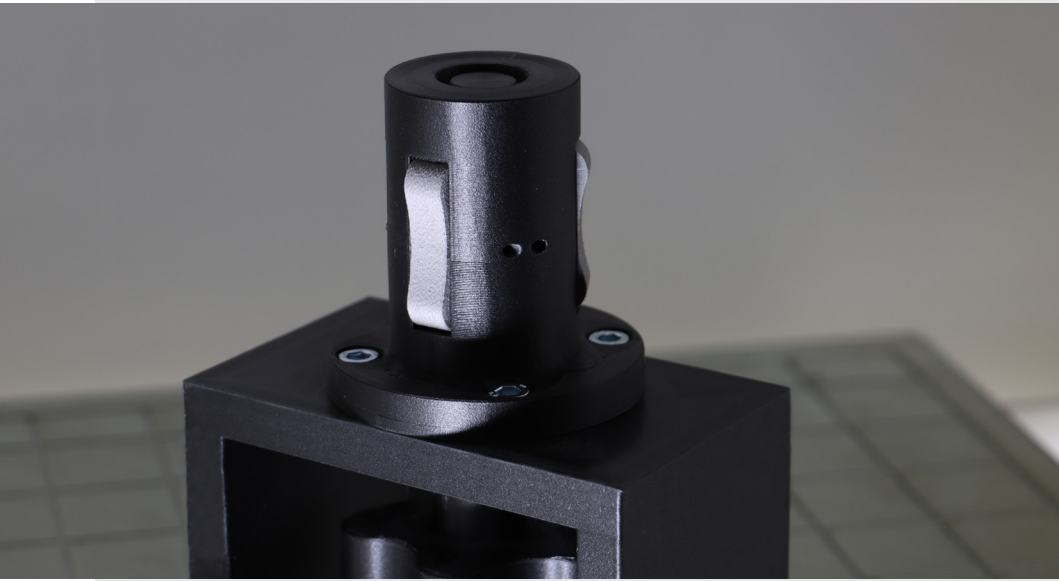
PolyMide™ PA12-CF



Industrial

For other languages, please visit
www.polymaker.com

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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.

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 ˚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˚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^2)	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

The PCP is divided in 5 steps:

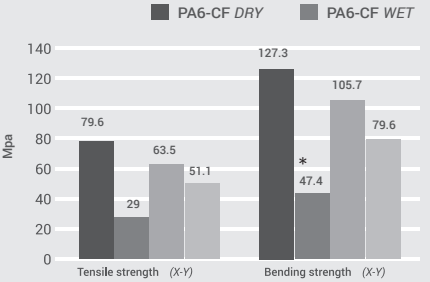
It uses less than 300g of materials and less than 7h of working time.

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

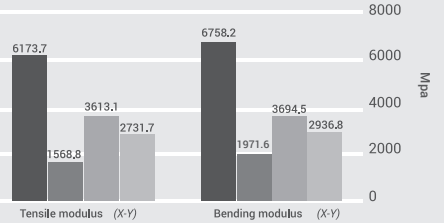
Each of these steps has a specific objective and introduces an important concept about the FFF 3D printing process. Each step will also give you the possibility to push your test further for more accurate results.

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 immerged 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 crystalization 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 unique application.



Material development

-Twin-screw compounding
-Single-screw extrusion
-Torque rheometry
-Wet chemistry
-Other polymer processing equipment

Testing and characterization

-Thermal characterization (DSC, softening point)
-Mechanical testing (tensile, 3-point bending)
-Optical microscopy
-Capillary rheometry
-FTIR-ATR

3D Printing

-3D printing
-Post-processing
-Application development

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!

Application

Processability technologies

Printing thechnologies
Post-processing
Other

Properties & functions

Mechanical
Thermal
Electrical
Other

Form

Pellet
Filament
Powder
Other

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

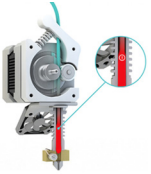
PolyBox™
Polysher™

More products
coming soon...

Technologies

JAM-FREE™

Regular PLA



With Jam-Free™

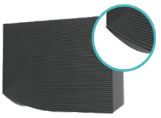
ASH-FREE™

Without Ash-Free™
Ash content: 0.5%

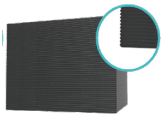
With Ash-Free™
Ash content: 0.003%

WARP-FREE™

Regular Nylon



With Warp-Free™



STABILIZED FOAMING™

Wood

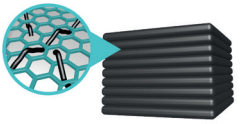
Stabilized Foaming™

LAYER-FREE™

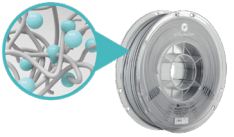
Rough surface

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:

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For technical support please contact:

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polymaker