Does wet filament make prints weaker?

Asked 3D Content Team
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Abstract. Yes: printing from wet filament cost polycarbonate up to 30% of its strength along the lines and 70% across them, ABS 25% and PA6 nylon 43%. PLA held a week at 65% RH.

Keywords: part-strength, nylon, pla

Table 1. The number

Filament (study)	How wet before printing	Printed strength against dry	What else changed
PLA, four grades (Quader, 2024)	1 week at 50 or 65% RH, 25 °C	4043D within 3.73%; the other three not significantly affected	None reported
PLA 4043D (Quader, 2024)	1 week at 80% RH, or 1 week under water	"Reduced drastically" (no figure in the text)	Porosity 1.16% dried, 2.97% after the soak
PLA, four grades (Quader, 2024)	3 months in room air	24 to 36% lower	Weight gain minimal; the authors suspect hydrolysis
ABS (Hamrol, 2024)	Filament moisture 0.17% up to 0.75%	About 25% lower	Bubbles inside; samples swelled and came out about 1.5% lighter
PC (Fang, 2020)	Up to 0.15% water by mass (24 h at 70% RH, 22 °C)	Up to 30% lower along the lines, up to 70% lower across them	Porosity 0.16% dried, up to 11.7% wet
PA6 nylon (Thanasuptawee, 2024)	7 days against 35 days in lab air	43.1% lower	Impact resistance 29.2% lower
Overture Easy Nylon (Gong, 2022)	0.9% against 5.5% water (72 h at 40 °C, 80% RH)	Yield and ultimate strength lower (no figure in the text)	Wet bars broke at 8% strain; two bars from the fresh spool hadn't broken when the extensometer ran out of travel

1 Does wet filament make prints weaker?

Yes. Absorbed water flashes to steam in the nozzle and leaves pores in the part. In a 2020 study, polycarbonate filament holding 0.15 percent water printed up to 30 percent weaker along the lines and 70 percent weaker across them. PLA (polylactic acid) kept a week at 65 percent relative humidity stayed within 4 percent of dry.

That's printing from wet filament. A nylon part that soaks up water after printing is a separate effect: it gets weaker and much less stiff, but far tougher.

1.1 The number

Each row comes from the study named, all listed under Sources. RH is relative humidity. ABS is acrylonitrile butadiene styrene and PC is polycarbonate. PA6 is nylon 6.

1.2 Why

Bambu Lab says the moisture vaporizes in the hot nozzle and makes the melt "expand, extrude erratically, and form bubbles," which reduces strength. The pores cut the load-bearing cross-section and act as crack starters, Fang and colleagues found. Long storage can do more than add water: Quader's team suspects the 3-month PLA lost strength because its polymer chains hydrolyzed, though it gained almost no weight.

How much it matters depends on the plastic. Prusa says PLA "doesn't change properties too much by uptaking humidity," while polyamide (nylon) is "affected quite significantly." Badly stored polyamide can absorb water up to 10 percent of its weight, per the Prusa Knowledge Base.

1.3 Does wet filament affect layer adhesion?

Yes, and the layer bond takes the bigger hit. Fang's polycarbonate bars lost up to 70 percent of their strength across the printed lines, more than twice the loss along them. Prusa and Polymaker both list poor layer adhesion as a sign of wet filament. CNC Kitchen's older test found lower layer adhesion and impact strength from undried PETG (glycol-modified polyethylene terephthalate).

Bonds between lines and layers are the weak direction even when dry, which is why print orientation matters for loaded parts.

1.4 Is wet filament brittle?

It can make brittle prints. Whether it makes a brittle spool is disputed. Polymaker says wet filament gives "weak, brittle layers," and Gong's wet nylon bars broke at 8 percent strain. CNC Kitchen explains the chemistry: at high temperature water breaks the long polymer chains, and the shorter chains "can make your parts more brittle."

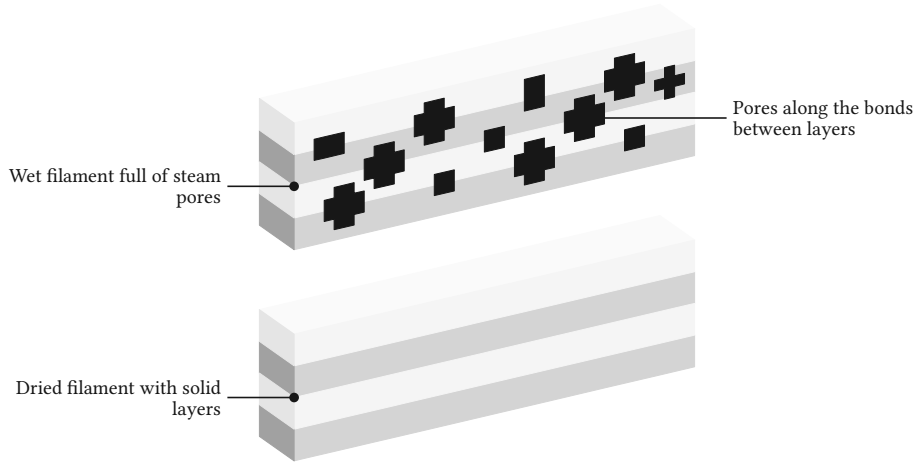


Figure 1. Steam from the absorbed water leaves pores in the part, which cut the load-bearing cross-section and act as crack starters.

On the spool, the makers split. Bambu Lab says filament "can break inside the tool head, if it not dry enough." Yet Bambu also says "a very dry or old filament can quickly become very brittle." Polymaker blames brittleness partly on long vacuum sealing "that partially dehydrates the polymer." Quader's team pulled the filament itself: moisture-conditioned 4043D lost 20 percent of its tensile strength but stretched further before breaking. Wet made it weaker, not more brittle.

1.5 Does drying filament make it less brittle?

It can, says Polymaker. Its first fix for snapping is to dry the filament, because "drying can improve layer adhesion and reduce snapping." If the spool sat vacuum-sealed for a long time, it says to remove the outer 50 g, where tension or dehydration made the winding brittle.

Don't keep drying it. CNC Kitchen warns that repeatedly heat-drying filament damages the polymer chains much as moisture does, "making it more brittle." Drying once or twice is usually fine.

1.6 Does moisture weaken a finished nylon part?

It lowers strength and stiffness but raises toughness. Forward AM tested printed Ultrafuse PA bars both ways:

Table 2. Does moisture weaken a finished nylon part?

Ultrafuse PA property	Dried (80 °C, 504 h)	Conditioned (70 °C, 62% RH, 336 h)
Tensile strength, flat (XY)	61.4 MPa	32.2 MPa
Tensile strength, upright (ZX)	16.4 MPa	17.6 MPa
Young's modulus, flat	2419 MPa	395 MPa
Elongation at break, flat	9.6%	143.3%
Elongation at break, upright	0.8%	12.8%
Notched Izod impact, flat	5.8 kJ/m²	85.4 kJ/m²

The upright bars, loaded across the layers, held their strength and stretched 16 times further. CNC Kitchen's nylon didn't keep its layer bond as well. Its SUNLU PA6-CF (carbon-fiber nylon 6), conditioned to about 3 percent water, kept 56 percent of its 140 MPa dry strength. Its layer adhesion dropped significantly, while its impact strength more than tripled. The SUNLU carbon-fiber PA12 (CF-PA12) took up about 0.7 percent water and lost 15 percent of its strength, with layer adhesion barely affected.

A data sheet's single figure is often the dry one. Bambu Lab anneals and dries its glass-fiber PA6 (PA6-GF) test bars at 80 °C for 12 hours before testing. Soaked-part figures are in is 3D printed nylon waterproof.

1.7 How to check it on your own print

- **Weigh the spool before and after drying.** Even after two weeks in a desiccant cabinet, heat-drying CNC Kitchen's nylon spool removed almost 2 percent more of its weight (about 20 g). Cardboard skews the reading: CNC Kitchen judged that most of the weight its PLA roll lost was water in the cardboard spool.
- **Listen at the nozzle.** Polymaker says popping or hissing is water vapor escaping.
- **Print the same test piece twice.** Print it from the current spool, then again after drying, and break both. Bambu Lab's oven settings are 50 °C for 8 hours for PLA Basic and 75 to 85 °C for 8 to 12 hours for PA6-CF and PA6-GF.
- **Bend the spool end.** If it snaps, dry it once. If it still snaps, cut off the outer 50 g as Polymaker advises, and route it without sharp bends.
- **Size nylon parts for the conditioned column** if they'll live in humid air, not for the dry data sheet value.
- **Seal dried filament right away.** Bambu Lab says freshly dried filament at about 55 percent RH can pick up enough moisture to hurt print quality within 2 to 12 hours, and recommends storage below 20 percent RH.

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