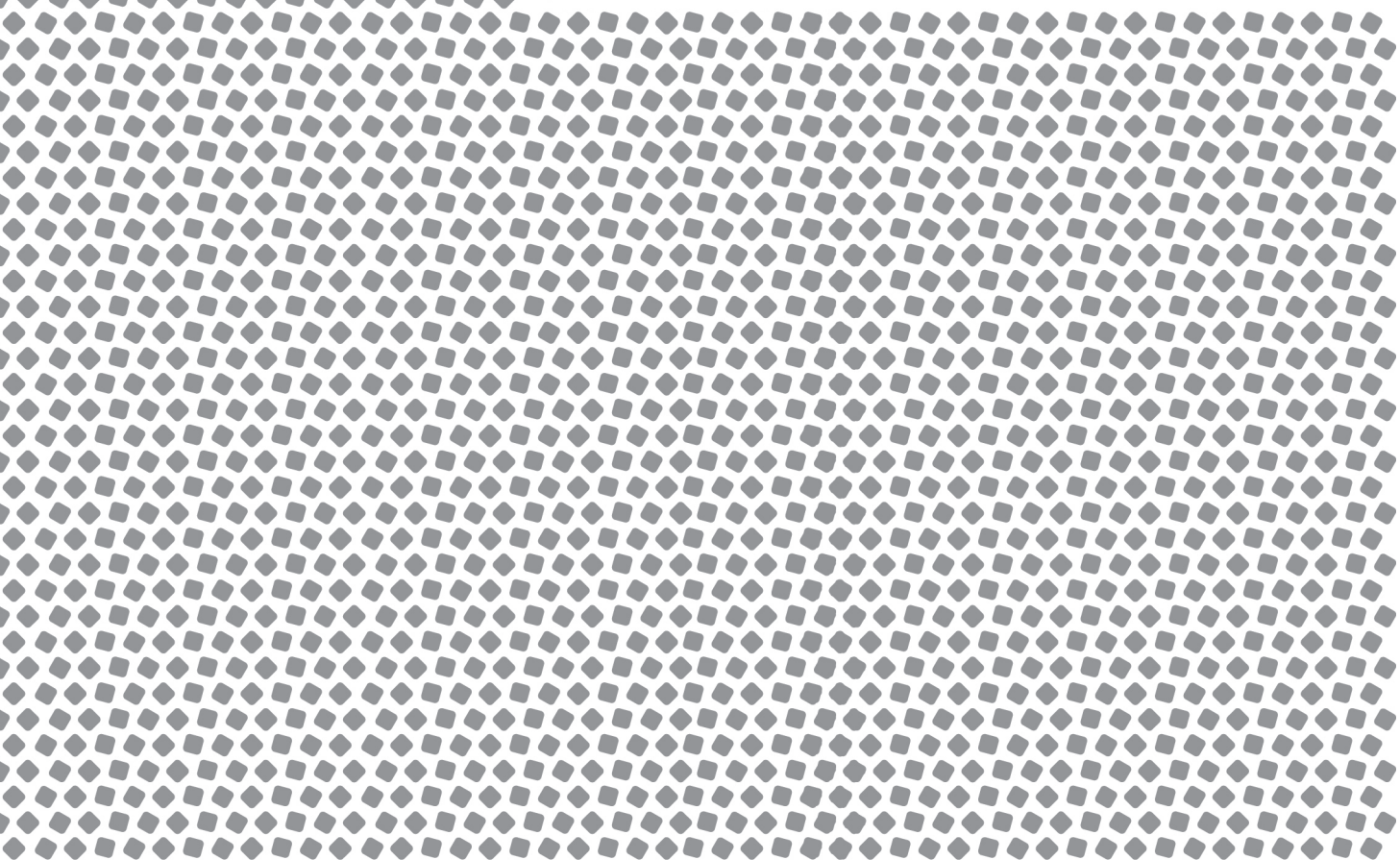


# Tecomid<sup>®</sup> HT PPA



## INTRODUCTION

Tecomid® HT is the registered trade mark for Polyphthalamide (PPA) High Performance Polyamide compounds produced by Eurotec.

Eurotec is offering a wide range of Polyphthalamide compounds suitable for technical applications that require outstanding properties especially at high temperatures.

## PROPERTIES

Our high quality technical compounds are able to meet the full range of requirements including product properties, process needs and end-use demands.

Key properties of Tecomid® HT resins offer;

- Excellent high temperature properties
- Very good chemical resistance
- Low moisture absorption (compared to PA6, PA6.6, PA4.6)
- Very high mechanical strength
- Good flammability characteristics
- Very good dimensional stability
- Good electrical properties
- High wear resistance and low friction
- Good flow and processing properties

## PRODUCTS

Tecomid® HT products are consisting of the most diverse characteristics with different modifiers, stabilizers, special additives and customized colours as;

- Unreinforced
- Impact modified
- Glass fiber reinforced
- Carbon fiber reinforced
- Aramide fiber reinforced
- Glass bead reinforced
- Mineral filled and reinforced
- Low warpage types
- Flame retardant
- Lubricated
- Surface modified
- Heat stabilized
- UV/light stabilized
- Electrical conductive
- Speciality

## APPLICATIONS

Due to excellent balance of properties, Tecomid® HT grades are suitable for an extensive range of industries like;

- Automotive
- Transportation
- Electrical / Electronic
- Construction
- Home appliances
- Sports and leisure
- Garden and power tools
- Safety equipment

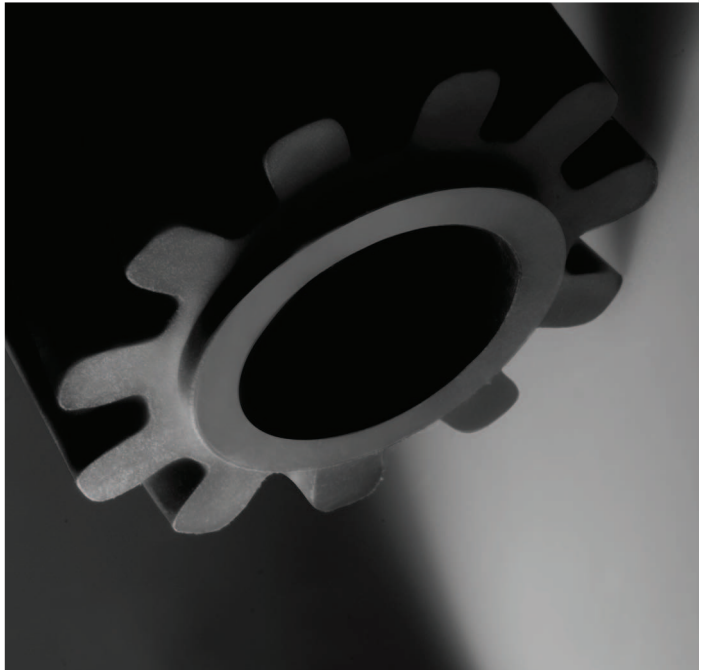
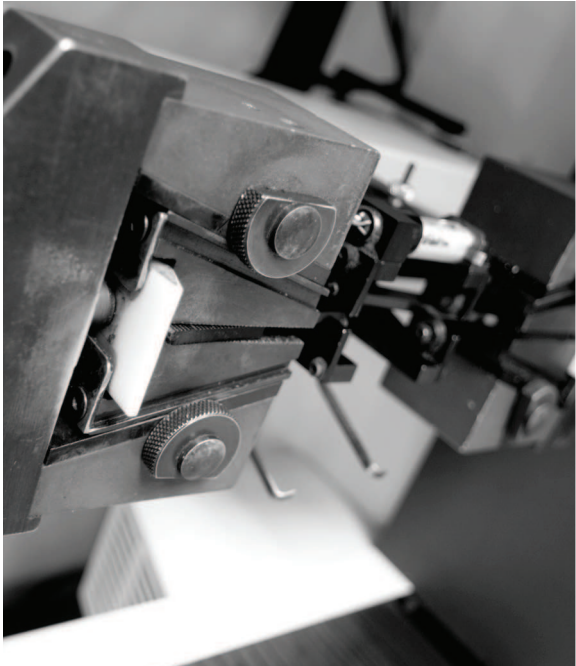
## PACKAGING

Tecomid® HT grades are supplied in pellet form and packed in moisture proof 25 kg multi-layer bags. Other forms of packing like octabins and big-bags with PE or Aluminum in-liners are also available.

All packaging is tightly sealed by Eurotec before shipment and should be opened just before processing. It is also advised to be kept in dry environment below 50°C while protected from UV-light. In order to prevent condensation, packaging stored in cold areas should be allowed to warm up to room temperature before being opened.

## SAFETY

Under normal conditions Tecomid® HT is not a toxic and hazardous material. During processing, necessary preventive actions should be held in case of contact with polymer melt or inhalation of the gases. Processing temperatures above 350 °C should be avoided. Detailed safety information can be found in our material safety data sheets (MSDS).



## PROCESSING

Tecomid® HT compounds can be processed in all commercial injection molding machinery.

### Injection Molding Machine

Selecting the proper design injection molding machine is important to have economic and quality moldings.

As a general rule, capacity of an injection molding machine should have 0.50 – 0.75 tons of clamping force for every square centimeter of projected shot area.

General purpose screw designs with compression ratios between 2.5:1 – 3.5:1, and screw size of 18D - 22D are recommended. Standard nitride screws and barrels are not resistant to the abrasion of fillers, especially glass fibers. However, bi-metallic barrel liners and surface hardened screws show outstanding resistance to wear.

Standard nozzles can be used, however reverse taper nozzles are accomplished to prevent both drool and freezing. The temperature control of the nozzle is very important in order to avoid thermal loss or overheating. In general, nozzle diameters should be 3 to 6 mm depending on the size of the part.

Non return valves are necessary in order to obtain constant pressure and consistent moldings.

It is important to have precise temperature control for processing Polyphthalamides therefore several heating zones of the barrel are necessary.

Cooling system of the feed throat is important to prevent sticking of the granules and to have consistent feed of material to barrel. On the other hand, too low throat temperature will cause condensation, resulting hydrolysis and melt foaming. Temperatures between 60°C – 80°C are suggested.

When molding Polyphthalamide the shot size should be between 30% - 60% of barrel capacity. Shots larger than 60% may generate improper melting, where shots less than 30% will increase the residence time of the material in the machine that can cause degradation, brittleness and discoloration.

Residence time of Tecomid® HT compounds in the barrel at correct processing temperatures should not exceed 4 minutes.

### Molding Conditions

For Polyphthalamide compounds, moisture content should be less than 0.05% before processing. Tecomid® HT compounded grades are manufactured with a maximum moisture content of 0.1%. Therefore products need pre-drying prior to processing at 120°C for 4 hours. Temperatures above 120°C will result in discoloration and in addition to that, over drying will cause poor flow resulting molding problems and short shots.

The recommended pre-drying method is using desiccant driers where drying is independent of atmospheric environment. Controlling the performance of drying in desiccant driers depends on the dew point that indicates the proportion of water in the air. In order to obtain proper drying, values below –20°C for the dew point is suggested.

When using air circulating ovens, the quality of the drying depends on the atmospheric conditions. High relative humidity of air reduces the quality of drying and therefore circulating air ovens are not suggested to pre-dry PPA.

Some guide recommendations for processing parameters are presented in [Table 1](#).

The temperature of the melt in injection molding depends on barrel temperature settings, material residence time, screw design and speed. As it is difficult to estimate the effect of each parameter on melt temperature, it is suggested to be measured periodically with a pyrometer from the purged molten polymer. Tecomid® HT compounds should always be molded in a temperature-controlled mold. Uniform mold temperature within the cavity is very important to have good quality parts.

	Grade	Feed Throat Temperature (°C)	Processing Temperature (°C)	Mold Temperature (°C)	Hold Pressure (MPa)
Tecomid® HT (PPA)	Un-reinforced	60-80	320 - 340	70-90	40-80
	Impact Modified	60-80	320 - 330	70-90	40-80
	Reinforced	60-80	320 - 340	140-180	40-80
	Flame Retardant	60-80	320 - 330	140-180	40-80

Table 1. Recommended processing parameters for Tecomid® HT

Maximum quality with minimized post-shrinkage is obtained by sufficient crystallinity. Tecomid® HT compounds need in general mold temperatures of 160 °C for optimum crystallization, surface aspect and dimensional stability.

For un-reinforced Polyphthalamides the peripheral screw speed should be maximum 400 mm/s where for reinforced types it should not exceed 200 mm/s in order to minimize fiber breakage, material degradation and discoloring.

Back pressure should be as low as possible to protect material properties.

The actual required injection pressure depends on many variables, such as melt and mold temperatures, part thickness and flow length. It is only necessary to have enough injection pressure to fill the cavity of the mold.

Due to crystalline nature of Polyphthalamides, it is required to use fast injection rates especially in reinforced grades. Slow injection rates can be used at the start-up of the injection to prevent jetting and burning of material.

The mold shrinkage of Polyphthalamide mostly depends on the holding pressure and the holding time. During this stage material melt is continuously pushed into the part cavity which compensates the shrinkage of the part during solidification. The level of holding pressures and time that depend mainly on the part thickness and runner geometry are generally 1:2 to 2:3 of the maximum injection pressure.

Effects of main processing parameters on material properties are shown in Table 2.

Processing Parameter	Weld Line Strength	Surface Quality	Cycle Time	Shrinkage	Sink Mark
Melt Temperature ↗	↗	↗	↗		
Mold Temperature ↗	↗	↗	↗	↗	
Hold Pressure ↗				↘	↘
Injection Speed ↗	↗	↗			

Table 2. Effect of processing parameters on material properties

## Recycling

Regrind levels up to 25% can be reused depending on the application and requirements. However for flame retardant grades maximum 10% addition is recommended. Regrinds should be free of contamination, should not be thermally degraded and must be dry as molded, or be dried prior to reuse.

PROPERTY	CONDITION	UNIT	STANDARD	Unreinforced		Reinforced		
				NT40 NL PPA, unfilled, natural	NT40 NL MB PPA, impact modified, heat stabilized, natural	NT40 MR40 NL HS PPA, 40% mineral reinforced, heat stabilized, natural	NT40 GR15 NL HS PPA, 15% glass fiber reinforced, heat stabilized, natural	NT40 GR30 NL HS PPA, 30% glass fiber reinforced, heat stabilized, natural
<b>GENERAL</b>								
Density	-	g/cm <sup>3</sup>	ISO 1183	1.20	1.15	1.54	1.31	1.43
Molding Shrinkage	Parallel/ Normal	%	Eurotec	1.5 / 1.5	1.7 / 1.7	1.0 / 1.0	0.4 / 1.1	0.2 / 1.0
Moisture Content	-	%	ISO 15512	<0.2	<0.2	<0.2	<0.2	<0.2
Moisture Absorption	50% RH, 23 °C	%	ISO 62	2.4	2.2	1.4	2.0	1.7
<b>MECHANICAL</b>								
Stress at Break	+23°C	MPa	ISO 527	-	-	90	115	185
Strain at Break	+23°C	%	ISO 527	-	10	2	2	2
Tensile Modulus	+23°C	MPa	ISO 527	3500	2750	9000	7000	11000
Yield Strength	+23°C	MPa	ISO 527	90	80	-	-	-
Izod Impact, notched	+23°C	kJ/m <sup>2</sup>	ISO 180/1A	7	20	5	7	11
Izod Impact, notched	-30 °C	kJ/m <sup>2</sup>	ISO 180/1A	4	18	4	6	10
Izod Impact, un-notched	+23°C	kJ/m <sup>2</sup>	ISO 180/1U	-	-	-	-	-
Izod Impact, un-notched	-30 °C	kJ/m <sup>2</sup>	ISO 180/1U	-	-	-	-	-
<b>THERMAL</b>								
Melting Temperature	10 K/min	°C	ISO 11357	315	315	315	315	315
Heat Deformation Temperature	0.45 MPa	°C	ISO 75	-	-	-	300	305
Heat Deformation Temperature	1.80 MPa	°C	ISO 75	125	115	185	270	280
Vicat Softening Temperature	50N	°C	ISO 306	245	-	-	275	290
<b>ELECTRICAL &amp; FLAMMABILITY</b>								
Volume Resistivity	-	Ohm.cm	IEC 60093	1E+15	1E+15	1E+15	1E+15	1E+15
Surface Resistivity	-	Ohm	IEC 60093	1E+13	1E+13	1E+13	1E+13	1E+13
Comparative Tracking Index	solution A	V	IEC 60112	600	600	550	550	550
Glow Wire Flammability Index	2 mm plaque	°C	IEC 60695	-	-	-	-	-
Glow Wire Ignitability Temperature	2 mm plaque	°C	IEC 60695	-	-	-	-	-
Flame Rating	0.75 mm	-	UL94	V2	HB	HB	HB	HB
Flame Rating	1.6 mm	-	UL94	V2	HB	HB	HB	HB

\* Data are based on dry as molded

Reinforced			Flame Retardant		
<b>NT40 GR50 NL HS</b> PPA, 50% glass fiber reinforced, heat stabilized, natural			<b>NT40 GR60 NL HS</b> PPA, 60% glass fiber reinforced, heat stabilized, natural		
<b>NT40 CR30 BK111 HS</b> PPA, 30% carbon fiber reinforced, heat stabilized, black			<b>NT40 NL XA60</b> PPA, unfilled, flame retardant - halogen & red phosphorus free, heat stabilized, natural		
<b>NT40 GR30 NL XA60</b> PPA, 30% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized, natural					
1.63	1.76	1.31	1.24	1.45	
0.2 / 0.7	0.1 / 0.6	0.1 / 0.8	1.1 / 1.1	0.2 / 0.9	
<0.2	<0.2	<0.2	<0.2	<0.2	
1.2	1.0	1.7	2.0	1.3	
250	275	275	75	170	
2	1.5	1.5	2	2	
18000	22000	25000	4000	11500	
-	-	-	-	-	
14	15	8	4	8	
13	14	7	3	7	
-	-	-	-	-	
-	-	-	-	-	
315	315	315	315	315	
305	305	-	-	-	
290	290	290	130	280	
295	295	-	-	-	
1E+15	1E+15	<1E+3	1E+15	1E+15	
1E+13	1E+13	-	1E+13	1E+13	
550	550	-	600	600	
-	-	-	960	960	
-	-	-	775	850	
HB	HB	HB	V0	V0	
HB	HB	HB	V0	V0	