5. Material Guide

A full table of materials is available online! Due to limited space within this guide, we can only provide a brief overview of popular materials here. Visit help.prusa3d.com/materials to find a **full overview of a wide range of printing materials.** The Original Prusa XL 3D printer is compatible with almost all filaments available. Individual materials may differ not only in color but also in mechanical and optical properties, or even in printing difficulty. If you have no experience with 3D printing, **we recommend starting with PLA.** Only if PLA filament is limiting you in any way, consider other materials such as PETG or ASA.

Prusament is our in-house made line of high-quality filaments. We were not satisfied with the quality of filaments on the market, so we decided to make our own! The whole manufacturing process is closely monitored and tested – string diameter, color consistency, and mechanical properties – to make sure that **every spool is perfect.** We are the only manufacturer that gives customers **the option to fully inspect the parameters of every filament spool.** Just scan a QR code on the spool to see all details online. We offer an entire range of various materials at **prusa3d.com** and it keeps growing every day!

5.1. PLA

PLA is the most commonly used material for 3D printing. It prints easily and prints from PLA are very hard. Perfect choice for printing large objects due to low shrinkage (prints don't warp on the bed) and for printing detailed small models.

Advantages	Disadvantages
• Easy to print, suitable for beginners • Easily print small detailed models • Trouble-free printing of larger objects • Almost odorless • Affordable • Wide range of colors	• Brittle and inflexible • Slightly worse temperature resistance (50-60 °C) • Difficult post-processing • Not suitable for outdoor use (low UV and temperature resistance)

Typical uses: Prototypes, toys, action figures, jewelry and small detailed models in general, architecture models and more!

Prints best on a smooth (or satin) print sheet. When post-processing PLA prints, it is best to use wet sanding to achieve better results. If you use sandpaper dry, the heat generated by friction can start to deform the printed object. PLA can only be dissolved in chemicals such as chloroform or heated benzene. For gluing, a good quality superglue is sufficient, certain types of PLA can also be glued with acetone.

- **Nozzle temperature:** 215 °C
- **Heated print bed temperature:** 50-60 °C
- **Print surface:** Make sure the print bed is clean, as per instructions in the Spring steel print sheets chapter.

5.2. PETG

PETG is one of the most popular materials for 3D printing. It is a great choice for parts that will be subject to mechanical stress. Compared to PLA, it has a higher temperature resistance, it is more flexible and less brittle. Thanks to its low thermal expansion, it holds well to the bed and does not warp. Printing with it is almost as easy as with PLA, but unlike PLA it offers much better mechanical properties. Parts of our printers are printed with PETG!

Advantages:

- Good temperature resistance
- Easy printing
- Low thermal expansion
- Durable and tough
- Easy machining (sanding)
- Printing almost without smell
- Glossy surface
- Good adhesion of layers.

Disadvantages:

- Not suitable for printing small/highly detailed models
- Nozzle can leave behind thin filament strands (stringing)
- Problematic bridging and overhangs
- Strong adhesion to the bed
- Cannot be smoothed with commonly available solvents, soluble only in dangerous chemicals
- Removal of supports can be difficult.

Typical use: Mechanical parts, Holders and cases, Waterproof prints (flower pots).

Tips and tricks:

PETG requires a higher heatbed temperature (85 °C). PETG usually has worse results when bridging two points, plus PETG tends to string - this means it's leaving fine plastic strings on the surface of the print (which can be relatively easily removed). Stringing can be reduced by setting appropriate retraction and using lower printing temperatures - we recommend sticking to the values in PrusaSlicer profiles. The print must be well cooled - it has better details and stringing can be prevented to some extent. However, if you want the most durable print, try turning off the print fan. A higher temperature will cause the layers to stick better to each other, resulting in better mechanical resistance. Generally, we recommend printing the first few layers with the fan turned off (for adhesion) and then turning it on at 50% power.

- **Nozzle temperature:** 240 °C
- **Bed temperature:** 70-90 °C
- **Print surface:** A textured print sheet and a satin print sheet do not require any special preparation, just keep them clean and free of grease. For a smooth print sheet, you should apply a thin layer of glue stick, as PETG may adhere too strongly to the sheet surface, making it difficult to remove prints from the sheet.

Do not print large PETG parts on the satin sheet - you might damage the surface. Instead, for large PETG prints use the textured powder-coated PEI sheet.

5.3. ASA (ABS)

ASA and ABS are very similar materials. In some respects, ASA is better than ABS. ASA is UV-stable compared to ABS and shrinks slightly less during printing. When it comes to post-processing, ABS and ASA can be similar, but the latter is currently more popular, so we will focus mainly on it.

ASA is a strong and versatile material. A higher melting temperature than PLA gives ASA good thermal resistance, so your prints will not show signs of deformation up to temperatures around 100 °C. Unfortunately, compared to PLA, ASA has a very high thermal expansion, which complicates printing, especially larger models. Even with a heatbed set to 100 °C, the print can start to warp and detach from the bed. ASA also produces a noticeable odor during printing.

Advantages:

• High impact and wear resistance (lower than PETG)
• Very good thermal resistance
• Suitable for outdoor use - UV stable
• Soluble in acetone - can be used for gluing
• Possibility of smoothing with acetone vapors
• Detailed prints without stringing (leaving fibers on the print)
• Easy post-processing (e.g. sanding, cutting, etc.)

Disadvantages:

• Difficult printing
• Tendency to warp (printing in an enclosed box is recommended)
• Unpleasant smell when printing (contains styrene)

Typical uses:

- Cases and protective covers
- Prototypes
- Spare parts
- Toys and figures
- Parts suitable for exterior use

Tips and tricks:

Printing with ASA/ABS is much easier if the printer is placed inside an environment with increased stable temperatures. This significantly reduces both deformation and layer separation. Thanks to acetone, it is easy to join several prints together. Just lightly rub the contact surfaces and press the parts together. In addition, it is possible to smooth the prints with acetone vapors and get a perfectly glossy surface. Be careful when handling acetone!

- **Printing temperature:** 220-275 °C
- **Bed temperature:** 90-110 °C (larger objects require higher temperature)
- **Print surface:** ASA and ABS materials work best with a satin print sheet, which requires no special preparation - just keep it clean and free of grease. However, if you are printing ABS/ASA on a grainy/smooth print bed, it is necessary to apply a glue stick.

5.4. PC (polycarbonate) and PC Blend

Polycarbonate (PC) is a technical material boasting excellent strength, tensile strength, and resistance to high temperatures. It is however quite demanding to print, thus making it suitable mainly for advanced users. This of course does not apply to our Prusament PC Blend, which is much easier to print compared to other polycarbonates. Polycarbonate surpasses all of the aforementioned materials in its mechanical, chemical, and thermal resistance.

Advantages

- High-temperature resistance
- High strength and tension resistance
- Clear polycarbonate is transparent
- Good electrical insulation properties

Disadvantages

- Pure polycarbonate is highly hygroscopic
- High nozzle and bed temperatures
- Strong warping, especially for large models
- Mild smell during printing
- Separating layer application recommended
- High price

Typical uses: Polycarbonate is mostly suitable for technical components, for which we require a higher resistance to mechanical wear and tear and high temperatures.

Tips and tricks: Consider printing in a closed box - to prevent warping of the printed objects; enable the "Brim" feature in PrusaSlicer - set it higher than the default outline, ideally to the whole height of the print; add a "Skirt" in PrusaSlicer around small objects; do not print in low-temperature zones;

- **Nozzle temperature:** 270-275 °C
- **Bed temperature:** 110 °C for the first layer, 115 °C for the following layers
- **Print surface:** Textured print sheet and smooth print sheet with a layer of stick glue offer the best adhesion properties. Although the textured print sheet offers good adhesion properties on its own, we recommend applying a separating layer of glue to prevent wear/damage of the surface.

5.5. PVB

Polyvinyl butyral (PVB) is a material that can be easily smoothed with isopropyl alcohol (IPA). Prints, when properly set up, are clear and transparent, thus making PVB a suitable material for printing vases, lamp shades, and other decorative models. The printing settings are similar to those for PLA, but the mechanical properties of PVB are slightly better.

Advantages

- Similar printing settings to PLA
- Transparent filament
- Suitable for decorative models - vases, lamp shades, etc.
- Chemical smoothing with IPA
- Good toughness
- Good tensile strength (similar to PETG and PLA)
- Less prone to warping (less than PLA)
- Suitable in combination with 0.8mm nozzle

Disadvantages

- Lower adhesion between layers
- Hygroscopic material (absorbs moisture)
- Higher price

Typical uses: PVB finds its best use when printing transparent (translucent) models – e.g. jewelry, vases, lamp shades, etc.

Tips and tricks: PVB has good adhesion to clean smooth or satin print sheet, while textured print sheets have rather poor adhesion. If you want to print translucent prints which you will later smooth with isopropyl alcohol, we recommend using a bigger nozzle (0.8mm) and enabling the "Spiral vase" mode in PrusaSlicer. When printing with multiple perimeters, the individual layers will be clearly visible even after smoothing with isopropyl alcohol. Store the filament in a dry environment – PVB is a material prone to absorbing moisture, which can negatively affect the quality of the print. Always return the filament to its plastic bag with silica gel, or let it dry for 4 hours at 60 °C before printing with it.

The main advantage of PVB material is that it can be smoothed with isopropyl alcohol (IPA). Models printed from PVB can be smoothed in IPA vapors, by immersing into an IPA bath, or by directly applying IPA on the object surface (by using a sprayer or brush). Detailed instructions can be found on our blog at blog.prusa3d.com.

- **Nozzle temperature:** 215±10 °C
- **Bed temperature:** 75 °C
- **Print surface:** Do not use the standard grainy print bed. PVB will better adhere to the clean smooth or satin print bed. Textured print sheets may not have sufficient adhesion properties.

5.6. Flexible Materials

Flexible filaments are typically very strong and elastic materials. In many cases, the classic hard plastic (PLA, PETG) may not be ideal or even completely unsuitable for certain models. Whether you are printing a phone case, a housing for an action camera or even wheels for an RC car, it is better to use a flexible material. These materials are often expensive and not very common and are not suitable for beginners.

Before you start printing with Flex, clean the nozzle from the previous material by inserting PLA into the preheated extruder and pushing out all the previous material. For Original Prusa 3D printers, we recommend using Semiflex or Flexfill 98A, or Filatech FilaFlex40, for which we have tuned profiles in PrusaSlicer. Feeding flexible filament into PTFE tubes is more demanding - feed the filament gradually and don't apply too much pressure.

Advantages:

- Flexibility and elasticity
- Minimal shrinkage
- Excellent adhesion of layers
- Great resistance to wear

Disadvantages:

- Requires a special procedure for inserting filament
- Very poor bridging and overhangs
- Requires lower print speed
- Higher price
- Absorbs moisture - must be stored in a dry environment

- **Nozzle temperature:** 220 - 260 °C
- **Bed temperature:** 40 - 85 °C. (larger objects require higher temperature)
- **Print surface:** If you are printing on a smooth or satin print sheet, apply a separation layer to it! A glue stick is ideal. Textured sheets with a powder-coated PEI surface do not require a separation layer - the print will hold well and can be easily removed from the sheet after cooling.

5.7. PA (Polyamide) / PA11CF

Polyamide (also known as Nylon) is a versatile material known for its durability and is commonly used for 3D printing special models due to its high difficulty in printing (not applicable to PA11CF) and higher costs. There are several types of polyamide, which differ in properties such as temperature resistance, water absorption and adhesion to different types of surfaces.

Prusament PA11CF has great temperature resistance (up to 192 °C), strong resistance to a range of chemicals, and prints easily. Some polyamides, including the PA11CF, are reinforced with carbon fibers to reduce shrinkage, often at the expense of mechanical strength. We recommend the PA11CF for printing extremely stressed parts, such as plastic engine components, etc.

Advantages:

- Great temperature resistance (can reach up to 192 °C)
- Resistance to a range of chemicals
- Hard and resilient in thick layers, flexible in thin layers
- Smooth glossy surface of clean PA
- Excellent layer adhesion
- Suitable insulation material

Disadvantages:

- Not suitable for printing small/highly detailed models
- Prone to warping (not applicable to PA11CF)
- Challenging bridging and overhangs
- Strong (or too weak) adhesion to the surface
- Cannot be smoothed with commonly available solvents, dissolvable only in dangerous chemicals
- Difficult to remove supports
- Highly hygroscopic material

Typical use: Mechanical parts, holders and housings, electrical insulation parts, movable parts, and parts requiring great temperature resistance.

Tips and tricks:

It is absolutely essential to keep the filament dry, otherwise its adhesion and overall printing quality will significantly worsen. Therefore, we recommend drying the filament for at least 4 hours at a maximum temperature of 90 °C before printing. The print from a dried polyamide should have a smooth and glossy surface, while materials reinforced with carbon fibers have a matte surface.

When printing polyamides, we recommend using an enclosed printer with active filtration or keeping the printer in a well-ventilated room. Not only are potentially hazardous particles released when printing (all) PA, but the higher ambient temperature also reduces warping and improves layer adhesion. Carbon-reinforced polyamides can be printed without a covered printer, but due to the internal tension caused by the sudden temperature change, the finished prints may have slightly worse mechanical properties.

- **Nozzle temperature:** 240 - 285 °C
- **Bed temperature:** 70 - 115 °C

- **Print sheet surface:** For printing most polyamides we recommend using our special PA Nylon print sheet, which ensures ideal adhesion even when its only cleaned with water. However, the adhesion of some types of polyamide may be too high, leading to damage to the sheet, so we recommend checking the compatibility in our material table (help.prusa3d.com/materials). We do not recommend printing polyamides on a smooth print sheet, and when using a textured or satin sheet a layer of paper glue (glue stick - Kores) must be applied.

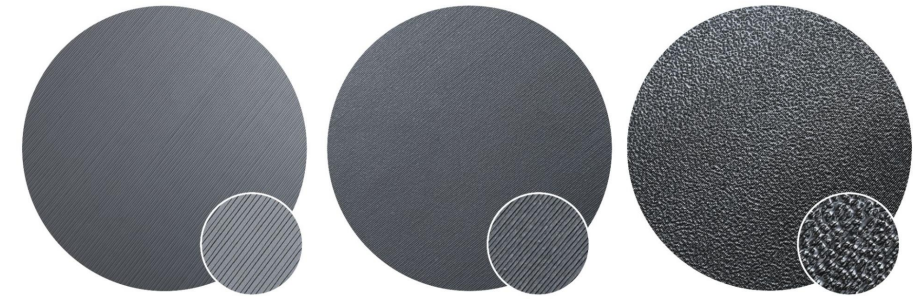
6. Regular Maintenance

The Original Prusa XL was designed from the beginning as a true print "workhorse". Despite its high reliability, it is still a device with mechanical components that require more or less regular maintenance. Follow the instructions below to keep your printer in perfect condition for as long as possible.

6.1. Flexible Print Sheets

To achieve the best adhesion of the print surface, it needs to be kept clean. Choose the right cleaning agent depending on the type of print sheet (see below). Drop a small amount of the agent onto a clean paper towel and wipe the print surface. Best results will be achieved when the print sheet is cold, otherwise, you may burn yourself on the nozzle or heated bed. Also, the alcohol will evaporate before it has a chance to clean anything. Details can be found in the chapter **Your First Print** in this manual.

The effect of various print sheets on the first layer can be seen below. From left to right: smooth, satin and textured powder-coated print sheet.



The print surface does not need to be cleaned before every print, just be aware of not touching it with your fingers.

Recommended cleaning agents differ slightly depending on the type of print sheet. Instructions for the use of specific materials (e.g. the need to use a separation layer to avoid damaging the surface) can be found in the previous chapter.

	Correct usage:	Risks and dangers:
Print sheet with smooth PEI surface	• Isopropyl alcohol 90%+ (IPA) is the best option for degreasing. Do not use dermatological hand products which may contain isopropyl alcohol - they contain other additives (ointments, hydrating ingredients). • Warm water with a few drops of dish soap (in case IPA does not remove residues like sugar from the bed) • Acetone - occasionally for thorough cleaning of the print sheet • When printing with Flex material you need to apply glue stick (Kores)	• Prints from PETG would stick too strongly to the sheet cleaned with isopropyl alcohol (IPA) and removing it could damage the surface. Materials such as PETG, ASA, ABS, PC, CPE, PP and FLEX should only be printed with a separating layer (glue stick).
Print sheet with a textured powder-coated surface	• Isopropyl alcohol 90%+ (IPA) - best for degreasing	• **Do not use acetone**
Satin print sheet	• Suitable for PLA and PETG • 90% isopropyl alcohol (IPA) is the best degreaser • For printing flexible filaments you need a separating layer of glue (Kores) • Broad spectrum of supported materials; including advanced materials such as PC Blend and others	• **Never use acetone!** • For printing ASA and PC Blend you need to add a brim, outline or shield around the print • Do not use sharp objects to remove the print from the bed!

Consumable materials such as print sheets are not covered by our warranty unless they arrive damaged or incorrectly manufactured. Print sheets are consumables and the warranty only applies to defects that appear immediately after unpacking.

All original print sheets made in Prusa Research are double-sided.

6.1.1. Double-Sided TEXTURED Print Sheet

- Surface resistant to damage and scratches
- Texture on the surface of the sheet is transferred to the bottom side of the printed object
- Simpler Z-axis calibration
- FLEX does not require glue (Kores) application to the print bed
- After the print sheet cools down, the print usually detaches itself
- PLA prints with small contact area may require a brim
- Large PLA prints may warp
- **Never clean with acetone**

The textured powder-coated surface applied directly to metal allows us to create a print sheet that is highly resistant to damage. If a heated nozzle hits it, the metal is able to quickly dissipate heat. **The textured powder coating also gives the bottom surface of the print a unique, interesting texture.**

The textured surface is able to mask most scratches and similar types of damage caused by various tools. One can only scratch the highest points of the texture, yet this type of damage will not be visible on the print.

Never clean the textured powder surface with acetone! This will cause micro-cracks in the PEI layer, which will eventually lead to a significant deterioration of the surface quality.

6.1.2. Double-Sided SMOOTH Print Sheet

- Excellent for PLA
- Great adhesion to almost all materials
- Smooth bottom layer of prints
- Even small prints will hold well
- Occasionally clean with acetone

For printing materials such as PETG, ASA, ABS, PC, CPE, PP, Flex and others, it is necessary to apply a glue separation layer. More information can be found in the Materials Guide.

The industrial adhesive used to attach the PEI layer to the print sheet tends to soften at temperatures above 110°C. The adhesive can then move beneath the surface, creating small bumps.

If you notice small bubbles appearing beneath the PEI layer on the flexible print sheet, just flip it over and print on the other side. After a few days or weeks, the bubbles should disappear. The bubbles have no effect on the print quality.

6.1.3. Double-Sided SATIN Print Sheet

- Suitable for PLA and PETG
- Soft texture on the bottom part of the print
- **Only use quality isopropyl alcohol (90+ %) to clean**
- FLEX requires the use of a glue separation layer (Kores) on the print sheet
- Wide range of supported materials, including advanced materials such as PC Blend and more
- Easy maintenance and good adhesion
- **Do not use acetone! Acetone will damage the surface of the print sheet!**
- When printing with ASA and PC Blend, a brim or a raft may be required around the print, depending on the model height
- **Do not use sharp metal objects to remove prints from the sheet (e.g. a metal spatula)**

6.1.4. Improving the Adhesion

In certain special cases, such as printing a very tall object that touches the print sheet with a very small area, it may be necessary to **improve the adhesion.** PEI is fortunately a chemically very resistant polymer, so it is possible to **apply various substances to improve adhesion without risking damage to the surface.** This also applies to various materials whose adhesion to PEI would be very weak under normal circumstances. More information can be found on the website help.prusa3d.com/materials.

Before applying anything to the print sheet, consider using the Brim feature in PrusaSlicer to increase the area of the first layer.

6.2. Keeping the Printer Clean

After several hours of printing, various kinds of debris may start to accumulate inside the printer under the heatbed - pieces of filament, dust, scraps, broken supports, etc. Always make sure that the internal parts of the printer are clean. You can use a brush, small broom or a vacuum to remove debris from the inside of the printer.

6.3. Linear Rails

Depending on the dustiness of the environment, you should **wipe the linear rails with a dry tissue every few dozens or hundreds of hours of printing** - never use wet wipes, sponges, etc. - linear bearings must not come into contact with water and degreasers.

This is all that is required for regular maintenance of the linear rails. It is not necessary to apply any sort of lube or grease onto the rails.

6.4. Threaded rods

In case the Z-axis threaded rods start producing a creaking/squeaking noise after several dozens or hundreds of hours of printing, use the enclosed Prusa Lube to lubricate the threaded rods. You