2024

3D Printing
Pellet Product
Portfolio

PolyCore™

By polymaker

About Polymaker

Polymaker is a developer and manufacturer of 3D printing materials committed to innovation, quality and sustainability. Its award-winning product portfolio has enabled numerous individuals and companies to “better create and innovate”.
Headquartered in Changshu, China, Polymaker has multiple office locations in Shanghai,Utrecht and Houston ready to serve customers across the globe.

PolyCore™ is a range of 3D printing pellets that are specifically designed for Big Area Additive Manufacturing (BAAM) or Medium Area Additive Manufacturing (MAAM). PolyCore™ is commonly applied in two main applications: Architecture & Tooling/Molding. Within these applications there are a number of grades suiting more specific needs, such as high and low temperature mold making or weather resistant grades for exterior use. PolyCore™ pellets are optimized for printability, functionality, dimensional stability, and with great focus on layer adhesion.

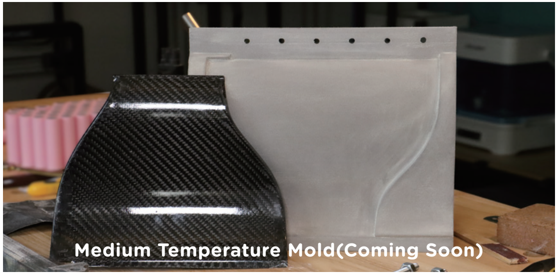
Architecture


Outdoor Architecture


Indoor Decoration

Mold & tooling


Normal Temperature Mold


Medium Temperature Mold(Coming Soon)

Architecture

Introduction

Architecture is a physical foundation of human activities and social developments. However, from a traditional perspective, architecture seems to be perceived as a “labor-intensive” and “time-consuming” industry, producing “rigid designs with limited flexibility” and “high carbon emissions”. The above-mentioned drawbacks & characteristics limit applications in many scenarios especially where total lead time has to be short, design structure is complex and carbon emission reduction is important.

3D printing is playing a significant role in creative buildings, not only in residences but in entire urban sections of towns and cities.

- **Design Flexibility**
- **Cost Effective**
- **Environment Friendly**

Polymaker is reputational for its proficiency in material-extrusion based 3D printing, offering a range of comprehensive solutions. For architecture requirements, Polymaker successfully launched a PolyCore™ series to meet customer's diversified demands and leading marketing trends.



Outdoor Architecture

https://polymaker.com/polycore/

PolyCore™ ASA-3012 20% glass fiber reinforced

PolyCore™ ASA-3012 is reinforced with 20% glass fiber, featuring excellent weather resistance and UV stability as well as strong mechanical properties. ASA-3012 is known for its ability to withstand harsh outdoor environments, making it a popular choice for outdoor applications such as bridge, horticulture and landscape.

PolyCore™ PETG-1013 30% glass fiber reinforced

PolyCore™ PETG-1013 is a glass fiber reinforced (30% mass percent) PETG pellets featuring excellent dimensional stability, strong mechanical properties and weather resistance. Designed for Big Area Additive manufacturing (BAAM) technology, PETG-1013 can withstand impact and stress well, which makes it an ideal material for printing objects that will be subjected to wear and tear or rough handling.

Download TDS & SDS

“Liuyun Bridge” in Chengdu, China

https://polymaker.com/polymakers-liuyun-bridge/

Youtube Video

Read more

“Liuyun Bridge” is a 3D printed polymer bridge built jointly by Shanghai Construction Group Co., Ltd., Polymaker, and Shanghai Coin Robotics, in Yimahe Park, Longquanyi District, Chengdu in 2021.

Inspired by the free-flowing shape of the stagecoach and dancing silk, “Liuyun Bridge” achieves bold innovations in landscape design by using new technology and materials unlike ever before while managing to overcome many obstacles in the 3D printing process. Polymaker was largely responsible for the conception and completion of this project, providing the materials and spearheading the exploration of landscape bridge design.

PolyCore™ ASA-3012 was the optimal material for this bridge, with mechanical properties suited for outdoor use and a formula designed for enhancing the dimensional stability and interlayer adhesion of large 3D prints.

“Liuyun Bridge” is not the first bridge to use 3D printing technology though. Polymaker has worked on the construction of a few other 3D printed bridges, both local and abroad, to realize new breakthroughs and accomplishments on each of their projects.

April, 2022

Taopu Central Park Bridge in Shanghai, China

https://polymaker.com/footage-of-worlds-largest-plastic-3d-printer-printing-pedestrian-bridge/

Youtube Video

Read more

In 2018, the world's first 3D printed pedestrian bridge was installed in a Shanghai park. Weighing 5,800kg, the bridge serves as a physical landmark in the downtown park, as well as a landmark in for large scale 3D Printing.

Polymaker developed the fiber reinforced ASA for this application, a material chosen for its favorable properties of weather and chemical resistance, thermal stability, and toughness. To determine the best plastic for the job, Polymaker 3D printed a 5-meter version of the bridge with several different compounds before choosing AS100GF (now known as **PolyCore™ ASA-3012**). The bridge is predicted to hold 13 tons which equals to 4 people per square meter.

AS100GF containts 12.5% glass fibers by weight, increasing strength whilst also reducing the common issue of warping in large 3D prints.

Dec, 2018




Namthaja's Rakah Roundabout

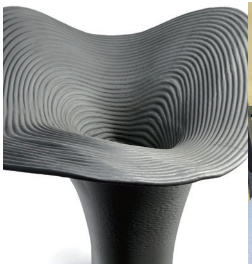
Rakah Roundabout project is based in Saudi Arabia and initiated by Namthaja in 2022. The company chose **PolyCore™ ASA-3012** as the major printing material. Rakah Roundabout is a unique and ambitious project that features sustainability and recyclability. It is one of the largest 3D printing projects worldwide.

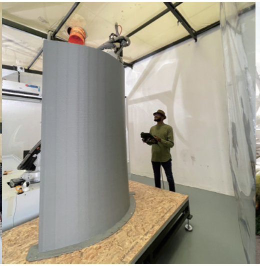
Project size: 2000 m^2
Materials volume: 15 tons
Production time: 100 days

Reasons for choosing the material:

- Printability and repeatability which is crucial for long printing jobs (up to 24 hrs).
- Dimensional stability, vertical panels with height up to 2 meters were printed with minimal warpage/ shrinkage.
- UV/Weather Resistance, the material is an excellent match for outdoor applications.
- Strength, the material is lightweight yet strong which allowed using it in functional applications such as outdoor cladding, molds, and bridges.

Oct, 2022






Indoor Decoration

https://polymaker.com/polycore/

PolyCore™ PETG-1000 Transparent PETG

PolyCore™ PETG-1000 is a cost-effective PETG pellet with good printability and unique aesthetic effect, specially designed for Medium Area Additive Manufacturing (MAAM) and Big Area Additive manufacturing (BAAM). It is suitable for indoor applications such as furniture, luminaires and decoration.

Download TDS & SDS

Indoor Decoration

Indoor decoration, also known as interior design, is the art and science of enhancing the interior of a space to create a visually pleasing and functional environment.

Pellet-based 3D printing can be used to create a variety of objects, such as vases, sculptures, figurines, decorative panels and more. It offers several advantages for indoor decoration, including:

- **Customization**
- **Complex and Intricate Designs**
- **Cost-Effective**
- **Sustainability**

Oct, 2023



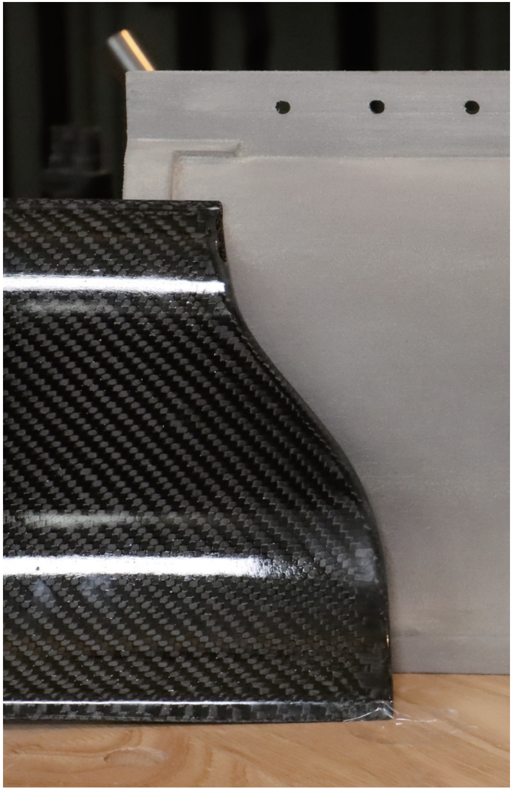
Mold & Tooling

Introduction

3D printing technology offers a more cost-effective, flexible, and sustainable solution to traditional mold & tooling production, with higher production efficiency and greater design flexibility, mainly thanks to below reasons:

- **Lower Cost**
- **Shortest Lead Time**
- **Design Flexibility**
- **Reduced Maintenance & Iteration Cost**
- **Scalability**
- **Sustainability**

In the realm of BAAM, mold production & tooling stands out as one of the most vital application. Based on the difference of operating temperature, Polymaker divides the application into three categories:
normal (operating temperature up to 80°C) &
medium (operating temperature up to 140°C) & high temperature (operating temperature up to 190°C)
Polymaker fully recognizes this significance and has consequently introduced a series of PolyCore™ products specifically tailored for this application.



Normal Temperature Mold

https://polymaker.com/polycore/

PolyCore™ ABS-5012 20% glass fiber reinforced

PolyCore™ ABS-5012 is a 20% glass fiber reinforced ABS pellet features great cost effectiveness, excellent printability, balanced mechanical properties and broad applicability. This product can be applied to a wide range of scenarios including but not limited to: low-to-mid temperature tooling, architecture template such as concrete mold, general prototyping, etc.

PolyCore™ ABS-5022 20% carbon fiber reinforced

PolyCore™ ABS-5022 is a 20% carbon fiber reinforced ABS pellet with strong mechanical properties, great dimensional stability, good durability and high thermal conductivity with relatively low CTE. It is suitable for applications where durability & thermal resistance matters, for example, marine prototype and low-to-medium temperature composite tooling (<80°C).

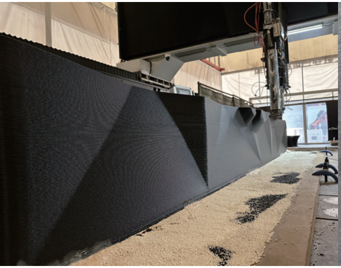
Download TDS & SDS

Polymaker Factory - Molds for Concrete Preforms

Molds for concrete preforms are more and more used in the construction projects. In Polymaker's new factory construction, a 3D printed mold was produced and used. The mold was printed with **PolyCore™ ABS-5012** and the total weight is more than 400kg. It took only 2 weeks from design to finalize the concrete parts. The 3D printed mold provides the following advantages:

- **Design Freedom**
- **Shorter Lead Times**
- **Cost-Effective**
- **Environmentally Friendly**

Sep, 2023





Medium Temperature Mold

https://polymaker.com/polycore/

PolyCore™ PC-7414 Glass fiber reinforced PC

Composite tooling used in autoclave is one of the most important applications in BAAM. PolyCore™ PC-7414 is designed for medium temperature autoclaving tools, which can withstand up to 140°C during curing process. This grade is still under development and is on our releasing schedule.


同济大学
03
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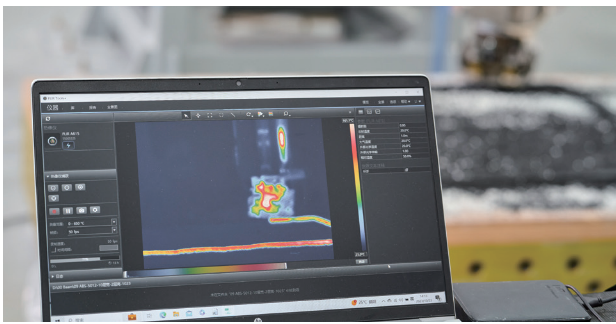
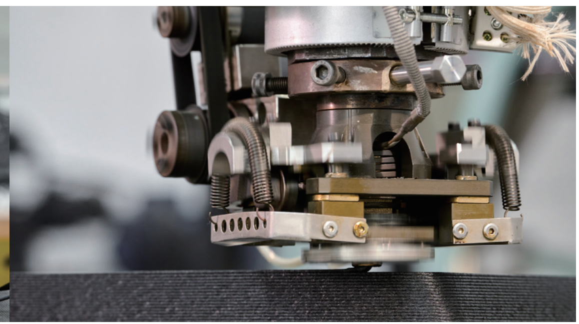
JTEKT
covestro
Continental

Introducing the Layer Time Table

The importance of thermal history control in Big Area Additive Manufacturing (BAAM) cannot be overlooked. Thermal history refers to the temperature changes of the material throughout the entire printing process, from extrusion, deposition, cooling, to final solidification. The control of thermal history directly affects the quality of final printed print, including its mechanical properties (especially layer adhesion), dimensional stability and surface quality. In Big Area Additive Manufacturing (BAAM), layer time (the time spent for depositing one layer of the printed part) is typically adjusted to quickly regulate the thermal history of the printing process. Therefore, the layer time is a core technological parameter of Big Area Additive Manufacturing (BAAM).

For the first time in the Big Area Additive Manufacturing (BAAM) industry, Polymaker has provided the **Layer Time Table** for each PolyCore™ product. When using Polymaker materials, users only need to consult the table in conjunction with line width, layer height, ambient temperature and extrusion temperature to get a recommended layer time as a starting point for testing. This helps users greatly improve process development efficiency and significantly reduce cost.

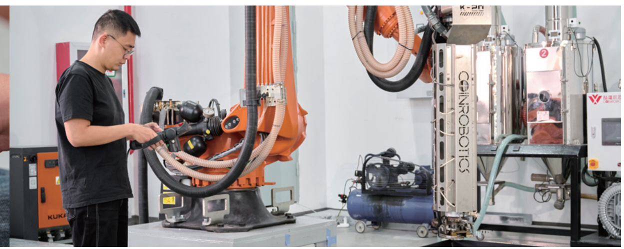




Introducing T_{top} (top layer temperature)

In large-scale 3D printing, we have identified two primary process challenges that commonly arise:
a. Cracking and warping of the printed part, normally due to too long layer time or too low top layer temperature.
b. Collapse of the printed part, typically due to too short layer time or too high top layer temperature.

Here an important concept emerges, called "top layer temperature", abbreviated as T_{top}. The definition of T_{top} is: the instantaneous temperature of a specific point on the topmost completed layer, measured when the nozzle printing the current layer is positioned directly above it. Polymaker considers T_{top} to be an almost intrinsic property of the material. By choosing from the recommended layer time range, the T_{top} during the printing process can always fall within a reasonable area, thus balancing the interlayer performance and dimensional stability of the printed part.Polymaker considers T_{top} (top layer temperature) to be an almost intrinsic property of the material. By choosing from the recommended layer time range, the T_{top} during the printing process can always fall within a reasonable area, thus balancing the interlayer performance and dimensional stability of the printed part.



On next page you will see the layer time table provided by Polymaker based on the PolyCore™ ABS-5012 product. The suitable T_{top} range for ABS-5012 is 100-160°C, and two colors are used to mark the corresponding layer time range: the green area is safe to use and is our recommended layer time; the yellow area's layer time is nearing its limit, which still can be used but will require additional monitoring. If the layer time exceeds the yellow area, the T_{top} may be too low or too high, which could potentially cause the printed part to crack or collapse. Example A: when the ambient temperature is 40°C, the layer height is 3mm, the line width is 22mm, and the extrusion temperature is 245°C, the recommended layer time range is 78-252s (green area). Example B: when the ambient temperature is 25°C, the layer height is 3mm, the line width is 19mm, and the extrusion temperature is 245°C, there are no directly corresponding parameters in the table. However, we notice that 19mm is between 22mm and 16mm, so the recommended layer time is also in the middle. A simple arithmetic average can be applied here, so the recommended layer time range is 61-166s.

Layer Time Table provided by Polymaker based on PolyCore™ ABS-5012

	Tr = 40℃ Width=22mm Height=3mm	Tr = 40℃ Width=16mm Height=3mm	Tr = 40℃ Width=5mm Height=2mm	Tr = 25℃ Width=22mm Height=3mm	Tr = 25℃ Width=16mm Height=3mm	Tr = 25℃ Width=5mm Height=2mm	Tr = 10℃ Width=22mm Height=3mm	Tr = 10℃ Width=16mm Height=3mm	Tr = 10℃ Width=5mm Height=2mm
Top layer Temperature	Layer Time (s)	Layer Time (s)	Layer Time (s)	Layer Time (s)	Layer Time (s)	Layer Time (s)	Layer Time (s)	Layer Time (s)	Layer Time (s)
160 ℃	58	52	27	48	46	22	41	39	17
150 ℃	78	67	34	63	58	29	55	51	22
140 ℃	104	86	44	82	74	39	74	67	29
130 ℃	140	112	56	108	93	52	100	88	37
120 ℃	188	144	72	141	117	68	134	115	48
110 ℃	252	186	93	184	148	91	181	151	62
100 ℃	338	241	119	240	187	120	234	180	80

1. Definition of each concept

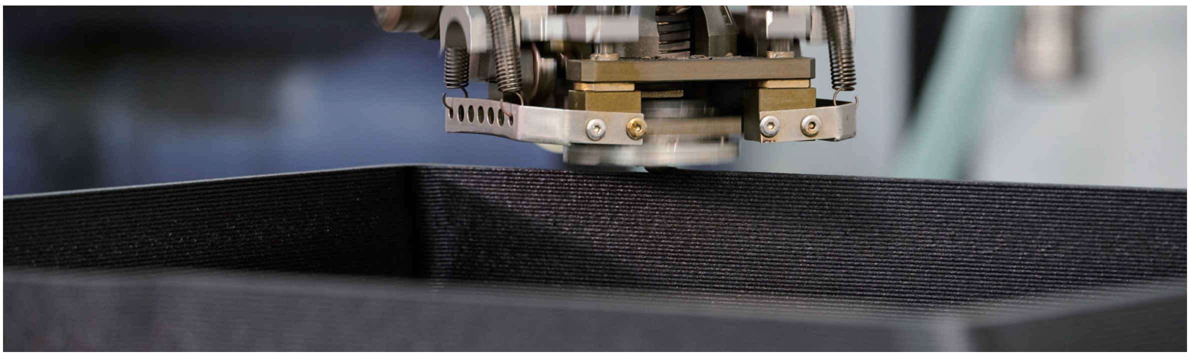
- Layer time: the time spent for depositing one layer of the printed part.
- Top layer temperature: the instantaneous temperature of a specific point on the topmost completed layer, measured when the nozzle printing the current layer is positioned directly above it.
- Width: the cross-sectional dimension of the printed layer, perpendicular to the direction of the print nozzle's movement.
- Height: the vertical dimension of the printed object, or the layer thickness during Big Area Additive Manufacturing (BAAM).
- Tr: room temperature when starting Big Area Additive Manufacturing (BAAM).

2. The top layer temperature should range between the material's glass transition temperature (Tg) and its non-collapse printing temperature for optimal mechanical properties and dimensional stability.
3. Above data is inferred based on an extrusion temperature of 240-250°C as recommended in TDS and a 1m*1m*1m square frame model.
4. The simulation condition is based on a closed room without additional air disturbances.
5. Above data is inferred based on the thermal history simulation software, Dragon, by Helio Additive. It should be used for reference only. For a more detailed analysis, please contact Polymaker.

All the layer time data is generated by the heat transfer simulation method co-developed by Polymaker and Helio Additive (a company is developing revolutionary software tools for 3D printing). The use of heat transfer simulation to optimize the printing process of BAAM is an industry first. However, there are still some limitations on the current simulation model, and this method is not yet perfect.

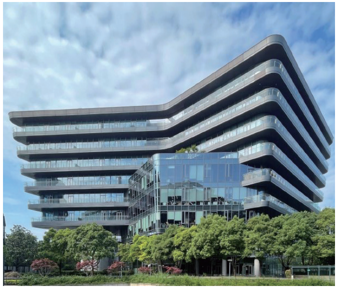
Polymaker will continue to refine the method, striving to eliminate the barriers to use for BAAM.

Please always contact Polymaker with any questions!



Polymaker Offices

Shanghai, China



Changshu, China

Houten, The Netherlands

Houston, USA

Mission

Polymaker is committed to simplifying creation by developing empowering 3D printing & material technologies for industries and consumers.

Contact Us

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