



BEST 3D FILAMENT: THE MAIN 3D PRINTER
FILAMENT TYPES

PLA



(Source: Luedke8572 via Reddit)

WHAT IS PLA?

In the realm of consumer 3D printing, polylactic acid (PLA) is king. Although it's often compared to ABS – arguably the next in line to the throne – PLA is easily the most popular type of 3D printer filament, and for good reason.

3D PRINTER FILAMENT PROPERTIES: PLA

- **Strength:** Medium | **Flexibility:** Low | **Durability:** Medium
- **Difficulty to use:** Low
- **Print temperature:** 180 – 230°C
- **Print bed temperature:** 20 – 70°C (but not needed)
- **Shrinkage/warping:** Minimal
- **Soluble:** No
- **Food safety:** Refer to manufacturer guidelines

MORE INFORMATION

First and foremost, PLA is easy to print with. It has a lower printing temperature than ABS and it doesn't warp as easily, meaning a heated print bed isn't required (although it definitely helps). Another benefit of using PLA is that it doesn't emit an offputting odor during printing (unlike ABS). It's generally considered an odorless filament, but many have reported smelling sweet *candy-like* fumes depending on the type of PLA.

Another appealing aspect of PLA is it's available in a nearly endless abundance of colors and styles. As you'll see in the exotics sections, many of these specialty filaments use PLA as the base material, such as those with conductive or glow-in-the-dark properties or those infused with wood or metal.

PLA is, to a point, more environmentally friendly than many 3D printer filaments. It will biodegrade under certain commercially attainable conditions. You're not going to be able to compost it at home, which makes us reluctant to tout the material as being "green" in any meaningful way, but you could spin an argument for it being better than some.

WHEN SHOULD I USE PLA 3D PRINTER FILAMENT?

In this case, the better question might be, *When shouldn't I use PLA?* Compared to other types of 3D printer filament, PLA is brittle, so avoid using it when making items that might be bent, twisted, or repeatedly dropped, such as phone cases, high-wear toys, or tool handles.

You should also avoid using it with items that need to withstand higher temperatures, as PLA tends to deform around temperatures of 60°C or higher. For all other applications, PLA makes for a good overall choice in 3D printer filament.

Common prints include models, low-wear toys, prototype parts, and containers.

RECAP OF PLA 3D PRINTER FILAMENT

- **Pros:** Easy to print, wide variety of colors/styles, biodegradable
- **Cons:** Brittle, lackluster mechanical properties



Filament types 2022



(Source: Alan Chia via Wikipedia)

WHAT IS ABS?

Acrylonitrile butadiene styrene (ABS) is less popular than PLA for everyday 3D printing. With respect to its material properties though, ABS is actually moderately superior to PLA, despite being slightly more difficult to print – it’s prone to warping without a hot print bed and bed adhesive.

Commonly used in injection molding, ABS is found in many manufactured household and consumer goods, including LEGO bricks and bicycle helmets.

3D PRINTER FILAMENT PROPERTIES: ABS

- **Strength:** High | **Flexibility:** Medium | **Durability:** High
- **Difficulty to use:** Medium
- **Print temperature:** 210 – 250°C
- **Print bed temperature:** 80 – 110°C
- **Shrinkage/warping:** Considerable
- **Soluble:** In esters, ketones, and acetone
- **Food safety:** Not food safe

MORE INFORMATION

Products made of ABS boast high durability and a capacity to withstand high temperatures, but 3D printer enthusiasts should be mindful of the filament’s high printing temperature, tendency to warp during cooling, and intense, potentially hazardous fumes. Be sure to print with a heated bed and a well-ventilated space (or with an enclosure).



See Also
[The Best ABS Filaments of 2022](#)

WHEN SHOULD I USE ABS 3D PRINTER FILAMENT?

ABS is tough – able to withstand high stress and temperature. It’s also moderately flexible, though there are certainly better options for that further down this list. Together these properties make ABS a good general-purpose 3D printer filament, but where it really shines is with items that are frequently handled, dropped, or heated. Examples include phone cases, high-wear toys, tool handles, automotive trim components, and electrical enclosures.

RECAP OF ABS 3D PRINTER FILAMENT

- **Pros:** High strength, high durability, resistance to high temperatures
- **Cons:** Warps easily, hazardous fumes, requires a high-temperature print nozzle



PETG (PET, PETT)



(Source: ddf3d.com)

WHAT IS PETG?

Polyethylene terephthalate (PET) is one of the most commonly used plastics in the world. Best known as the polymer used in water bottles, it is also found in clothing fibers and food containers. While "raw" PET is rarely used in 3D printing, its variant PETG is an increasingly popular 3D printer filament.

3D PRINTER FILAMENT PROPERTIES: PETG (PET, PETT)

- **Strength:** High | **Flexibility:** Medium | **Durability:** High
- **Difficulty to use:** Low
- **Print temperature:** 220 – 250°C
- **Print bed temperature:** 50 – 75°C
- **Shrinkage/warping:** Minimal
- **Soluble:** No
- **Food safety:** Refer to manufacturer guidelines

ADDITIONAL INFORMATION

The 'G' in PETG stands for "glycol." As a material for 3D printing, it is naturally clearer, less brittle, and most importantly, easier to print with than its base form. For this reason, PETG is often considered a good middle ground between ABS and PLA, two other commonly used 3D printer filament varieties – it is more flexible and durable than PLA and easier to print than ABS.



See Also
[The Best PETG Filaments of 2021](#)

Polyethylene coTrimethylene Terephthalate (PETT) is another PET variant. Slightly more rigid than PETG, this 3D printer filament is popular for its transparency.

Three things 3D printer enthusiasts should keep in mind when using PETG:

- PETG is *hygroscopic*, meaning it absorbs moisture from the air. This has a negative effect on the printability of the material, so make sure to store the 3D printer filament in a cool, dry place and, if necessary, dry it before use.
- PETG is sticky when printed, making this 3D printer filament a poor choice for support structures but good for layer adhesion.
- Though not brittle, PETG scratches more easily than ABS.

WHEN SHOULD I USE PETG (PET, PETT) 3D PRINTER FILAMENT?

PETG is a good all-rounder but stands out from many other types of 3D printer filament due to its flexibility, strength, and resistance to high temperature and impact. This makes it an ideal 3D printer filament to use for functional objects which might experience sustained or sudden stress, such as mechanical parts, printer parts, and protective components.

RECAP OF PETG 3D PRINTER FILAMENT

- **Pros:** Flexible, durable, easy to print
- **Cons:** Susceptible to moisture, surface scratches easily



TPE, TPU, TPC (Flexible)



When you want to print with flexible materials, direct drive is recommended (Source: [Creative Tools via YouTube](#))

WHAT IS TPE?

As the name implies, thermoplastic elastomers (TPE) are essentially plastics with rubber-like qualities, making them extremely flexible and durable. As such, TPE is commonly used to produce automotive parts, household appliances, and medical supplies.

3D PRINTER FILAMENT PROPERTIES: TPE, TPU, TPC (FLEXIBLE)

- **Strength:** Medium | **Flexibility:** Very High | **Durability:** Very High
- **Difficulty to use:** Medium (TPE, TPC); Low (TPU)
- **Print temperature:** 210 – 230°C
- **Print bed temperature:** 30 – 60°C (but not needed)
- **Shrinkage/warping:** Minimal
- **Soluble:** No
- **Food safety:** Not food safe

MORE INFORMATION

In reality, TPE is a broad class of co-polymers (and polymer mixtures), but it is nonetheless used to label many commercially available types of 3D printer filament. Soft and stretchable, these filaments can withstand the kind of physical punishment that neither ABS nor PLA can tolerate. On the other hand, printing is not always easy, as TPE can be difficult to extrude.



Don't Miss
[Flexible Filaments for 3D Printing – Simply Explained](#)

Thermoplastic polyurethane (TPU) is a particular variety of TPE and is a popular 3D printer filament. Compared to generic TPE, TPU is slightly more rigid – making it easier to print. It's also a little more durable and can better retain its elasticity in the cold.

Thermoplastic copolyester (TPC) is another variety of TPE, though not as commonly used as TPU. Similar in most respects to TPE, TPC's main advantage is its higher resistance to chemical and UV exposure, as well heat (up to 150°C).

WHEN SHOULD I USE TPE, TPU, OR TPC 3D PRINTER FILAMENT?

Use TPE or TPU when creating objects that need to take a lot of wear. If your 3D printed part bends, stretches, or compresses, these 3D printer filaments should be up to the task. Example prints might include toys, phone cases, or wearables (like wristbands). TPC can be used for similar applications but does especially well in harsher environments, like the outdoors, or anywhere it will be exposed to high heat, like in a car.

RECAP OF TPE/TPU/TPC 3D PRINTER FILAMENT

- **Pros:** Extremely flexible, perfect for parts that bend or compress
- **Cons:** Difficult to print, requires tight filament path and slow print speed



Nylon (PA)



(Source: RichRap3D via Blogspot)

WHAT IS NYLON?

Nylon, also known as Polyamide (PA), is a popular family of synthetic polymers used in many industrial applications and is a go-to material in powder-fusion 3D printing. As a filament for 3D printing, it excels where strength, flexibility, and durability are key requirements.

3D PRINTER FILAMENT PROPERTIES: NYLON

- **Strength:** Very High | **Flexibility:** High | **Durability:** High
- **Difficulty to use:** Medium
- **Print temperature:** 240 – 260°C
- **Print bed temperature:** 70 – 100°C
- **Shrinkage/warping:** Considerable
- **Soluble:** No
- **Food safety:** Refer to manufacturer guidelines

MORE INFORMATION

Another unique characteristic of this 3D printer filament is that you can dye it, either before or after the printing process. The negative side to this is that nylon, like PETG, is *hygroscopic*, meaning it absorbs moisture, so remember to store it in a cool, dry place to keep the filament in prime condition, ensuring better quality prints.



Don't Miss
Nylon 3D Printing – The Ultimate Guide

WHEN SHOULD I USE NYLON 3D PRINTER FILAMENT?

Taking advantage of nylon's strength, flexibility, and durability, this type of 3D printer filament can be used to create tools, functional prototypes, or mechanical parts (like hinges, buckles, or gears).

Recap of Nylon 3D Printer Filament

- **Pros:** High strength, high flexibility, high durability
- **Cons:** Typically expensive, susceptible to moisture, requires high nozzle and print bed temperature



PC (Polycarbonate)



(Source: 3Dimensionals)

WHAT IS PC?

Polycarbonate (PC), in addition to being one of the strongest 3D printer filaments presented in this list, is extremely durable and resistant to both physical impact and heat – being able to withstand temperatures of up to 110°C. It's also naturally transparent, which explains its use in commercial items such as bulletproof glass, scuba masks, and electronic display screens.

3D PRINTER FILAMENT PROPERTIES: PC (POLYCARBONATE)

- **Strength:** Very High | **Flexibility:** Medium | **Durability:** Very High
- **Difficulty to use:** Medium
- **Print temperature:** 270 – 310°C
- **Print bed temperature:** 90 – 110°C
- **Shrinkage/warping:** Considerable
- **Soluble:** No
- **Food safety:** Not food safe

MORE INFORMATION

Despite being featured in similar use cases, PC shouldn't be confused with acrylic or plexiglass, which tend to shatter or crack under stress. Unlike these two materials, PC is moderately flexible (though not as much as nylon, for example), allowing it to bend until it eventually deforms.

PC 3D printer filament is *hygroscopic*, absorbing water from the air, so remember to store it in a cool, dry place to ensure better quality prints.



Don't Miss
The Best Polycarbonate (PC) Filaments of 2022

WHEN SHOULD I USE PC 3D PRINTER FILAMENT?

Due to its physical properties, PC is an ideal 3D printer filament for parts that need to retain their strength, toughness, and shape in high-temperature environments such as electrical, mechanical, or automotive components. You can also leverage its optical clarity for lighting projects, screens, and other applications that call for transparency.

RECAP OF PC 3D PRINTER FILAMENT

- **Pros:** Extremely strong, resistant to heat and physical impact
- **Cons:** Susceptible to moisture, requires very high print temperature



Wood-Filled



(Source: Jeremie Francois)

WHAT IS WOOD-FILLED FILAMENT?

Interested in printing objects that look and feel like wood? Well, you can! Of course, it's not really wood – that wouldn't make for a very good 3D printer filament. Wood 3D printer filament is typically a PLA infused with wood fiber.



Don't Miss
Wood 3D Printer: How to 3D Print Wood

MORE INFORMATION

There are many wood-PLA 3D printer filaments available today. These include the more standard wood varieties, such as Pine, Birch, Cedar, Ebony, and Willow, but the range also extends to less common types, like Bamboo, Cherry, Coconut, Cork, and Olive.

As with other types of 3D printer filament, there is a trade-off with using wood. In this case, the aesthetic and tactile appeal comes at the cost of reduced flexibility and strength.

Be careful with the temperature at which you print wood, as too much heat can result in an almost burnt or caramelized appearance. On the other hand, the base appearance of your wooden creations can be greatly improved with a little post-print processing! Wood-filled filament can also accelerate the degradation of your 3D printer's nozzle a little, as the wood fibers it's comprised of are abrasive and will tear away at softer materials like brass.



Don't Miss
The Best Wood PLA Filaments of 2022

WHEN SHOULD I USE WOOD-FILLED FILAMENT?

Wood is popular with items that are appreciated less for their functional capabilities and more for their natural appearance. Consider using wood-filled 3D printer filament when printing objects displayed on a desk, table, or shelf. Examples include bowls, figurines, and awards. One really creative application of wood as a 3D printer filament is creating scale models, such as those used in architecture.

RECAP OF WOOD-FILLED FILAMENT

- **Pros:** Visually striking, ideal for aesthetic purposes
- **Cons:** Lackluster mechanical properties, abrasive to the print nozzle



Filament types 2022

PVA



(Source: Zortrax)

WHAT IS PVA?

Polyvinyl alcohol (PVA) is soluble in water, and that's exactly what commercial applications take advantage of. Popular uses include packaging for dishwasher detergent "pods" or bags full of fishing bait. (Throw the bag in water and watch it dissolve, releasing the bait.)

MORE INFORMATION

The same principle applies in 3D printing, making PVA a great support material when paired with another 3D printer filament in a dual extrusion 3D printer. The advantage of using PVA over HIPS is that it can support more materials than just ABS.

The trade-off is a 3D printer filament that is slightly more difficult to handle. One must also be careful when storing it, as the moisture in the atmosphere can damage the filament before printing. Dry boxes and silica pouches are a must if you plan to keep a spool of PVA usable in the long run.



Don't Miss
The Best PVA Filament of 2021

WHEN SHOULD I USE PVA 3D PRINTER FILAMENT?

PVA filament is a great choice as support material on complex prints with overhangs.

RECAP OF PVA 3D PRINTER FILAMENT

- **Pros:** Terrific support material
- **Cons:** Difficult to handle, susceptible to moisture



ASA



(Source: StratasyS)

WHAT IS ASA FILAMENT?

Sure, ABS is great, but it has its flaws. As filament it typically contains additives that help make it printable in the first place. Compared to its use in injection molding, it's not quite the same, which is why there's no shortage of ABS-like alternatives for 3D printing. One such alternative is acrylonitrile styrene acrylate (ASA), which was originally developed to be a hardy weather-resistant material. It is commonly used in the automotive industry.

MORE INFORMATION

In addition to being a 3D printer filament that is strong, rigid, and relatively easy to print with, ASA is also extremely resistant to chemical exposure, heat. Extreme condition excepted, it generally won't change shape or color. For example, prints made of ABS tend to denature and yellow if left outdoors. Not the case with ASA.

Another minor benefit to using ASA over ABS is that it warps less during printing. But be careful with how you adjust your cooling fan; ASA can easily delaminate (crack at the layers) if your print cooling is too strong.



Don't Miss
The Best ASA Filaments of 2022

WHEN SHOULD I USE ASA 3D PRINTER FILAMENT?

For anything from birdhouses to custom garden gnomes and replacement outlet covers, look no further than this 3D printer filament.

RECAP OF ASA 3D PRINTER FILAMENT

- **Pros:** Great for functional applications, especially automotive parts
- **Cons:** Susceptible to cracking during the printing process