Do 3D prints float in water?

Asked 3D Content Team
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Abstract. A closed print with sparse infill usually floats. Solid PLA (1.24 g/cm³), PETG, ABS and nylon sink in water (1.00 g/cm³); polypropylene (0.9 g/cm³) floats.

Keywords: watertight, pla, petg

Table 1. Filament density against water

Filament (maker's data sheet)	Density, g/cm³	Solid part in fresh water (1.00)	Solid part in sea water (1.025)	Most plastic a sealed print can hold and still float in fresh water
PLA: Prusament PLA, Bambu Lab PLA Basic	1.24	Sinks	Sinks	81% of its volume
PETG: Prusament PETG	1.27	Sinks	Sinks	79%
TPU: Prusament TPU 95A	1.25	Sinks	Sinks	80%
Nylon: Polymaker PolyMide CoPA	1.12	Sinks	Sinks	89%
Glass-filled PP: Prusament PP Glass Fiber	1.12	Sinks	Sinks	89%
ASA: Prusament ASA	1.07	Sinks	Sinks	93%
ABS: Bambu Lab ABS	1.05	Sinks	Sinks	95%
Nylon: Prusament PA11	1.02	Sinks	Floats, barely	98%
Carbon-filled PP: Prusament PP Carbon Fiber	0.91	Floats	Floats	No limit
PP: Spectrum PP	0.9	Floats	Floats	No limit

1 Do 3D prints float in water?

Usually, yes: a closed print with sparse infill floats because its walls trap air. Solid PLA (polylactic acid, 1.24 g/cm³), PETG, ABS, ASA, TPU and nylon sink: each is denser than water (1.00 g/cm³). A print sinks once water leaks in and fills the infill, or when printed nearly solid. Polypropylene (PP), at 0.9 g/cm³, floats even solid.

1.1 Filament density against water

A solid part floats only if its filament is lighter than water.

Densities come from each maker's technical data sheet: Prusa Polymers for the Prusament filaments, plus Bambu Lab, Polymaker and Spectrum Filaments. Fresh water is 1.00 g/cm³ per the USGS. Sea water is taken as 1.025 g/cm³, the constant in NOAA's World Ocean Database. The last column is 1.00 divided by the density.

PETG is glycol-modified polyethylene terephthalate, TPU thermoplastic polyurethane, ABS acrylonitrile butadiene styrene, ASA acrylonitrile styrene acrylate, and PA11 polyamide 11, a nylon.

Fillers move the number. Prusa Polymers' glass-filled PP sinks at 1.12, while its carbon-filled PP floats at 0.91.

1.2 Why a print floats when its plastic sinks

What decides it is the print's average density: its mass divided by the whole volume inside its outer surface, air included. Walls, top layers and bottom layers close off the sparse infill, and the air inside weighs next to nothing. Prusa Research says the "numerous air pockets" in cubic infill can make an object float on water.

Run the numbers for PLA. A sealed PLA print floats while plastic fills less than 1.00 ÷ 1.24 = 0.81 of its outer volume, or 81 percent. In sea water the limit rises to 1.025 ÷ 1.24 = 0.83. Prusa Research builds 10 to 20 percent infill into its PrusaSlicer profiles, which leaves most of the inside as air.

Size and shape change the answer. Xometry notes that a thin, flat plate comes out completely solid when it is thinner than its top and bottom layers combined. A large cube, by contrast, can end up with a very low density. So a thin PLA plate sinks like solid plastic, while a bulky closed part has far more room for air.

1.3 Why a floating print sinks later

Water gets in. Prusa Research watched PETG test parts leak "really quickly through the seams and contact points between perimeters and solid infill", and warns of "air pockets and crevices allowing the water to leak inside the model".

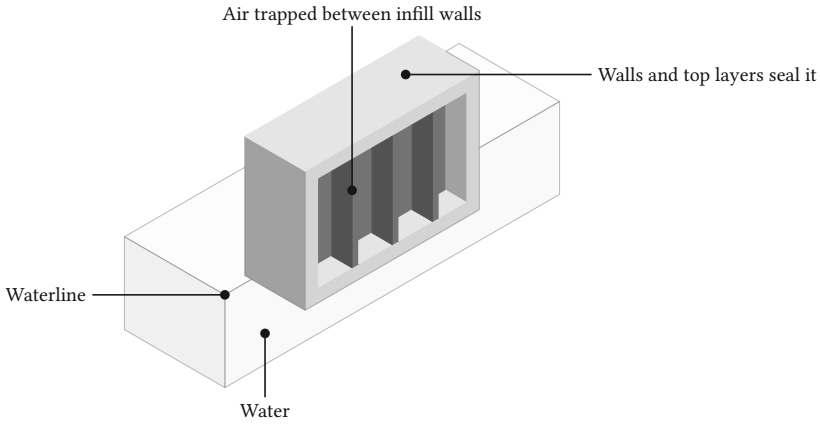


Figure 1. The walls and top layers close off the sparse infill, so the air inside keeps the whole print lighter than the water it pushes aside.

The Prusa Knowledge Base adds that a thick wall with infill can leak into the void between its inner and outer walls.

As water replaces the trapped air, the average density climbs toward the solid figure in the table. Once it passes 1.00 the print sinks. Unfilled PP is the exception: its plastic is lighter than water, so even a flooded PP print stays afloat. Xometry warns that liquid trapped in light infill sometimes does not dry out and can leak out later.

1.4 How to make a print float, or sink, on purpose

To keep it floating:

- **Close the shell.** In Prusa Research's leak tests, PLA, PETG and nylon needed four perimeters to hold water. ABS, ASA and PP needed two. The other settings are on how many walls make a print watertight.
- **Keep some infill.** Prusa warns that without infill the top layers can come out with small gaps or even large holes: leak paths straight into the print.
- **Split the inside into chambers.** Prusa suggests PrusaSlicer's solid-infill-every-n-layers setting for parts meant to float. It prints solid layers at intervals, which divide the inside into separate cavities. A leak then floods one cavity instead of the whole print.
- **Seal the surface.** The watertight 3D prints guide covers sealing along with the print settings.
- **Print it in unfilled PP.** It stays up even flooded, because the plastic is lighter than water.

To make it sink:

- **Print it at 100 percent infill** in a filament denser than water. PLA, PETG and TPU sink clearly. ABS and ASA sink too, but they are only 0.05 to 0.07 g/cm³ heavier than fresh water.
- **Leave an opening.** A print open to the water floods and sinks, unless it is printed in unfilled PP.
- **Add weight.** Pause the print before the top layers and drop steel nuts or ball bearings into a pocket in the model.

1.5 How to check it on your own print

1. Weigh the dry print on a kitchen scale, in grams.
2. Half-fill a measuring jug with water and note the level in milliliters.
3. Push the print just under the surface with a thin skewer and read the new level. The rise in milliliters is the print's volume in cubic centimeters: NIST defines the milliliter as a cubic centimeter.
4. Divide the grams by the cubic centimeters. Under 1.00 floats in fresh water; under 1.025 floats in sea water.
5. To find a slow leak, hold the print underwater for a few hours. Shake it out, towel it dry and weigh it again. Any gain is water inside the infill: add perimeters or seal the surface, then test again.

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