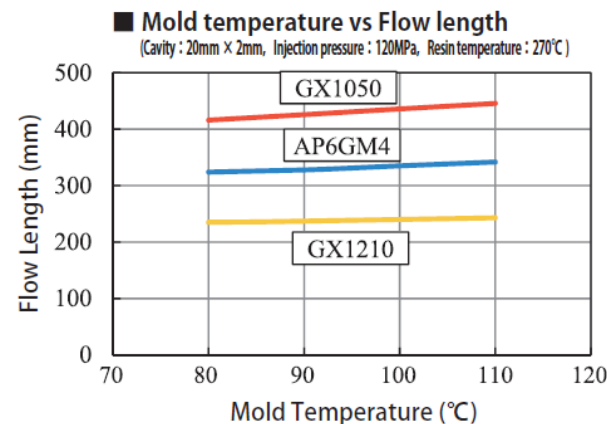
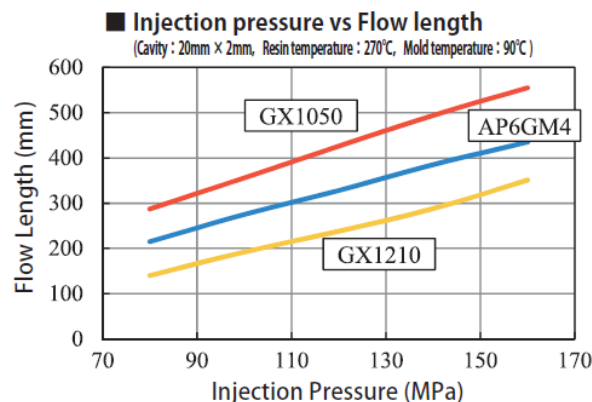
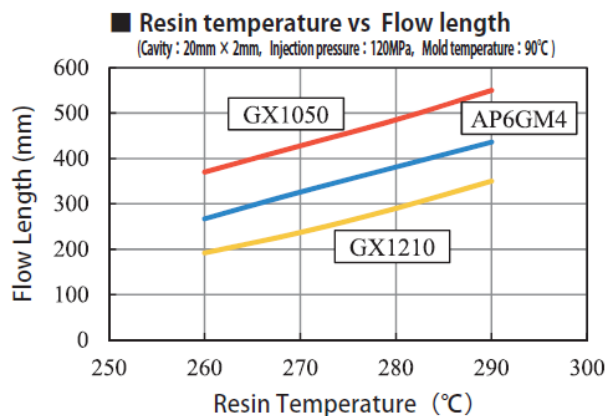
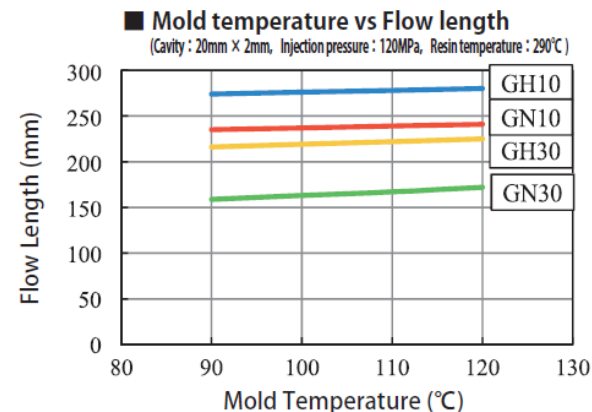
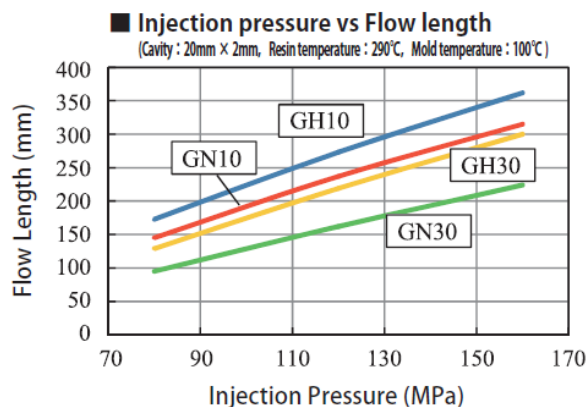
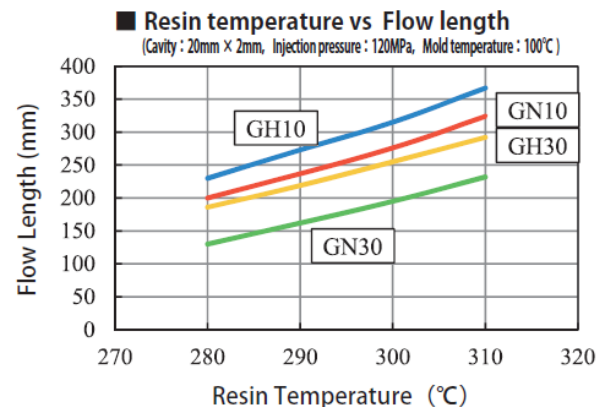
## Flow property of lupiace (1) (Unreinforced grade)

The flow properties of the unreinforced grades of lupiace are shown below. It can be seen that the flow properties of lupiace 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.



## Flow property of lupiace (2) (Reinforced grade)

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

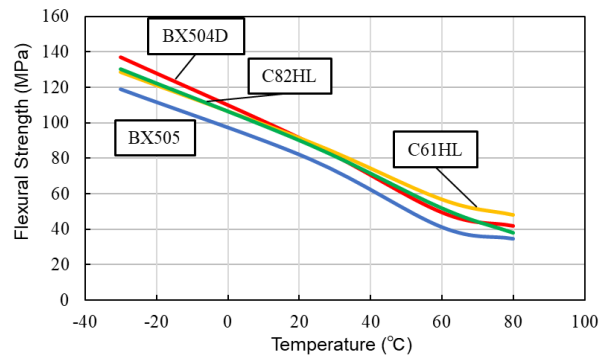


# Properties of LEMALLOY™

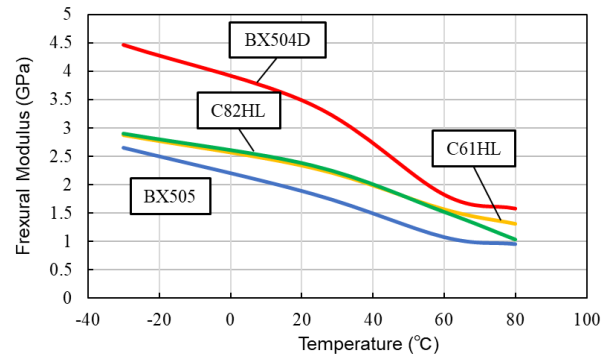
## Temperature dependence of LEMALLOY

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.

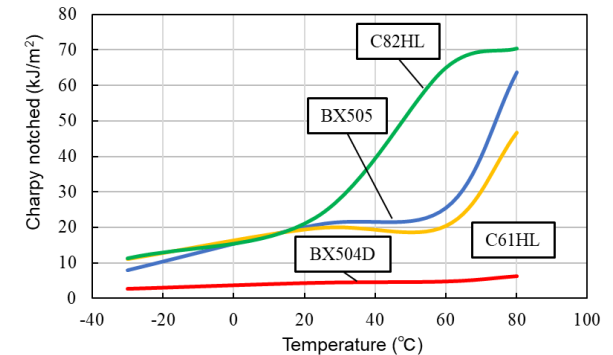
■ Flexural strength



■ Flexural modulus

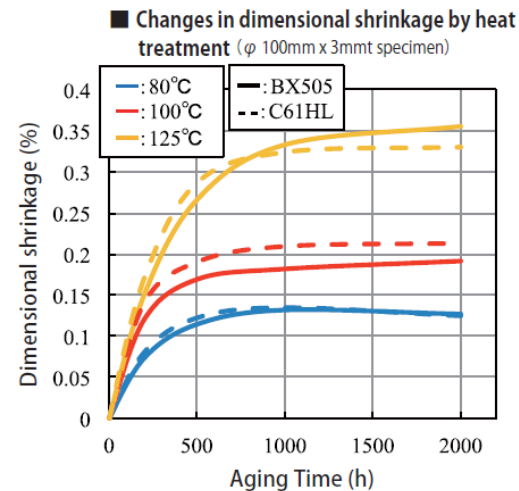
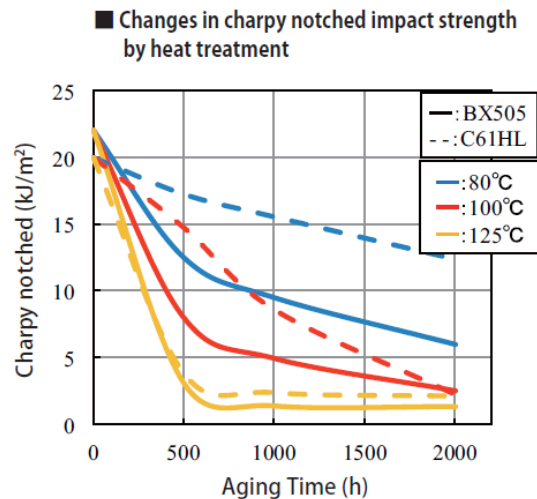
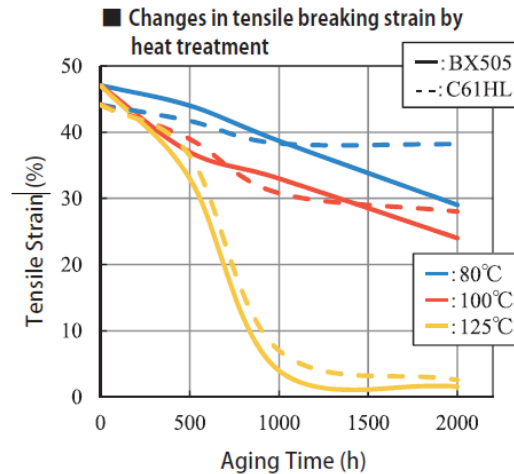
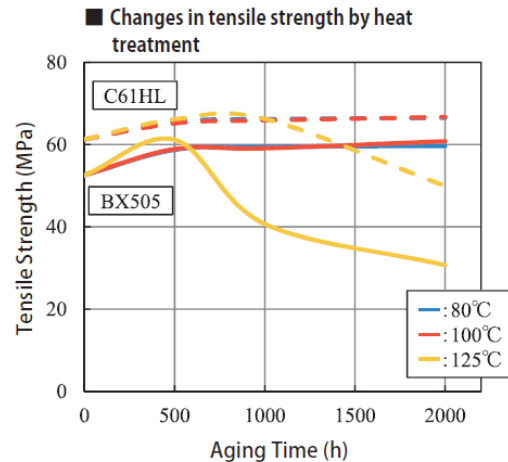


■ Charpy notched impact strength



## Heat and aging resistance property of LEMALLOY

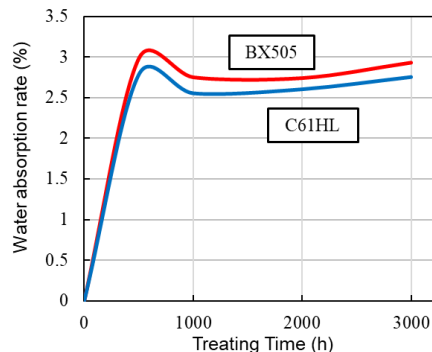
LEMALLOY resins were heat treated under high-temperature atmosphere and their physical property values are shown below. Although the tensile strengths and tensile elongations (tensile breaking strains) show no substantial decrease at 100°C or lower, they show substantial decrease at 125°C. Additionally, 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.



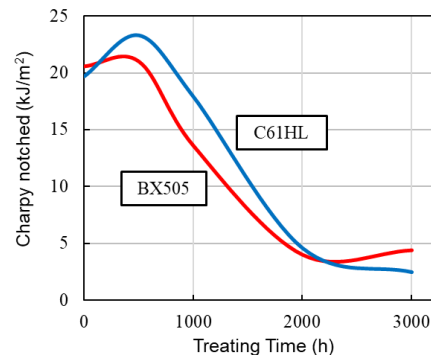
LEMALLOY resins were kept at high temperature and humidity (85°C and 85%RH) for a prolonged time, and the changes in water absorption rate and physical properties are shown below. LEMALLOY is an alloy material of polyphenylene ether and polyamide resin. Therefore, its water absorption rate is high because 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.

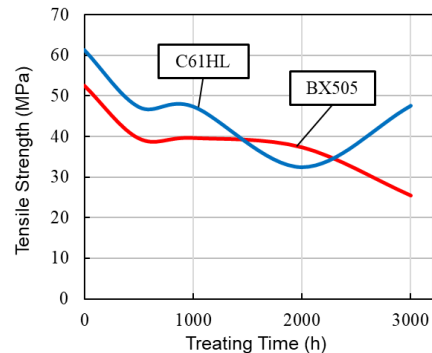
■ Changes in water absorption rate by steam treatment at 85°C, 85%RH



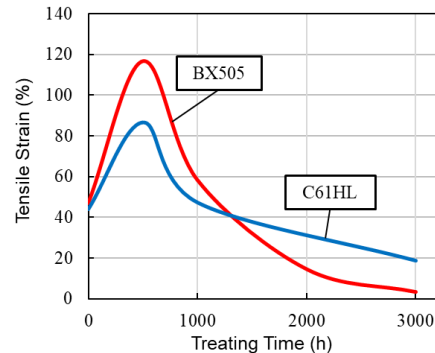
■ Changes in Charpy notched impact strength by steam treatment at 85°C, 85%RH



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

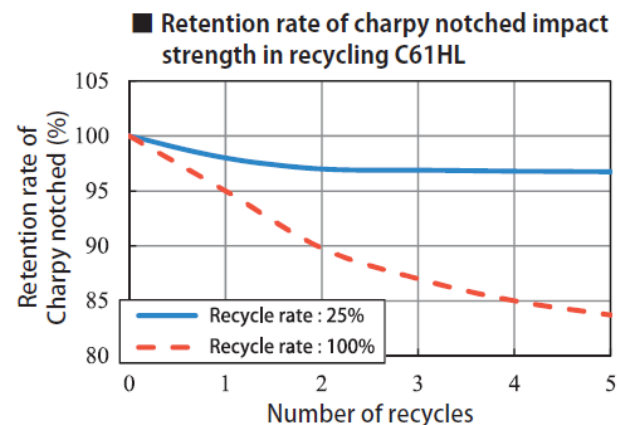
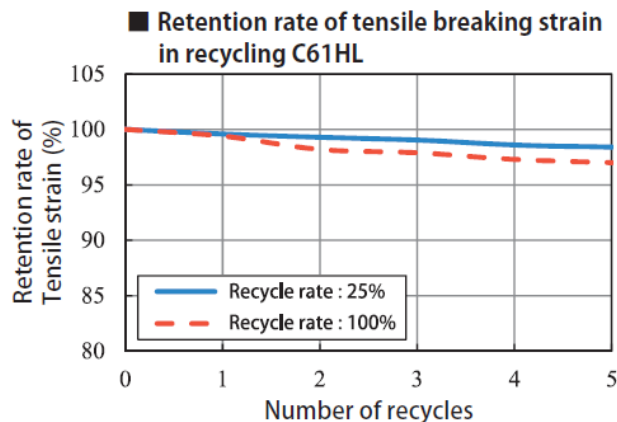
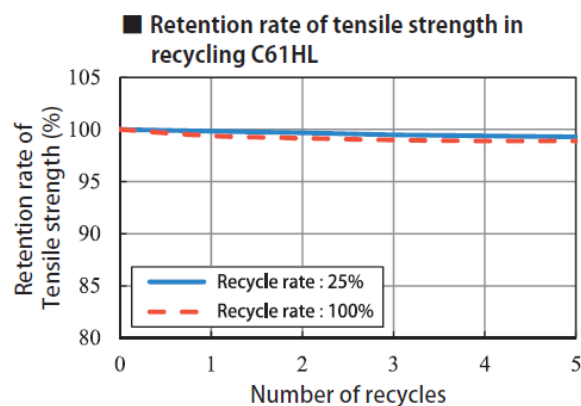


■ Changes in tensile breaking strain by steam treatment at 85°C, 85%RH



## 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 Lupiace, 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%.

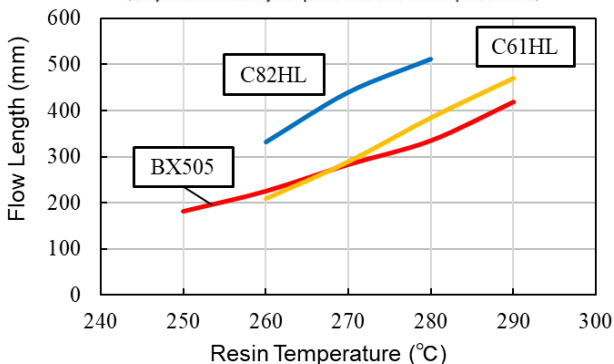


## Flow property of LEMALLOY

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

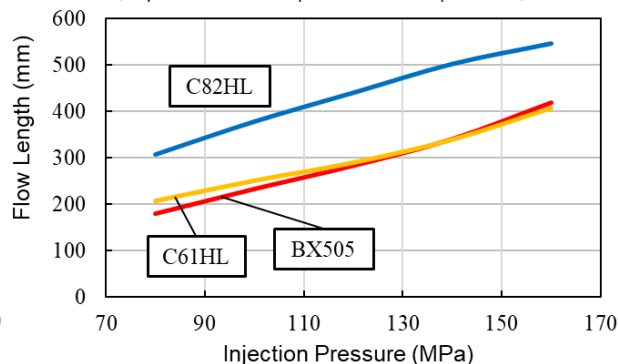
■ Resin temperature vs Flow length

(Cavity : 20mm × 2mm, Injection pressure : 120MPa, Mold temperature : 80°C)



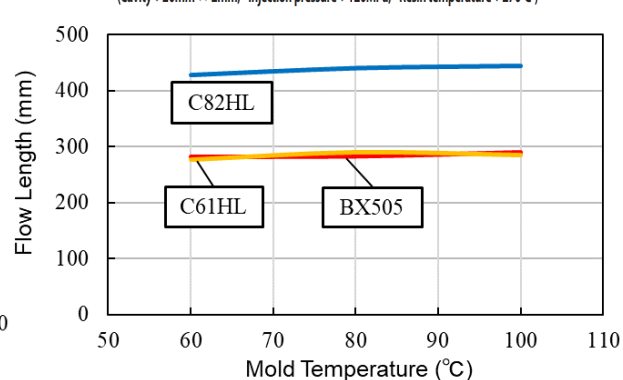
■ Injection pressure vs Flow length

(Cavity : 20mm × 2mm, Resin temperature : 270°C, Mold temperature : 80°C)



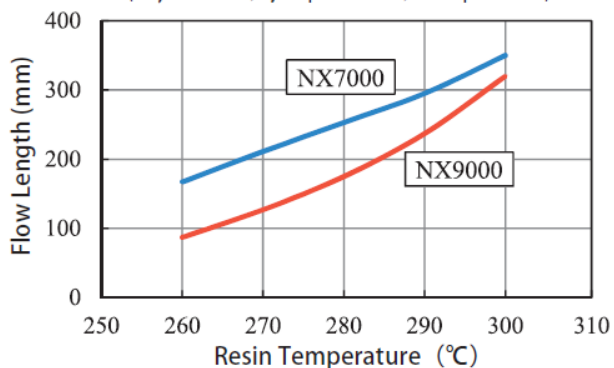
■ Mold temperature vs Flow length

(Cavity : 20mm × 2mm, Injection pressure : 120MPa, Resin temperature : 270°C)



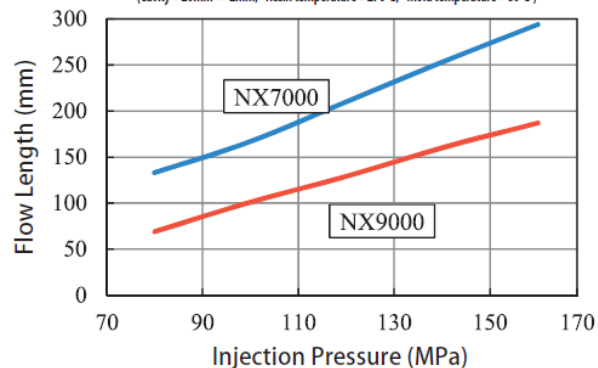
■ Resin temperature vs Flow length

(Cavity : 20mm × 2mm, Injection pressure : 120MPa, Mold temperature : 80°C)



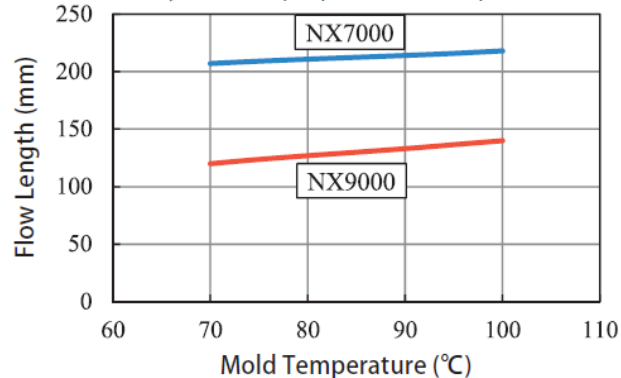
■ Injection pressure vs Flow length

(Cavity : 20mm × 2mm, Resin temperature : 270°C, Mold temperature : 80°C)



■ Mold temperature vs Flow length

(Cavity : 20mm × 2mm, Injection pressure : 120MPa, Resin temperature : 270°C)



# Chemical resistance property

## Chemical resistance (stress corrosion resistance) of lupiace and LEMALLOY

In order to investigate the chemical resistances of lupiace 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.

- lupiace 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          | lupiace |       | 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     |
| Chloroform                                 |                 | 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 lupiace 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 lupiace 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 lupiace 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 lupiace 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 lupiace 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 lupiace 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 lupiace.

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<br>2-4hrs<br>(°C) | Mold<br>Temp.<br>(°C) | Cylinder Setting Temp. |               |                |              |
|--------------------------------------------------------------------------|-----------------------------|-----------------------|------------------------|---------------|----------------|--------------|
|                                                                          |                             |                       | Nozzle<br>(°C)         | Front<br>(°C) | Middle<br>(°C) | Rear<br>(°C) |
| 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, AV91                                                         | 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<br>GV10, GV20, GV30<br>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<br>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<br>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<br>2-4hrs<br>(°C) | Mold<br>Temp.<br>(°C) | Cylinder Setting Temp. |               |                |              |
|                                                                          |                             |                       | Nozzle<br>(°C)         | Front<br>(°C) | Middle<br>(°C) | Rear<br>(°C) |
| 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      |
| C61HL                                                                    | 110-120                     | 60-100                | 250-290                | 250-290       | 250-290        | 240-270      |
| C82HL                                                                    | 110-120                     | 60-100                | 250-280                | 250-280       | 250-280        | 240-260      |

# Property table of unreinforced UL V-0 grades



|                                         |                      |                    |           | UL V-0 Grade           |                        |                        |                        |                        |                        |                        |
|-----------------------------------------|----------------------|--------------------|-----------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Properties                              | Test Method          | Terms              | Units     | LN23                   | LN30                   | LN40                   | LN60                   | JBS70                  | LN80                   | LN91                   |
| Physical properties                     |                      |                    |           |                        |                        |                        |                        |                        |                        |                        |
| Density                                 | ISO 1183             | -                  | g/cm³     | 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              | -                  | cm³/10min | 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 shrinkage (3.0mmt)              | MEP method           | MD<br>TD           | %         | 0.5 - 0.7<br>0.5 - 0.7 | 0.5 - 0.7<br>0.5 - 0.7 | 0.5 - 0.7<br>0.5 - 0.7 | 0.5 - 0.7<br>0.5 - 0.7 | 0.5 - 0.7<br>0.5 - 0.7 | 0.5 - 0.7<br>0.5 - 0.7 | 0.5 - 0.7<br>0.5 - 0.7 |
| Mechanical properties                   |                      |                    |           |                        |                        |                        |                        |                        |                        |                        |
| Tensile modulus                         | ISO 527-1<br>, 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                         | ISO 178              | 23degC             | %         | -                      | -                      | -                      | -                      | -                      | -                      | -                      |
| Flexural strength                       |                      |                    | MPa       | 80                     | 90                     | 95                     | 105                    | 105                    | 115                    | 105                    |
| Flexural modulus                        |                      |                    |           | 2400                   | 2400                   | 2500                   | 2380                   | 2400                   | 2400                   | 2700                   |
| Charpy impact strength                  | ISO 179-1<br>, 179-2 | 23degC             | kJ/m²     | -                      | -                      | -                      | -                      | -                      | -                      | -                      |
| Charpy notched impact strength          |                      | 23degC             | kJ/m²     | 11                     | 13                     | 12                     | 7                      | 26                     | 6                      | 7                      |
| Thermal properties                      |                      |                    |           |                        |                        |                        |                        |                        |                        |                        |
| Temperature of deflection under load    | ISO 75-1<br>, 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<br>TD           | 1/degC    | 5.5E-05<br>5.8E-05     | 5.5E-05<br>5.8E-05     | 5.5E-05<br>5.8E-05     | 5.5E-05<br>5.8E-05     | 5.5E-05<br>5.8E-05     | 5.5E-05<br>5.8E-05     | 5.5E-05<br>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<                   | -                      | -                      |

# Property table of unreinforced UL V-1 grades



|                                         |                      |                    |           | UL V-1 Grade       |                    |           |
|-----------------------------------------|----------------------|--------------------|-----------|--------------------|--------------------|-----------|
| Properties                              | Test Method          | Terms              | Units     | LV40               | LV60               | AV91      |
| Physical properties                     |                      |                    |           |                    |                    |           |
| Density                                 | ISO 1183             | -                  | g/cm³     | 1.10               | 1.09               | 1.08      |
| Water absorption                        | -                    | 23degC, Underwater | %         | 0.07               | 0.07               | 0.07      |
| Rheological properties                  |                      |                    |           |                    |                    |           |
| Melt Volume-flow Rate                   | ISO1133              | -                  | cm³/10min | 16                 | 8.5                | 3.4       |
|                                         |                      | Temperature        | degC      | 300                | 300                | 300       |
|                                         |                      | Load               | kg        | 2.16               | 2.16               | 2.16      |
| Molding shrinkage (3.0mmt)              | GPAC 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<br>, 527-2 | 23degC             | MPa       | -                  | -                  | 2500      |
| Yield stress                            |                      |                    |           | 60                 | 60                 | 73        |
| Yield strain                            |                      |                    | %         | -                  | -                  | 6.5       |
| Nominal strain at break                 |                      |                    |           | 20                 | 25                 | 20        |
| Stress at break                         |                      |                    | MPa       | -                  | -                  | -         |
| Strain at break                         | ISO 178              | 23degC             | %         | -                  | -                  | -         |
| Flexural strength                       |                      |                    | MPa       | 97                 | 100                | 109       |
| Flexural modulus                        |                      |                    |           | 2550               | 2650               | 2550      |
| Charpy impact strength                  | ISO 179-1<br>, 179-2 | 23degC             | kJ/m²     | -                  | -                  | -         |
| Charpy notched impact strength          |                      | 23degC             | kJ/m²     | 12                 | 12                 | 13        |
| Thermal properties                      |                      |                    |           |                    |                    |           |
| Temperature of deflection under load    | ISO 75-1<br>, 75-2   | 1.80MPa<br>0.45MPa | degC      | 100<br>115         | 115<br>130         | 141<br>-  |
| Coefficient of Linear thermal expansion | ISO 11359-2          | MD<br>TD           | 1/degC    | 6.3E-05<br>6.6E-05 | 6.3E-05<br>6.6E-05 | -<br>-    |
| 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            | -                  | -         | -                  | -                  | -         |

# Property table of unreinforced UL HB grades



|                                         |                      |                    |           | UL HB Grade            |                        |                        |                        |                        |
|-----------------------------------------|----------------------|--------------------|-----------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Properties                              | Test Method          | Terms              | Units     | AH40                   | AH60                   | AH70                   | AH80                   | AH91                   |
| Physical properties                     |                      |                    |           |                        |                        |                        |                        |                        |
| Density                                 | ISO 1183             | -                  | g/cm³     | 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              | -                  | cm³/10min | 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 shrinkage (3.0mmt)              | MEP method           | MD<br>TD           | %         | 0.5 - 0.7<br>0.5 - 0.7 | 0.5 - 0.7<br>0.5 - 0.7 | 0.5 - 0.7<br>0.5 - 0.7 | 0.5 - 0.7<br>0.5 - 0.7 | 0.5 - 0.7<br>0.5 - 0.7 |
| Mechanical properties                   |                      |                    |           |                        |                        |                        |                        |                        |
| Tensile modulus                         | ISO 527-1<br>, 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<br>, 179-2 | 23degC             | kJ/m²     | 153                    | 119                    | NB                     | 150                    | 140                    |
| Charpy notched impact strength          |                      | 23degC             | kJ/m²     | 14                     | 16                     | 20                     | 18                     | 15                     |
| Thermal properties                      |                      |                    |           |                        |                        |                        |                        |                        |
| Temperature of deflection under load    | ISO 75-1<br>, 75-2   | 1.80MPa<br>0.45MPa | degC      | 95<br>110              | 115<br>130             | 125<br>140             | 135<br>150             | 145<br>160             |
| Coefficient of Linear thermal expansion | ISO 11359-2          | MD<br>TD           | 1/degC    | 6.7E-05<br>7.1E-05     | 6.6E-05<br>6.9E-05     | 6.6E-05<br>6.9E-05     | 6.6E-05<br>6.9E-05     | 6.6E-05<br>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<br>1MHz      | -<br>-    | -<br>-                 | -<br>-                 | -<br>-                 | -<br>-                 | -<br>-                 |
| Dissipation factor                      | IEC 60250            | 100Hz<br>1MHz      | -<br>-    | -<br>-                 | -<br>-                 | -<br>-                 | -<br>-                 | -<br>-                 |
| 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<br>3mmt       | MV/m      | 38<br>20               | -                      | 44<br>>65              | -                      | -                      |
| Comparative tracking index              | IEC 60112            | -                  | -         | -                      | 275                    | -                      | -                      | -                      |

# Property table of high flowability UL V-0 grades



|                                         |                      |                    |           | High Flowability Grade (V-0) |                    |
|-----------------------------------------|----------------------|--------------------|-----------|------------------------------|--------------------|
| Properties                              | Test Method          | Terms              | Units     | AP4                          | AH8P               |
|                                         |                      |                    |           | Uninforced                   | Uninforced         |
| Physical properties                     |                      |                    |           |                              |                    |
| Density                                 | ISO 1183             | -                  | g/cm³     | 1.11                         | 1.10               |
| Water absorption                        | -                    | 23degC, Underwater | %         | 0.07                         | 0.06               |
| Rheological properties                  |                      |                    |           |                              |                    |
| Melt Volume-flow Rate                   | ISO1133              | -                  | cm³/10min | 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<br>, 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                         | ISO 178              | 23degC             | %         | -                            | -                  |
| Flexural strength                       |                      |                    | MPa       | 82                           | 93                 |
| Flexural modulus                        |                      |                    |           | 2000                         | 2400               |
| Charpy impact strength                  | ISO 179-1<br>, 179-2 | 23degC             | kJ/m²     | -                            | -                  |
| Charpy notched impact strength          |                      | 23degC             | kJ/m²     | 9                            | 7                  |
| Thermal properties                      |                      |                    |           |                              |                    |
| Temperature of deflection under load    | ISO 75-1<br>, 75-2   | 1.80MPa<br>0.45MPa | degC      | 80<br>90                     | 85<br>95           |
| Coefficient of Linear thermal expansion | ISO 11359-2          | MD<br>TD           | 1/degC    | -<br>-                       | 6.0E-05<br>6.0E-05 |
| Flammability                            | UL94                 | 0.75mmt            | -         | -                            | -                  |
|                                         |                      | 1.5mmt             | -         | V-0                          | V-0                |
|                                         |                      | 2.0mmt             | -         | -                            | -                  |
|                                         |                      | 3.0mmt             | -         | -                            | -                  |
| Electrical properties                   |                      |                    |           |                              |                    |
| Relative permittivity                   | IEC 60250            | 100Hz<br>1MHz      | -<br>-    | -<br>-                       | -<br>-             |
| Dissipation factor                      | IEC 60250            | 100Hz<br>1MHz      | -<br>-    | -<br>-                       | -<br>-             |
| 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<br>3mmt       | MV/m      | -<br>-                       | -<br>-             |
| Comparative tracking index              | IEC 60112            | -                  | -         | -                            | -                  |

# Property table of fiber reinforced UL V-0 grades



|                                         |                      |                    |           | Fiber Reinforced V-0   |                        |                        |
|-----------------------------------------|----------------------|--------------------|-----------|------------------------|------------------------|------------------------|
| Properties                              | Test Method          | Terms              | Units     | GN10                   | GN20                   | GN30                   |
|                                         |                      |                    |           | GF                     | GF                     | GF                     |
|                                         |                      |                    |           | 10%                    | 20%                    | 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 shrinkage (3.0mmt)              | MEP method           | MD<br>TD           | %         | 0.2 - 0.4<br>0.3 - 0.5 | 0.1 - 0.3<br>0.2 - 0.4 | 0.1 - 0.2<br>0.2 - 0.4 |
| Mechanical properties                   |                      |                    |           |                        |                        |                        |
| Tensile modulus                         | ISO 527-1<br>, 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                         | ISO 178              | 23degC             | %         | 2.5                    | 2.5                    | 1.5                    |
| Flexural strength                       |                      |                    | MPa       | 140                    | 160                    | 180                    |
| Flexural modulus                        |                      |                    |           | 4000                   | 6200                   | 8500                   |
| Charpy impact strength                  | ISO 179-1<br>, 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<br>, 75-2   | 1.80MPa<br>0.45MPa | degC      | 125<br>130             | 130<br>135             | 130<br>137             |
| Coefficient of Linear thermal expansion | ISO 11359-2          | MD<br>TD           | 1/degC    | 4.5E-05<br>7.5E-05     | 3.0E-05<br>6.8E-05     | 2.5E-05<br>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<br>1MHz      | -<br>-    | -<br>-                 | 0.0045<br>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                    |

# Property table of fiber reinforced UL V-1 grades



|                                         |                      |                    |                        | Fiber Reinforced V-1   |                        |                        |
|-----------------------------------------|----------------------|--------------------|------------------------|------------------------|------------------------|------------------------|
| Properties                              | Test Method          | Terms              | Units                  | GV10                   | GV20                   | GV30                   |
|                                         |                      |                    |                        | GF                     | GF                     | GF                     |
|                                         |                      |                    |                        | 10%                    | 20%                    | 30%                    |
| Physical properties                     |                      |                    |                        |                        |                        |                        |
| Density                                 | ISO 1183             | -                  | g/cm <sup>3</sup>      | 1.15                   | 1.22                   | 1.31                   |
| Water absorption                        | -                    | 23degC, Underwater | %                      | 0.06                   | 0.06                   | 0.06                   |
| Rheological properties                  |                      |                    |                        |                        |                        |                        |
| Melt Volume-flow Rate                   | ISO1133              | -                  | cm <sup>3</sup> /10min | 5.5                    | 3.6                    | 3.0                    |
|                                         |                      | Temperature        | degC                   | 300                    | 300                    | 300                    |
|                                         |                      | Load               | kg                     | 2.16                   | 2.16                   | 2.16                   |
| Molding shrinkage (3.0mmt)              | MEP method           | MD<br>TD           | %                      | 0.2 - 0.4<br>0.3 - 0.5 | 0.1 - 0.3<br>0.2 - 0.4 | 0.1 - 0.2<br>0.2 - 0.4 |
| Mechanical properties                   |                      |                    |                        |                        |                        |                        |
| Tensile modulus                         | ISO 527-1<br>, 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                         | ISO 178              | 23degC             | %                      | 2.5                    | 2.5                    | 1.5                    |
| Flexural strength                       |                      |                    | MPa                    | 135                    | 161                    | 170                    |
| Flexural modulus                        |                      |                    |                        | 4100                   | 6300                   | 8300                   |
| Charpy impact strength                  | ISO 179-1<br>, 179-2 | 23degC             | kJ/m <sup>2</sup>      | -                      | -                      | -                      |
| Charpy notched impact strength          |                      | 23degC             | kJ/m <sup>2</sup>      | 8                      | 7                      | 9                      |
| Thermal properties                      |                      |                    |                        |                        |                        |                        |
| Temperature of deflection under load    | ISO 75-1<br>, 75-2   | 1.80MPa<br>0.45MPa | degC                   | 125<br>135             | 130<br>137             | 130<br>140             |
| Coefficient of Linear thermal expansion | ISO 11359-2          | MD<br>TD           | 1/degC                 | 4.5E-05<br>7.5E-05     | 3.0E-05<br>6.8E-05     | 2.5E-05<br>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                    |

# Property table of fiber reinforced UL HB grades



|                                         |                      |                    |                        | Fiber Reinforced HB    |                        |                        |
|-----------------------------------------|----------------------|--------------------|------------------------|------------------------|------------------------|------------------------|
| Properties                              | Test Method          | Terms              | Units                  | GH10                   | GH20                   | GH30                   |
|                                         |                      |                    |                        | GF                     | GF                     | GF                     |
|                                         |                      |                    |                        | 10%                    | 20%                    | 30%                    |
| Physical properties                     |                      |                    |                        |                        |                        |                        |
| Density                                 | ISO 1183             | -                  | g/cm <sup>3</sup>      | 1.14                   | 1.22                   | 1.31                   |
| Water absorption                        | -                    | 23degC, Underwater | %                      | 0.06                   | 0.06                   | 0.06                   |
| Rheological properties                  |                      |                    |                        |                        |                        |                        |
| Melt Volume-flow Rate                   | ISO1133              | -                  | cm <sup>3</sup> /10min | 5.0                    | 4.4                    | 2.7                    |
|                                         |                      | Temperature        | degC                   | 300                    | 300                    | 300                    |
|                                         |                      | Load               | kg                     | 2.16                   | 2.16                   | 2.16                   |
| Molding shrinkage (3.0mmt)              | MEP method           | MD<br>TD           | %                      | 0.2 - 0.4<br>0.3 - 0.5 | 0.1 - 0.3<br>0.2 - 0.4 | 0.1 - 0.2<br>0.2 - 0.4 |
| Mechanical properties                   |                      |                    |                        |                        |                        |                        |
| Tensile modulus                         | ISO 527-1<br>, 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                         | ISO 178              | 23degC             | %                      | 2.6                    | 1.5                    | 1.3                    |
| Flexural strength                       |                      |                    | MPa                    | 130                    | 154                    | 170                    |
| Flexural modulus                        |                      |                    |                        | 4000                   | 6400                   | 8400                   |
| Charpy impact strength                  | ISO 179-1<br>, 179-2 | 23degC             | kJ/m <sup>2</sup>      | -                      | -                      | -                      |
| Charpy notched impact strength          |                      | 23degC             | kJ/m <sup>2</sup>      | 6                      | 7                      | 8                      |
| Thermal properties                      |                      |                    |                        |                        |                        |                        |
| Temperature of deflection under load    | ISO 75-1<br>, 75-2   | 1.80MPa<br>0.45MPa | degC                   | 125<br>135             | 130<br>140             | 130<br>142             |
| Coefficient of Linear thermal expansion | ISO 11359-2          | MD<br>TD           | 1/degC                 | 4.5E-05<br>7.5E-05     | 3.0E-05<br>6.8E-05     | 2.5E-05<br>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                    |

# Property table of filler reinforced grades

**Upiace™**

|                                         |                   |                    |                        | Filler Reinforced  |                       |             |
|-----------------------------------------|-------------------|--------------------|------------------------|--------------------|-----------------------|-------------|
| Properties                              | Test Method       | Terms              | Units                  | TX403              | TX903B                | TH620       |
|                                         |                   |                    |                        | Low Warpage        | Anticreep High impact | Low Warpage |
| Physical properties                     |                   |                    |                        |                    |                       |             |
| Density                                 | ISO 1183          | -                  | g/cm <sup>3</sup>      | 1.09               | 1.09                  | 1.20        |
| Water absorption                        | -                 | 23degC, Underwater | %                      | 0.06               | 0.06                  | 0.06        |
| Rheological properties                  |                   |                    |                        |                    |                       |             |
| Melt Volume-flow Rate                   | ISO1133           | -                  | cm <sup>3</sup> /10min | 16                 | 2.5                   | 12.0        |
|                                         |                   | Temperature        | degC                   | 280                | 300                   | 300         |
|                                         |                   | Load               | kg                     | 5                  | 2.16                  | 2.16        |
| Molding shrinkage (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                         | ISO 178           | 23degC             | %                      | -                  | -                     | -           |
| Flexural strength                       |                   |                    | MPa                    | 80                 | 90                    | 100         |
| Flexural modulus                        |                   |                    |                        | 2500               | 2350                  | 5100        |
| Charpy impact strength                  |                   |                    | kJ/m <sup>2</sup>      | NB                 | NB                    | -           |
| Charpy notched impact strength          |                   |                    | kJ/m <sup>2</sup>      | 20                 | 32                    | 4           |
| Thermal properties                      |                   |                    |                        |                    |                       |             |
| Temperature of deflection under load    | ISO 75-1 , 75-2   | 1.80MPa<br>0.45MPa | degC                   | 95<br>100          | 145<br>-              | 115<br>-    |
| Coefficient of Linear thermal expansion | ISO 11359-2       | MD<br>TD           | 1/degC                 | 6.0E-05<br>6.0E-05 | -<br>-                | -<br>-      |
| 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         | -                  | -                      | -                  | -                     | -           |

# Property table of high flowability and reinforced grades



|                                         |                      |                    |                      | High Flowability and reinforced Grade (V-1) |                        |                        |                        |                        |                    |                    | High Flowability and reinforced Grade (V-0) |                    |    |
|-----------------------------------------|----------------------|--------------------|----------------------|---------------------------------------------|------------------------|------------------------|------------------------|------------------------|--------------------|--------------------|---------------------------------------------|--------------------|----|
| Properties                              | Test Method          | Terms              | Units                | 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+Filler          | GF |
|                                         |                      |                    |                      | 20%                                         | 35%                    | 10%                    | 20%                    | 30%                    | 30%                | 20%                | 20%                                         | 20%                |    |
| Physical properties                     |                      |                    |                      |                                             |                        |                        |                        |                        |                    |                    |                                             |                    |    |
| Density                                 | ISO 1183             | -                  | g/cm³                | 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              | -                  | cm³/10min            | 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 shrinkage (3.0mmt)              | MEP method           | MD<br>TD           | %                    | 0.2 - 0.4<br>0.3 - 0.5                      | 0.1 - 0.3<br>0.2 - 0.4 | 0.3 - 0.5<br>0.3 - 0.5 | 0.2 - 0.4<br>0.3 - 0.5 | 0.1 - 0.3<br>0.2 - 0.4 | 0.3<br>0.4         | 0.5<br>0.7         | 0.2 - 0.4<br>0.3 - 0.5                      | 0.2-0.4<br>0.2-0.4 |    |
| Mechanical properties                   |                      |                    |                      |                                             |                        |                        |                        |                        |                    |                    |                                             |                    |    |
| Tensile modulus                         | ISO 527-1<br>, 527-2 | 23degC             | MPa                  | 6100                                        | 10500                  | 4000                   | 5700                   | 7800                   | -                  | -                  | 6100                                        | 6200               |    |
| Yield stress                            |                      |                    | -                    | -                                           | -                      | -                      | -                      | -                      | -                  | -                  | -                                           |                    |    |
| Yield strain                            |                      |                    | %                    | -                                           | -                      | -                      | -                      | -                      | -                  | -                  | -                                           | -                  |    |
| Nominal strain at break                 |                      |                    | -                    | -                                           | -                      | -                      | -                      | -                      | -                  | -                  | -                                           | -                  |    |
| Stress at break                         | ISO 178              | 23degC             | 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                       |                      |                    | MPa                  | 122                                         | 175                    | 116                    | 132                    | 145                    | 140                | 108                | 140                                         | 120                |    |
| Flexural modulus                        | ISO 178              | 23degC             |                      | 6000                                        | 10500                  | 3800                   | 5500                   | 7300                   | 8000               | 3400               | 5800                                        | 6000               |    |
| Charpy impact strength                  |                      |                    | ISO 179-1<br>, 179-2 | 23degC                                      | kJ/m²                  | -                      | -                      | -                      | -                  | -                  | -                                           | -                  | -  |
| Charpy notched impact strength          |                      |                    |                      | 23degC                                      | kJ/m²                  | 5                      | 5                      | 6                      | 6                  | 6                  | 5                                           | 6                  | 5  |
| Thermal properties                      |                      |                    |                      |                                             |                        |                        |                        |                        |                    |                    |                                             |                    |    |
| Temperature of deflection under load    | ISO 75-1<br>, 75-2   | 1.80MPa<br>0.45MPa | degC                 | 105<br>-                                    | 115<br>-               | 95<br>-                | 115<br>-               | 115<br>-               | 109<br>-           | 117<br>-           | 121<br>-                                    | 103<br>-           |    |
| Coefficient of Linear thermal expansion | ISO 11359-2          | MD<br>TD           | 1/degC               | 3.7E-05<br>6.8E-05                          | -<br>-                 | 4.7E-05<br>5.8E-05     | 3.7E-05<br>6.8E-05     | 2.6E-05<br>6.1E-05     | 2.1E-05<br>4.0E-05 | 4.5E-05<br>6.5E-05 | 3.7E-05<br>6.8E-05                          | 4.0E-05<br>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<br>1MHz      | -                    | -<br>-                                      | -<br>-                 | -<br>-                 | 3.2<br>3.1             | 3.5<br>3.3             | 3.5<br>3.3         | 3.2<br>3.1         | 3.2<br>3.1                                  | -<br>-             |    |
| Dissipation factor                      | IEC 60250            | 100Hz<br>1MHz      | -                    | -<br>-                                      | -<br>-                 | -<br>-                 | 0.0057<br>0.0067       | 0.0092<br>0.0077       | 0.0130<br>0.0049   | 0.0090<br>0.0039   | 0.0057<br>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<br>3mmt       | MV/m                 | -<br>-                                      | -<br>-                 | -<br>-                 | 35<br>18               | 34<br>17               | 47<br>19           | 49<br>24           | 35<br>18                                    | -<br>-             |    |
| Comparative tracking index              | IEC 60112            | -                  | -                    | 175                                         | -                      | 200                    | 200                    | 150                    | 175                | 600                | 200                                         | -                  |    |

# Property table of anti-static grades



|                                         |                      |                    |           | Anti-static        |               |            |
|-----------------------------------------|----------------------|--------------------|-----------|--------------------|---------------|------------|
| Properties                              | Test Method          | Terms              | Units     | EHM1010A           | EHM1000 9905M | EHM103R    |
|                                         |                      |                    |           | CB                 | CB            | CB         |
| Physical properties                     |                      |                    |           |                    |               |            |
| Density                                 | ISO 1183             | -                  | g/cm³     | 1.16               | 1.14          | 1.16       |
| Water absorption                        | -                    | 23degC, Underwater | %         | -                  | -             | -          |
| Rheological properties                  |                      |                    |           |                    |               |            |
| Melt Volume-flow Rate                   | ISO1133              | -                  | cm³/10min | -                  | 9.0           | -          |
|                                         |                      | Temperature        | degC      | -                  | 320           | -          |
|                                         |                      | Load               | kg        | -                  | 5             | -          |
| Molding shrinkage (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<br>, 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                         | ISO 178              | 23degC             | %         | 2.2                | 9.0           | 8.0        |
| Flexural strength                       |                      |                    | MPa       | 110                | 102           | 105        |
| Flexural modulus                        |                      |                    | 3860      | 2500               | 2700          |            |
| Charpy impact strength                  | ISO 179-1<br>, 179-2 | 23degC             | kJ/m²     | 20                 | 100           | 40         |
| Charpy notched impact strength          |                      | 23degC             | kJ/m²     | 3                  | -             | -          |
| Thermal properties                      |                      |                    |           |                    |               |            |
| Temperature of deflection under load    | ISO 75-1<br>, 75-2   | 1.80MPa<br>0.45MPa | degC      | 155<br>165         | 161<br>-      | 150<br>160 |
| Coefficient of Linear thermal expansion | ISO 11359-2          | MD<br>TD           | 1/degC    | 5.3E-05<br>5.5E-05 | -<br>-        | -<br>-     |
| 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, High-dielectric grade

*Dupiace*™

|                                         |                      |                    |           | Friction/Wear Resistance Improved |                    | High dielectric |
|-----------------------------------------|----------------------|--------------------|-----------|-----------------------------------|--------------------|-----------------|
|                                         |                      |                    |           | AHF6010B                          | GHF3010            | HD7007          |
| Properties                              | Test Method          | Terms              | Units     | Unreinforced                      | Fiber Reinforced   | -               |
|                                         |                      |                    |           | PTFE                              | PTFE+GF            | -               |
|                                         |                      |                    |           | 10%                               | 10%                | -               |
| Physical properties                     |                      |                    |           |                                   |                    |                 |
| Density                                 | ISO 1183             | -                  | g/cm³     | 1.12                              | 1.37               | 1.32            |
| Water absorption                        | -                    | 23degC, Underwater | %         | 0.06                              | 0.10               | 0.10            |
| Rheological properties                  |                      |                    |           |                                   |                    |                 |
| Melt Volume-flow Rate                   | ISO1133              | -                  | cm³/10min | 4.5                               | 1.9                | 6.5             |
|                                         |                      | Temperature        | degC      | 300                               | 300                | 300             |
|                                         |                      | Load               | kg        | 2.16                              | 2.16               | 5               |
| Molding shrinkage (3.0mmt)              | GPAC method          | MD                 | %         | 0.5 - 0.7                         | 0.1 - 0.2          | -               |
|                                         |                      | TD                 |           | 0.5 - 0.7                         | 0.2 - 0.4          | -               |
| Mechanical properties                   |                      |                    |           |                                   |                    |                 |
| Tensile modulus                         | ISO 527-1<br>, 527-2 | 23degC             | MPa       | 2400                              | 9000               | 4900            |
| Yield stress                            |                      |                    | 51        | -                                 | -                  |                 |
| Yield strain                            |                      |                    | %         | 5.0                               | -                  | -               |
| Nominal strain at break                 |                      |                    | 15        | -                                 | -                  |                 |
| Stress at break                         |                      |                    | MPa       | -                                 | 90                 | 60              |
| Strain at break                         |                      |                    | %         | -                                 | 1.8                | 2.0             |
| Flexural strength                       | ISO 178              | 23degC             | MPa       | 84                                | 140                | 95              |
| Flexural modulus                        |                      |                    | 2500      | 9000                              | 4800               |                 |
| Charpy impact strength                  | ISO 179-1<br>, 179-2 | 23degC             | kJ/m²     | -                                 | -                  | 12              |
| Charpy notched impact strength          |                      | 23degC             | kJ/m²     | 8                                 | 6                  | -               |
| Thermal properties                      |                      |                    |           |                                   |                    |                 |
| Temperature of deflection under load    | ISO 75-1<br>, 75-2   | 1.80MPa<br>0.45MPa | degC      | 110<br>-                          | 125<br>-           | 125<br>-        |
| Coefficient of Linear thermal expansion | ISO 11359-2          | MD<br>TD           | 1/degC    | 6.0E-05<br>6.0E-05                | 2.5E-05<br>6.0E-05 | -<br>-          |
| Flammability                            | UL94                 | 0.75mmt            | -         | -                                 | -                  | -               |
|                                         |                      | 1.5mmt             | -         | HB                                | HB                 | -               |
|                                         |                      | 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             | -               |
| Surface resistivity                     | IEC 60093            | -                  | Ω         | 6.E+15                            | 2.E+15             | -               |
| Electric strength                       | IEC 60243-1          | 1mmt               | MV/m      | -                                 | -                  | -               |
|                                         |                      | 3mmt               |           | -                                 | -                  | -               |
| Comparative tracking index              | IEC 60112            | -                  | -         | -                                 | -                  | -               |

# Property table of PA alloy grades



|                                         |                      |                    |           | Unreinforced PPE/PA6 Alloy | Fiber Reinforced PPE/PA6 Alloy | Unreinforced PPE/PA66 Alloy |
|-----------------------------------------|----------------------|--------------------|-----------|----------------------------|--------------------------------|-----------------------------|
| Properties                              | Test Method          | Terms              | Units     | NX7000                     | NXG7201 8240                   | NX9000                      |
|                                         |                      |                    |           | -                          | GF                             | -                           |
|                                         |                      |                    |           | -                          | 20%                            | -                           |
|                                         |                      |                    |           | dry(50%RH)                 | dry(50%RH)                     | dry(50%RH)                  |
| Physical properties                     |                      |                    |           |                            |                                |                             |
| Density                                 | ISO 1183             | -                  | g/cm³     | 1.10                       | 1.26                           | 1.11                        |
| Water absorption                        | -                    | 23degC, Underwater | %         | -                          | -                              | -                           |
| Rheological properties                  |                      |                    |           |                            |                                |                             |
| Melt Volume-flow Rate                   | ISO1133              | -                  | cm³/10min | 5.5                        | 6.0                            | 2                           |
|                                         |                      | Temperature        | degC      | 275                        | 275                            | 275                         |
|                                         |                      | Load               | kg        | 2.16                       | 2.16                           | 2.16                        |
| Molding shrinkage (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<br>, 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                         | ISO 178              | 23degC             | %         | -                          | 2.2 (-)                        | -                           |
| Flexural strength                       |                      |                    | MPa       | 102 (59)                   | 171 (73)                       | 100 (-)                     |
| Flexural modulus                        |                      |                    |           | 2500 (1500)                | 5700 (4100)                    | 2500 (-)                    |
| Charpy impact strength                  | ISO 179-1<br>, 179-2 | 23degC             | kJ/m²     | -                          | -                              | -                           |
| Charpy notched impact strength          |                      | 23degC             | kJ/m²     | 30 (77)                    | 6 (9)                          | 25 (-)                      |
| Thermal properties                      |                      |                    |           |                            |                                |                             |
| Temperature of deflection under load    | ISO 75-1<br>, 75-2   | 1.80MPa<br>0.45MPa | degC      | -<br>180                   | -<br>210                       | -<br>190                    |
| Coefficient of Linear thermal expansion | ISO 11359-2          | MD<br>TD           | 1/degC    | 9.0E-05<br>-               | 3.0E-05<br>-                   | 7.0E-05<br>-                |
| 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            | -                  | -         | -                          | -                              | -                           |

# Property table of PA, PP alloy grades

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|                                         |                      |                    |           | PPE/PA6 Alloy |               |               | PPE/PA66 Alloy   |                  | PPE/PP Alloy |
|-----------------------------------------|----------------------|--------------------|-----------|---------------|---------------|---------------|------------------|------------------|--------------|
| Properties                              | Test Method          | Terms              | Units     | 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              | -                  | cm³/10min | 14            | 15            | 21            | 31               | 100              | 55           |
|                                         |                      | Temperature        | degC      | 280           | 280           | 280           | 280              | 280              | 280          |
|                                         |                      | Load               | kg        | 5             | 5             | 5             | 5                | 5                | 5            |
| Molding shrinkage (3.0mmt)              | MEP method           | MD                 | %         | 1.2 - 1.4     | 1.2 - 1.4     | 0.7 - 0.9     | 1.1 - 1.3        | 1.1 - 1.3        | 1.0 - 1.2    |
|                                         |                      | TD                 |           | 1.1 - 1.3     | 1.0 - 1.2     | 0.6 - 0.8     | 1.1 - 1.3        | 1.1 - 1.3        | 1.1 - 1.3    |
| Mechanical properties                   |                      |                    |           |               |               |               |                  |                  |              |
| Tensile modulus                         | ISO 527-1<br>, 527-2 | 23degC             | MPa       | 2200 (1200)   | 2500 (1400)   | 4200 (2200)   | 2500 (1600)      | 2600 (1500)      | 1900         |
| Yield stress                            |                      |                    |           | 54 (38)       | 62 (37)       | - (42)        | 66 (51)          | 60 (45)          | 42           |
| Yield strain                            |                      |                    | %         | 4.2 (18.8)    | 5.0 (14.9)    | - (8.4)       | 5.3 (11.4)       | 4.8 (19.2)       | -            |
| Nominal strain at break                 |                      |                    |           | 41 (115)      | 57 (140)      | - (74)        | 42 (73)          | 47 (88)          | -            |
| Stress at break                         |                      |                    | MPa       | -             | -             | 62 (-)        | -                | -                | -            |
| Strain at break                         | ISO 178              | 23degC             | %         | -             | -             | 6.1 (-)       | -                | -                | -            |
| Flexural strength                       |                      |                    | MPa       | 80 (47)       | 91 (60)       | 100 (57)      | 90 (71)          | 90 (60)          | 59           |
| Flexural modulus                        |                      |                    |           | 2000 (1200)   | 2300 (1400)   | 3650 (2100)   | 2300 (1700)      | 2400 (1500)      | 1900         |
| Charpy impact strength                  | ISO 179-1<br>, 179-2 | 23degC             | kJ/m²     | -             | -             | -             | NB (NB)          | NB (NB)          | NB           |
| Charpy notched impact strength          |                      | 23degC             | kJ/m²     | 22 (88)       | 26 (66)       | 6 (12)        | 20 (45)          | 20 (62)          | 5            |
| Thermal properties                      |                      |                    |           |               |               |               |                  |                  |              |
| Temperature of deflection under load    | ISO 75-1<br>, 75-2   | 1.80MPa<br>0.45MPa | degC      | -<br>150      | -<br>165      | -<br>175      | -<br>180         | -<br>165         | -<br>115     |
| Coefficient of Linear thermal expansion | ISO 11359-2          | MD<br>TD           | 1/degC    | 9.0E-05<br>-  | 9.0E-05<br>-  | -<br>-        | 9.0E-05<br>-     | -<br>-           | -<br>-       |
| Flammability                            | UL94                 | 0.75mmt            | -         | -             | -             | -             | -                | -                | -            |
|                                         |                      | 1.5mmt             | -         | -             | -             | -             | -                | -                | -            |
|                                         |                      | 2.0mmt             | -         | -             | -             | -             | -                | -                | -            |
|                                         |                      | 3.0mmt             | -         | -             | -             | -             | -                | -                | -            |
| Electrical properties                   |                      |                    |           |               |               |               |                  |                  |              |
| Relative permittivity                   | IEC 60250            | 100Hz<br>1MHz      | -<br>-    | -<br>-        | -<br>-        | -<br>-        | 3.3<br>3.2       | 3.4<br>3.2       | -<br>-       |
| Dissipation factor                      | IEC 60250            | 100Hz<br>1MHz      | -<br>-    | -<br>-        | -<br>-        | -<br>-        | 0.0040<br>0.0094 | 0.0050<br>0.0121 | -<br>-       |
| 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<br>3mmt       | MV/m      | -<br>-        | -<br>-        | -<br>-        | 30<br>17         | 33<br>18         | -<br>-       |
| Comparative tracking index              | IEC 60112            | -                  | -         | -             | -             | -             | -                | -                | -            |

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