How to seal 3D prints with epoxy or a coating

Asked 3D Content Team
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Abstract. Brush-on epoxy step by step from the XTC-3D data sheet, Prusa's results for epoxy, lacquer, chemical smoothing and nail polish, and the food-contact rules.

Keywords: waterproofing, watertight, food-safety

1 How do you seal a 3D print with epoxy?

Mix a two-part brush-on epoxy, brush one thin coat over the whole surface and let it cure. Smooth-On's XTC-3D mixes 2:1 by volume, gives 10 minutes in the cup, is tack free in 2 hours at 23 °C and cured in about 4. Prusa Research's leaking PETG box became fully watertight after one epoxy treatment.

1.1 The procedure

Figures are from the XTC-3D technical bulletin. Other brush-on epoxies differ, so read the sheet that came with yours.

1. **Work at room temperature, with protection.** Smooth-On specifies 23 °C, a well-ventilated area, a respirator approved by NIOSH (the US National Institute for Occupational Safety and Health), gloves, long sleeves and safety glasses. The mix generates heat and can burn skin.
2. **Measure accurately.** 2 parts A to 1 part B by volume, or 100:42 by weight. Use plastic, metal or wax-free paper cups, never foam or glass.
3. **Mix for at least one minute.** Scrape the sides and bottom several times with a square-edged stick.
4. **Pour it into a flat foil tray.** Pot life in a cup is 10 minutes; spread thin in a tray it is 15, and a thin film stays workable for 20.
5. **Brush one thin coat** with a foam brush, under 0.4 mm. Keep working the surface until the resin starts to set so it does not run. Coat complicated prints one section at a time.
6. **Recoat if needed** once the first layer is tacky hard, within about 90 minutes.
7. **Cure.** Tack free in 2 hours at 23 °C, cured in a thin layer in 3.5 hours. Mild heat of 60 °C cures it in 15 minutes, but some print materials deform above 93 °C, so keep the oven low.
8. **Fill and test** before trusting it. The leak test is a night on a dry tissue.

One 28 g mix covers 651 cm² at that thickness, so a small kit does several parts. The cured coat is Shore D 80, sandable and paintable. Smooth-On lists PLA (polylactic acid), ABS

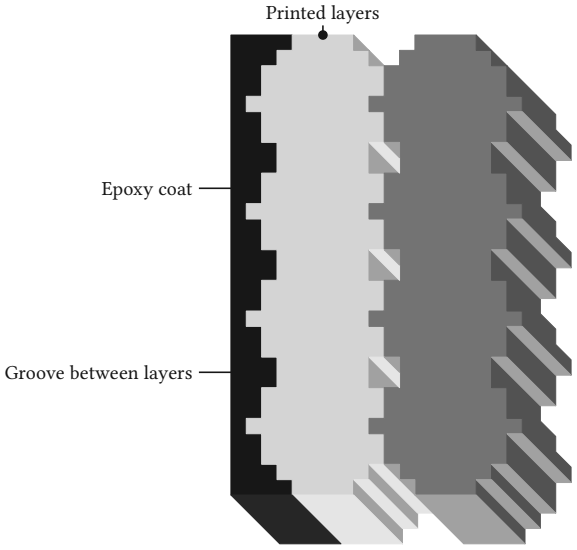


Figure 1. One thin brushed coat covers the outer face of the wall, including the grooves between layers.

Table 1. Which coating for which job

Coating class	How it goes on	Result in Prusa's tests	Food contact
Two-part epoxy	brushed, cured hours to days	leaking PETG box became fully watertight; also improved mechanical properties	only a certified food-contact epoxy, cold use
Acrylic lacquer spray	sprayed inside and out a few times, left to dry	seals surface pores; Prusa gives no depth figure	Prusa advises against it for food
Chemical smoothing	acetone vapor, ABS, ASA, HIPS and PVB only	acetone-smoothed ASA still leaked slowly in the closed-box test	not addressed
Nail polish	brushed from the bottle	works on small areas; impractical and expensive	not addressed

(acrylonitrile butadiene styrene) and PETG (glycol-modified PET) among the plastics it bonds to.

1.2 Which coating for which job

Prusa tried four ways to seal a print that still leaked after the slicer changes on the watertight guide:

Epoxy is the only class Prusa found that both sealed a failed part and can be made food safe. The cost is fumes, gloves and, in Prusa's words, a cure that may take several days for the resins it used.

1.3 Sealing PLA

Nothing in the procedure changes for PLA. Smooth-On names PLA as a supported surface, and Prusa's part 1 lists lacquer and epoxy as options for every material. The one PLA-specific rule is the oven: PLA softens above 60 °C, so cure a PLA part at room temperature rather than the 60 °C fast cure.

1.4 Food-safe epoxy

A watertight coat is not a food-safe coat. Prusa's food-grade study used Efkoresin Art UV, an epoxy certified under EU regulation 10/2011, and after 14 days of simulated use the coated print grew no bacterial colonies while the untreated print grew the most. Resin Pro's Epoxyfood is another resin built from the 10/2011 positive list: 100:55 by weight, workable after about 10 hours, fully cured in 24 to 48 hours, and rated to 70 °C.

Three rules follow from those sources:

- **Cured only.** Prusa notes that every epoxy resin is toxic in liquid form. Food contact starts after the full cure the maker states, not when it feels dry.
- **Cold use only.** Prusa rules out chopping boards, hot soups, microwaves and dishwashers for coated prints. Resin Pro certifies its resin for cold snacks.
- **Personal use.** Prusa holds no food-contact certification for its filaments and says such prints are not for sale.

A general-purpose print coating like XTC-3D carries no food-contact statement in its data sheet, so treat it as a sealant for vases, housings and outdoor parts, not cups.

1.5 Cookie cutters and other short-contact parts

Prusa's Knowledge Base says a printed cookie cutter is fine to make, with one limit. Food collects in the layer lines and bacteria grow there, so the cutter is something "you want to throw away after some use." The article asks for no coating. It treats the cutter as disposable instead.

The same article sets the print conditions:

1. **Nozzle:** stainless steel or titanium. Prusa does not consider a standard brass nozzle food safe because it wears, and its food-grade blog adds that brass can contain lead.
2. **Filament:** natural PETG with no colorant, which Prusa calls the "best bet".
3. **Coating, optional:** a certified food-contact epoxy from the section above, after its full cure. In Prusa's milk test the coated surface grew no colonies in 14 days. Raw dough is cold food, so a coated cutter stays inside the cold-use rule.

For parts that touch food every day, see food-safe appliance parts.

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