

VESTAMID® HT *plus* F1001 and F2001 World Innovation: Mono-Filaments made of PPA

VESTAMID® HT *plus* F1001 and F2001 are the first polyphthalamide (PPA) materials that allow the drawing of filaments. They can easily be processed to form different varieties of filaments. Modifications in geometry and color are also possible.

Discover VESTAMID® HT *plus* F1001 and F2001 for filaments made of polyphthalamide to identify new application fields!



Unique combination of properties

Polyphthalamide is renowned for its outstanding performance at high temperatures with excellent mechanical properties. It is used in areas where metal is being replaced, or when other plastics such as PA 6 and PA 66 no longer fulfil the requirements. Parts made from the material show very good dimensional stability and wear resistance. Because of its crystallinity the chemical resistance is exceptional. Thus VESTAMID® HT *plus* F1001 and F2001 can be used in very aggressive media and demanding environments.

Challenging application fields

Due to the material's melting point of about 320°C the filaments are suitable for elevated service temperatures. Thus they can be used for thermally demanding applications, e.g., for professional brushes.

Monofilaments made from VESTAMID® HT *plus* F1001 and F2001 show a high stress at break as well as a high strain at break depending on stretching conditions (see table). Thus they can be used as bristles for specialty applications with highly demanding requirements. Other fields of application are mono- and multi-filaments for, e.g., filters, fabrics or fleeces.

Specialists for the synthesis of polyamides

In over 40 years of manufacturing high-performance plastics we have amassed a substantial know-how in the synthesis of specialties. With our fully backward integrated facilities many modifications in the polymer backbone can be realized in order to fine-tune the performance of the resulting polymer resin.

Optimum support through many years of expertise

Our customers are supported by our technical experts, from the initial concept until the finished product is ready for mass production. Our state-of-the-art facilities are at your disposal; these include our cutting-edge technical centers with injection molding and extrusion machines as well as our analytical labs.

Important properties of VESTAMID® HTplus F1001 and F2001

General properties		Test method	Unit	VESTAMID® HTplus F1001	VESTAMID® HTplus F2001
Density	23°C	ISO 1183	g/cm ³	1.20	1.11
Tensile test		ISO 527-1			
Stress at break		ISO 527-2	MPa	100	80
Strain at break			%	3	6
Tensile modulus		ISO 527-1, -2	MPa	3700	2700
Melting range		ISO 11357			
DSC	2 nd heating		°C	300-315	245-265
Monofilament properties					
Tensile test of filaments		following		1)	1)
After extrusion		ISO 527-1			
Stress at break	23°C	ISO 527-2	MPa	>550	>450
Strain at break	23°C		%	>30	>50
After conditioning (3h/180°C)					
Stress at break	23°C		MPa	>550	>450
Strain at break	23°C		%	>20	>30

1) aspect ratio up to 1:4 useful, higher aspect ratio possible depending on stretching values, evaluated at average filament diameter of 0.25-0.5 mm

Processing

Delivery and Drying

VESTAMID® HTplus grades are supplied as spherical pre-dried pellets in moisture-proof polyethylene bags. The moisture content is <0.1%. Higher moisture content will lead to problems during processing or to poor filament properties. Therefore we recommend pre-drying at 120°C for 8 – 12 hours before processing. Drying conditions exceeding these limits should be avoided due to the risk of yellowing and discoloration.

Settings for extrusion

Based on following recommendations the optimum settings have to be evaluated according to the resulting filament diameter, quality and process conditions. The melt should be crystal-clear, free of bubbles, waves and streaks in order to obtain filaments with superior appearance and mechanical properties.

Melt temperatures

The melt temperature of VESTAMID® HTplus should be at least 315°C degrees for the grade F1001, 265°C for F2001. We recommend a short residence time. Melt temperature should not exceed 345 °C; higher temperatures have to be avoided.

Screw and melt pump speed

Set the screw speed as low as possible. We recommend a maximum peripheral screw speed in the range of 5-12 m/min.

Excessive rotation speeds of screw and melt pump are not recommended because of possible thermal overload of the melt and local hot spots caused by frictional heating, especially in the feeding zone near the hopper.

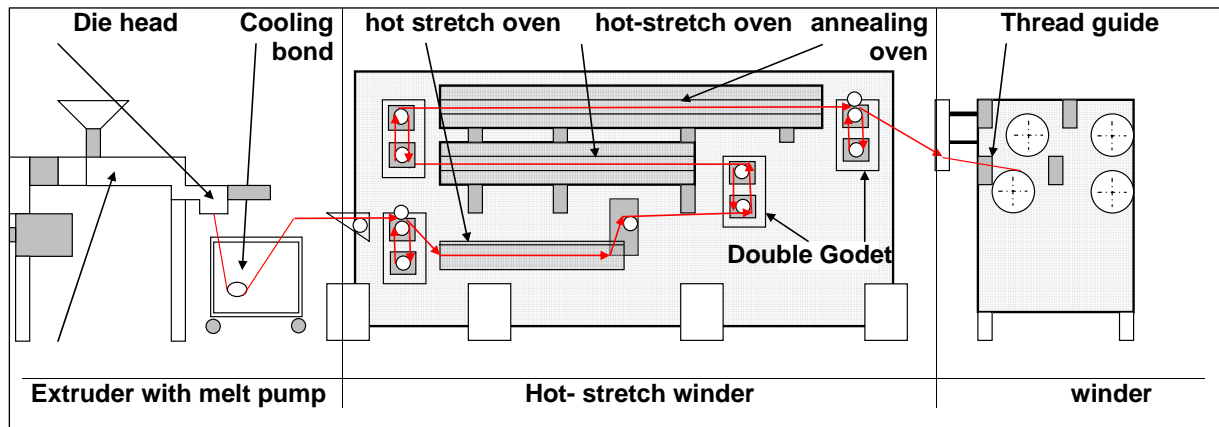
Draw down ratio (extrusion process)

The possible draw down ratio of the extruded melt before the stretching process depends on the viscosity resulting from processing settings of the extruder and the drawing unit. Typical water temperatures vary from 40°C up to 85°C.

We recommend a multiple step drawing process, if possible. We do not recommend a draw ratio exceeding 3.5 in one step.

The drawing temperature depends on the heated length and haul-off speed in the oven and should usually be about 200°C for drawing and about 180°C for annealing. If you need lower temperatures make sure to reach at least 160°C or higher.

Monofilament line at technical lab of Evonik



Typical values for cylinder and die temperatures when processing VESTAMID® HTplus on monofilament line in technical lab of Evonik are given in the following table.

Recommended extrusion processing temperatures

VESTAMID® HTplus	Hopper [°C]	Zone 1 [°C]	Zone 2 [°C]	Zone 3 [°C]	Adapter melt pump [°C]	Die [°C]
F1001	60 - 120	305 - 320	315 - 325	315 - 330	315 - 335	320 - 340
F2001	60 - 120	270 - 290	280 - 300	290 - 310	290 - 320	300 - 330

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