



PolyMide™ PA12-CF



Industrial

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# Printing with PolyMide™ PA12-CF

## PolyMide™ PA12-CF

PolyMide™ PA12-CF is a carbon fiber reinforced PA12 (Nylon 12) filament. Thanks to the low moisture sensitivity of PA12, this product features outstanding mechanical and thermal properties even after the moisture conditioning process. Combined with its ease of print with Warp-Free™ technology, this product is ideal to create manufacturing tools.



### Printing settings

Nozzle Temperature:	260-300 °C
Bed Temperature:	25-50 °C (Do NOT exceed 50 °C)
Chamber Temperature:	25-50 °C (Do NOT exceed 50 °C)
Printing Speed:	30-60 mm/s
Cooling Fan:	Turn OFF

**Note:** Settings are based on 0.4 mm nozzle, and may vary with different printers and nozzle diameters.



### Bed surface

PolyMide™ PA12-CF can be printed on almost any surface with a thin coat of PVP glue or Magigoo PA. We recommend a flex plate to facilitate the removal of the model from the plate.

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## Wear resistant nozzle

PolyMide™ PA12-CF contains 10% chopped carbon fibers by weight which makes it very abrasive. It is important to have an abrasion resistant nozzle.

Nozzles can come in many different materials, from soft to hard:

Brass

Nickel plated copper

Steel

Stainless steel

Tool steel

Tungsten-carbide

Ceramic/Metal hybrid

PolyMide™ PA12-CF can easily damage a brass nozzle after a few hundred grams of printing. Hardened nozzles, whilst abrasion resistant, are more expensive. Therefore, it is important to consider the cost of investing in a hardened nozzle, the potential frequency of use and scale of the print project.

**Note:** Brass nozzle will give a better thermal conductivity than hardened nozzle such as stainless steel.

### High temperature hot end

We recommend a full metal hot end that can maintain a stable temperature of at least  $> 260\text{ }^{\circ}\text{C}$ .

### Annealing PolyMide™ PA12-CF parts

We recommend annealing all models printed in PolyMide™ PA12-CF. This allows users to take advantage of the full mechanical and thermal properties of this material.

The annealing process consists of putting the model in an oven at  $80\text{ }^{\circ}\text{C}$  for 6 hours.

	PolyMide™ PA12-CF	
	As Printed	80 °C Annealed
Tensile Strength (MPa)	43.55 ± 0.27	71.63 ± 1.67
Young's Modulus (MPa)	1971.77 ± 135.0	3304.39 ± 145.15
Bending Strength (MPa)	48.19 ± 3.69	109.97 ± 1.38
Notched Charpy Impact Strength (kJ/m <sup>2</sup> )	17.69 ± 1.14	12.52 ± 0.68
HDT @ 1.8 MPa	/	105 °C

## Support material

When using PolyMide™ PA12-CF as a self-support, it is important to remove the support structure right after printing.

Leaving the part exposed to atmospheric moisture may result in strong bonding between the support and printed part, making support removal difficult.

## Feeding system

PolyMide™ PA12-CF is a very stiff filament so it is required to have a good set up to ensure a good feeding. For example we recommend avoiding excessive bending in the filament guide system.

## Dry box system

Although it is less sensitive to moisture, we recommend storing PolyMide™ PA12-CF in a PolyBox™ to prevent moisture absorption. If the filament has absorbed moisture it can be dried at 80 °C for 12 hours in a convection oven.

**Note:** Polymaker provides the filament with the right moisture amount, having a filament with an extremely low moisture content can affect its processability.

# PCP: Profile Creation Process

The profile creation process (PCP) allows users to rapidly develop a printing profile for any given material/printer. During this process is important to consider all of these factors to build a successful profile.

- Geometry
- Material
- Printer
- Environment
- Purpose

Polymaker developed the PCP to assist customers in creating their own tailored print profiles; taking into account the material, printer, environment as well as the models geometry and purpose. Additionally, the PCP allows individuals to develop their own knowledge and troubleshooting skills.

**The PCP is available on [www.polymaker.com](http://www.polymaker.com)**

The PCP is divided in 5 steps:

It uses less than 300g of materials and less than 7h of working time.

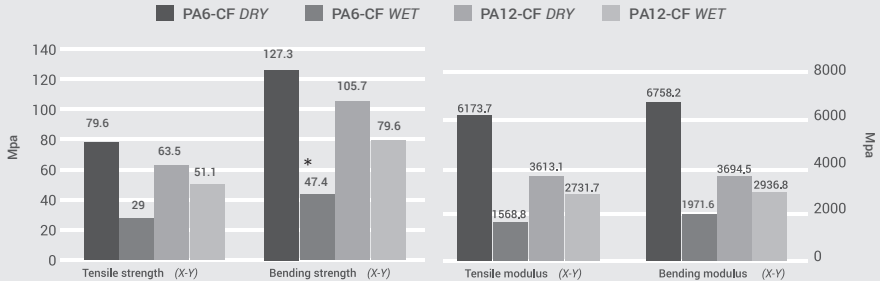
- Step 1: Extrusion Flow
- Step 2: Flow Management
- Step 3: Cooling Fan
- Step 4: Warpage
- Step 5: Fine Details

Each of these steps has a specific objective and introduces an important concept about the FFF 3D printing process. Each step will also give you the possibility to push your test further for more accurate results.



# PolyMide™ Family

Mechanical properties comparison between PolyMide™ PA12-CF and PolyMide™ PA6-CF under dry and wet status



Tensile and bending strength

Tensile and bending modulus

\*Value at the maximum displacement of the testing machine. Specimen did not break or yield.

**Note:** 3D printed PolyMide™ PA6-CF and PolyMide™ PA12-CF specimens were tested on dry and wet status. Wet status means the specimens were immersed in ambient temperature water for 3 days.

## Low moisture sensitivity

Compared with PolyMide™ PA6-CF and other PA6 on the market, the moisture absorption of our PolyMide™ PA12-CF is the lowest and the changes of mechanical properties in dry and wet status are minimal.

**Excellent surface quality** In fused filament fabrication (FFF), material itself contributes significantly to the surface quality. The surface finish of printed PolyMide™ PA12-CF objects is excellent due to better fluidity of PolyMide™ PA12-CF and less fiber content.

**No warping** Nylon warps due to its crystallization behavior and warping can significantly influence dimensional accuracy of printed parts. Our Warp-Free™ technology is achieved by the fine control of micro-structure and crystallization behavior of Nylon, which can help printed parts prevent warping and realize excellent dimensional stability.

## Fiber Adhesion™ Technology

Fiber Adhesion™ technology dramatically improves the Z-axis strength, via engineering the surface chemistry of the fibers to achieve a strong fiber/matrix bonding.

In contrast to conventional fiber-reinforced filaments, which exhibit considerable reduction in Z-axis strength, PolyMide™ PA12-CF provides a higher interlayer adhesion compared to unreinforced PA 12.



### Layer adhesion

Tensile strength  
(Z axis)  
ASTM D638  
(ISO 527, GB/T 1040)

### Unreinforced PA12

17.6Mpa  
PolyMide™ PA12-CF  
21.4Mpa  
**+21.9%**

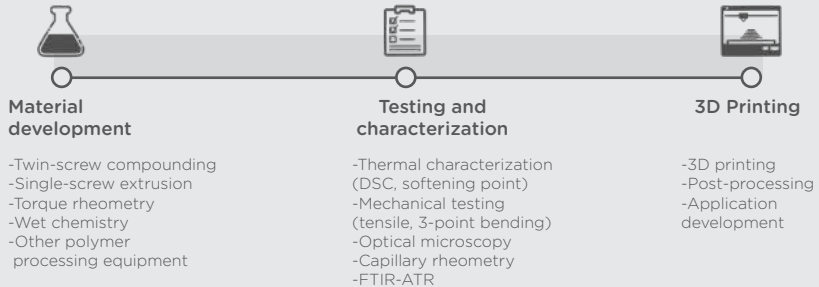
### Competitor 1

35% CF by weight

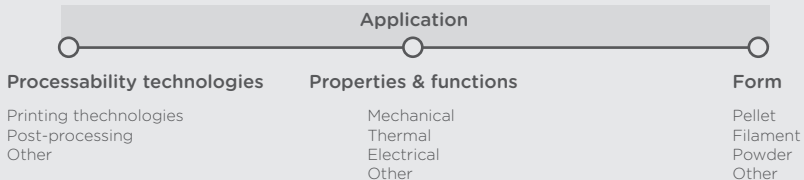
PA12  
48 Mpa  
PA12 CF  
28.9 Mpa **-40%**

# Material Development

If your application requires a specific material that is not yet available in the market, consider our custom development service. With our talented material scientists and application engineers, we are ready to develop the necessary materials to enable your application.



Our state-of-the art R&D facilities allow us to engineer materials at different levels and fully optimize them for 3D printing. Our goal is to deliver materials with the right combination of properties/functions, processability and form to suit your needs!



# Polymaker products



## PolyLite™

PLA  
PETG  
ABS  
PC  
ASA



## PolyMax™

PLA  
PETG  
PC  
⚙️ PC-FR



## PolyFlex™

TPU90  
TPU95  
⚙️ TPU95-HF



## PolyMide™

CoPA  
⚙️ PA6-CF  
⚙️ PA6-GF  
⚙️ PA12-CF



## PolyDissolve™

S1



## Specialty

PolyWood™  
PolySmooth™  
PolySupport™  
PolyCast™  
⚙️ PC-ABS  
⚙️ PC-PBT



## Hardware

PolyBox™  
Polysher™

More products  
coming soon...

# Technologies

## JAM-FREE™

Regular PLA



With Jam-Free™



## ASH-FREE™

Without Ash-Free™  
Ash content: 0.5%



With Ash-Free™  
Ash content: 0.003%



## WARP-FREE™

Regular Nylon



With Warp-Free™



## STABILIZED FOAMING™

Wood



Stabilized Foaming™



## LAYER-FREE™

Rough surface



With Layer-Free™



## FIBER ADHESION™



## NANO-REINFORCEMENT



# About Polymaker

## Our Values



Customer  
Oriented



Responsible



Entrepreneurial



Embracing  
Innovation

## Mission

Polymaker is committed to lowering the barriers to innovation and manufacturing, by continuously developing advanced 3D printing material technologies for industries and consumers.

# Contact us

For any inquiries please contact:

[inquiry@polymaker.com](mailto:inquiry@polymaker.com)

For technical support please contact:

[support@polymaker.com](mailto:support@polymaker.com)

The information provided in this document is intended to serve as basic guidelines on how particular product can be used. Users can adjust the printing conditions based on their needs and actual situations. It is normal for the product to be used outside of the recommended ranges of conditions. Each user is responsible for determining the safety, lawfulness, technical suitability, and disposal/recycling practices of Polymaker materials for the intended application. Polymaker makes no warranty of any kind, unless announced separately, to the fitness for any particular use or application. Polymaker shall not be made liable for any damage, injury or loss induced from the use of Polymaker materials in any particular application



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