ObJet 30Pro 3D Printer

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Location: 228 Duffield

Specs

Maximum build size – 294 x 192 x 148 mm (XYZ)
Resolution (XY) – 600 dpi (42-micron spacing)
(Z) –1587 dpi for VeroClear (16-um layer)
900 dpi for other (28-um layers)
Accuracy – tolerances ± 120 microns
Minimum feature size –500 microns (give or take)
Input file requirement - .STL or .SLC format

How it Works

PolyJet© technology combines ink-jet technology with UV curable polymers to produce detailed, physical devices. CAD files (.STL format) are sliced into vertical layers of 16 or 28 microns. Each layer is printed, UV-cured, and flattened before the next layer is added. Removable support material is jetted to add strength to sidewalls and to support overhangs. Cured devices can be handled and cleaned right after printing.

Model Materials

VeroClear RGD 810 – PMMA (acrylic/plexiglass)-like
colorless (grey tint at thicknesses > 10 mm)
highest printing resolution

High-temperature RGD 525 – acrylonitrile butadiene styrene-like; white opaque
withstands 75 – 80 °C.

DurusWhite RGD 430 – like polypropylene, polystyrene or HDPE; white opaque.

VeroBlackPlus RGD 875 – black, opaque.
VeroWhitePlus, VeroBlue, VeroGray.

Removable Support material

FullCure705 – Swells in water and basic solutions
-physical removal-water, picks, sanding
-adds strength while printing
-supports features over empty spaces.

CAD software and computer interface

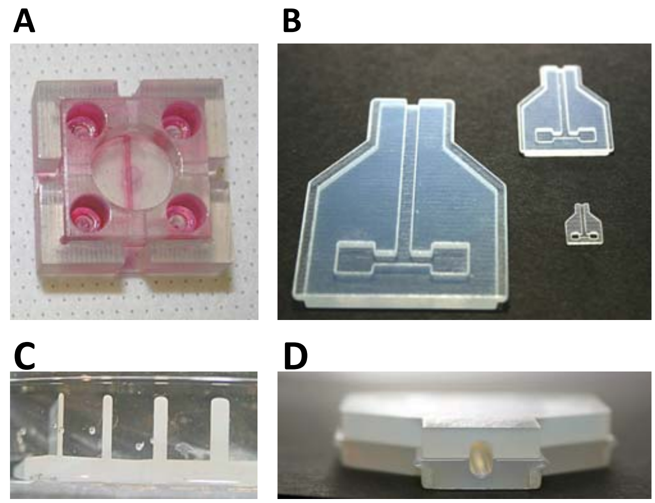
Any program that outputs in .STL or .SLC format.
Free CNF CAD software: AutoDesk Inventor 2014

ObJet control software can rescale any .STL input file.

Applications

Most economical for devices smaller than 5" cubed)

- Prototypes (at scale or enlarged)
- Fluidic cell culture devices*
- Open-faced fluidic molds*
- Jigs to hold devices
- machine parts
- PDMS master molds*



A Fluidic cell culture device; **B** Fluidic needle guide prototypes at different scales (top view); **C** Mold cast in PDMS; **D** Assembled fluidic needle guide with side ridge (side view).

*Devices require post-printing treatments (outgassing, parylene coating, anti-stiction treatment or sterilization) depending on the use.

Sidewalls – can be sloped or vertical. More challenging to be vertical at low height:width aspect ratios.

Threaded screw holes – easily printed from CAD.

Channels – open channels are better. Enclosed channels (or other enclosed features) can be printed, but not cleared of support material.

Smoothness – vertical walls are scalloped (due to each layer being applied) and are likely to outgas unless covered with parylene or another polymer. Horizontally printed surfaces show intermittent printer drops and streaks, not absolutely flat.

Manufacturer: Stratasys (http://www.stratasys.com)

How long to print a device?

The larger or taller the device, the longer it takes to print. The quickest jobs take about an hour.

A device that is the size of an iPhone-sized device would take 4 to 6 hours to print.

- The printer heads will calibrate for 30 min. During this time the file (.STL format) can be loaded with the exact dimensions and number of copies.
- The job will print for 3 hours or 5.5 hours depending on the material. Opaque materials are printed in vertical layers of 28 microns, and the clear material is printed in 16-micron layers.

How do I clean the printed device?

A support material is printed in spaces with overhangs and along edges to keep features from collapsing. This material is designed to swell in water so that it can be physically removed.

A typical cleaning involves these steps:

A) 30 minutes - soak in soapy water
-remove the support by picking and spraying

B) 30 minutes - repeat the soak in soapy water
-repeat physical removal

C) 30 minutes - soak in 2% NaOH to loosen any remaining support residue
-rinse & wipe away the support residue

Other common post-treatments involve:

D) baking to make the material resistant to low heat (75 °C).

E) outgassing and parylene coating to prepare for cell culture

F) outgassing and antistiction treatment (silane, FOTS) for use as a mold

Can I get trained to use the printer?

Yes. That is our typical mode of operation. A CNF User can bring a .STL file for a small device and, in a couple of hours, be trained and have a device in hand. We also provide help in learning the basics of 3D CAD programs using AutoDesk Inventor 2014.

Can someone else print my device?

Yes. You can arrange for CNF staff or contractors to print your files if you don't mind paying for their time. CNF staff will accept a .STL file and a printing order form from any CNF User with a remote project account. Alternatively, you can make arrangements with an independent contractor who has can work in the CNF. (http://www.cnf.cornell.edu/cnf_remotework.html)

How much does it cost for CNF staff to print my device?

We charge for the material, the time the tool is used and staff time. The time it takes to print depends on the size of the device, choice of material and the height of the device as it prints.

The smallest printed devices have been clips, shallow trays or fluidic molds that are less than 1 cm tall. Most have used a couple grams of ink and taken an hour to print. They cost about $90 for academic users (those paying through an academic account) or $200 for non-academic users.

To print something the size of an iPhone, someone paying through an academic (i.e. university) account would pay $230 to $280:

- $65 worth of ink
- $110 in staff time
- $56 for a 3-hour run or $100 for a 5.5-hour run depending on the material.

If the iPhone were flipped up on end to print, it would take over 18 hours to print and cost much more to print, so we normally orient devices to print as quickly as possible unless there are small openings that must remain clear of support material.

What are the properties of the printed materials?

Most information is closely guarded by Stratasys. So we are testing properties such as chemical reactivity and resistance, melting temperatures, and biocompatibility. Check the tool page and the CNF Wiki site for up-dates.

Solvent testing – underway.

Operating temperatures – all but RGD 525 become soft at 42-45 °C. RGD 525 can withstand 75-80 °C.

Biocompatibility – testing underway. Promising results with long-term tissue culture in VeroClear that was coated with parylene C.

Can more than one model material be printed in a device?

Sorry, no. One model material plus the support material can be printed in a job.