



The 3D Print Professor's Guide to FDM Filaments

PLA





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PLA (Polylactic Acid) is one of the most commonly used thermoplastics in 3D printing. It is a biodegradable and bioactive thermoplastic derived from renewable resources like corn starch or sugarcane. PLA is favored for its ease of use, lower printing temperatures, and minimal warping. It is an excellent choice for beginners and for applications where mechanical properties are less critical.

PLA filaments are available in diameters of 1.75 mm and 2.85 mm, with a tolerance of ± 0.05 mm. The density of PLA is around 1.24 g/cm^3 . It has a tensile strength of 37-60 MPa and an elongation at break of 3.5-10%, indicating it is relatively stiff and brittle compared to other materials. PLA has a low melting point and a glass transition temperature of around 60-65°C, which makes it unsuitable for high-temperature applications.

Successful Applications

PLA is suitable for a wide range of applications, including:

- **Prototyping:** Ideal for creating rapid prototypes and models that do not require high mechanical strength.
- **Educational Projects:** Popular in educational settings for teaching 3D printing and creating visual aids.
- **Consumer Products:** Used for making decorative items, toys, and household goods.
- **Medical Devices:** Suitable for making medical models and devices that require biocompatibility and biodegradability.

When Not to Use PLA

Despite its benefits, there are scenarios where PLA may not be the best choice:

- **High-Temperature Applications:** PLA deforms at temperatures above 60°C, making it unsuitable for high-temperature environments.
- **Mechanical Parts:** Not ideal for parts requiring high impact resistance or flexibility.
- **Outdoor Use:** PLA degrades when exposed to UV light and moisture over time.

Popularity and Reasons



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PLA is extremely popular among hobbyists, educators, and professionals due to its ease of use and biodegradability. It is often the first choice for beginners due to its low warping and straightforward printing requirements. Its wide availability and variety of colors and finishes also contribute to its popularity.

Benefits

- **Ease of Use:** Low warping and no need for a heated bed make PLA easy to print with.
- **Biodegradability:** Made from renewable resources and is biodegradable under industrial composting conditions.
- **Variety:** Available in a wide range of colors and finishes, including matte, glossy, and specialty types like silk and wood-filled.
- **Low Odor:** Produces minimal odor during printing compared to other plastics like ABS.

Limitations

- **Low Heat Resistance:** Deforms at temperatures above 60°C, limiting its use in high-temperature environments.
- **Brittleness:** More brittle compared to other plastics like ABS and PETG, leading to potential cracking under stress.
- **UV Sensitivity:** Degrades when exposed to UV light over time.
- **Mechanical Properties:** Less suitable for applications requiring high strength, flexibility, or impact resistance.

Usual Print Settings

- **Print Temperature:** 180-220°C
- **Bed Temperature:** 20-60°C (optional, depending on the printer and environment)
- **Print Speed:** 40-60 mm/s
- **Nozzle:** Standard brass or hardened steel



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Precautions

- **Ventilation:** Ensure good ventilation to avoid inhaling fumes, although PLA emits minimal odor.
- **Handling:** Use gloves and eye protection when handling raw filament.
- **Storage:** Store in a cool, dry place to prevent moisture absorption and maintain filament quality.

Hygroscopic Characteristics

PLA is hygroscopic and can absorb moisture from the air, which can lead to printing issues such as bubbling and poor layer adhesion. Proper storage in a dry environment, using desiccants or moisture-control products, is crucial to maintain filament quality.

Why Use PLA:

- Easy to print with minimal warping and no need for a heated bed.
- Environmentally friendly and biodegradable.
- Wide availability and variety of colors and finishes.
- Suitable for rapid prototyping, educational projects, and consumer products.

Why Not to Use PLA:

- Low heat resistance, making it unsuitable for high-temperature applications.
- Brittle compared to other plastics, leading to potential cracking under stress.
- Degrades when exposed to UV light and moisture over time.
- Less suitable for applications requiring high strength, flexibility, or impact resistance.

Popularity and Why

PLA is extremely popular among hobbyists, educators, and professionals due to its ease of use and biodegradability. It is often the first choice for beginners due to its low warping and



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straightforward printing requirements. Its wide availability and variety of colors and finishes also contribute to its popularity.

Typical Availability

PLA is widely available from various suppliers and 3D printing stores. It is one of the most commonly stocked filaments, making it easy to find for most 3D printing needs.

Reliability of Availability

PLA is reliably available from major filament manufacturers and suppliers. It is commonly stocked and widely available, making it easy to find for most 3D printing needs.

Biodegradability

PLA is biodegradable under industrial composting conditions and is derived from renewable resources like corn starch or sugarcane. This makes it more environmentally friendly compared to petroleum-based plastics. Proper disposal and recycling practices should be followed to mitigate its environmental impact.

Common Applications

- **Prototyping:** Rapid prototypes and models that do not require high mechanical strength.
- **Educational Projects:** Teaching 3D printing and creating visual aids.
- **Consumer Products:** Decorative items, toys, and household goods.
- **Medical Devices:** Medical models and devices requiring biocompatibility and biodegradability.

Uncommon Applications

- **High-Temperature Parts:** Limited use due to low heat resistance.
- **Mechanical Parts:** Not ideal for parts requiring high impact resistance or flexibility.
- **Outdoor Use:** Degrades when exposed to UV light and moisture over time.

Printing Considerations



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- **Adhesion:** Ensure proper bed adhesion with materials like PEI or build surfaces designed for PLA.
- **Cooling:** Adjust cooling settings to prevent defects and maintain print quality.
- **Moisture Management:** Store in a dry environment with desiccants to prevent moisture absorption.

Common Manufacturers

1. **Hatchbox:** [Hatchbox PLA](#)
2. **MatterHackers:** MatterHackers PLA
3. **Prusa Research:** Prusament PLA
4. **Eryone:** [Eryone PLA](#)
5. **Bambu Lab:** [Bambu Lab PLA](#)

Moisture Management with The Original Moisture Buster and FilaDry

The Original Moisture Buster and FilaDry are essential for maintaining the quality of PLA filament by effectively managing moisture levels. PLA is hygroscopic and can absorb moisture, leading to print defects such as bubbling and poor layer adhesion. The Moisture Buster, equipped with a hygrometer, provides real-time humidity monitoring, ensuring that your filament is stored in optimal conditions. FilaDry, which is significantly more powerful than traditional desiccants like silica gel, quickly absorbs any moisture, keeping your filament dry and ready for use. This helps prevent issues associated with moisture absorption and ensures consistent, high-quality prints. For more information, you can visit Sculpt3DCreations.com or purchase the Original Moisture Buster on [Amazon Canada](#) and [Amazon USA](#).