TECHNOLOGY & HARDWARE

Assoc. Prof. Dr. Yalçın İŞLER

http://me.islerya.com/tech_hw.php

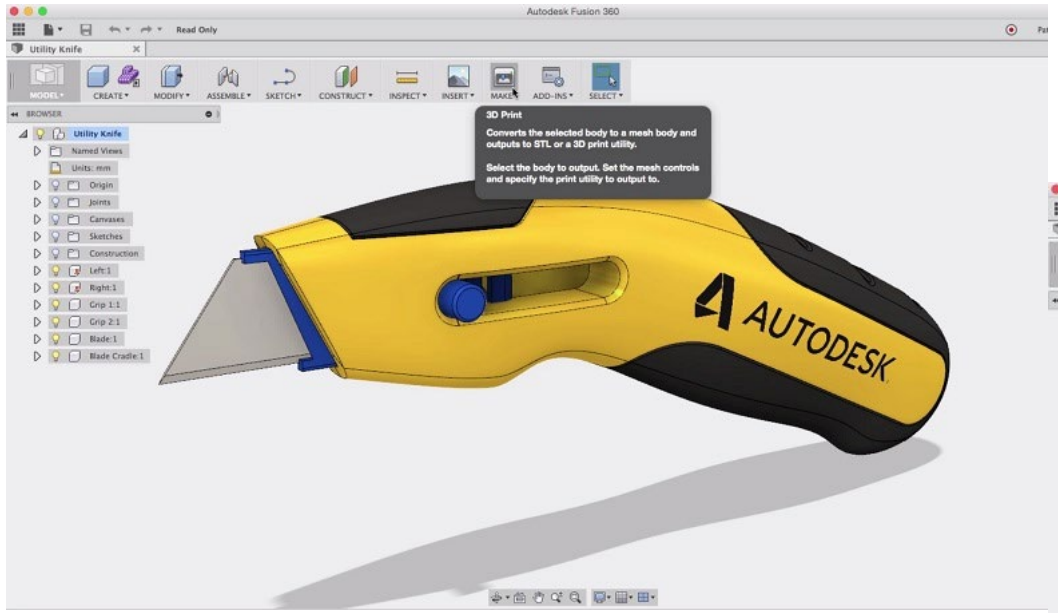
@ 2019-2021

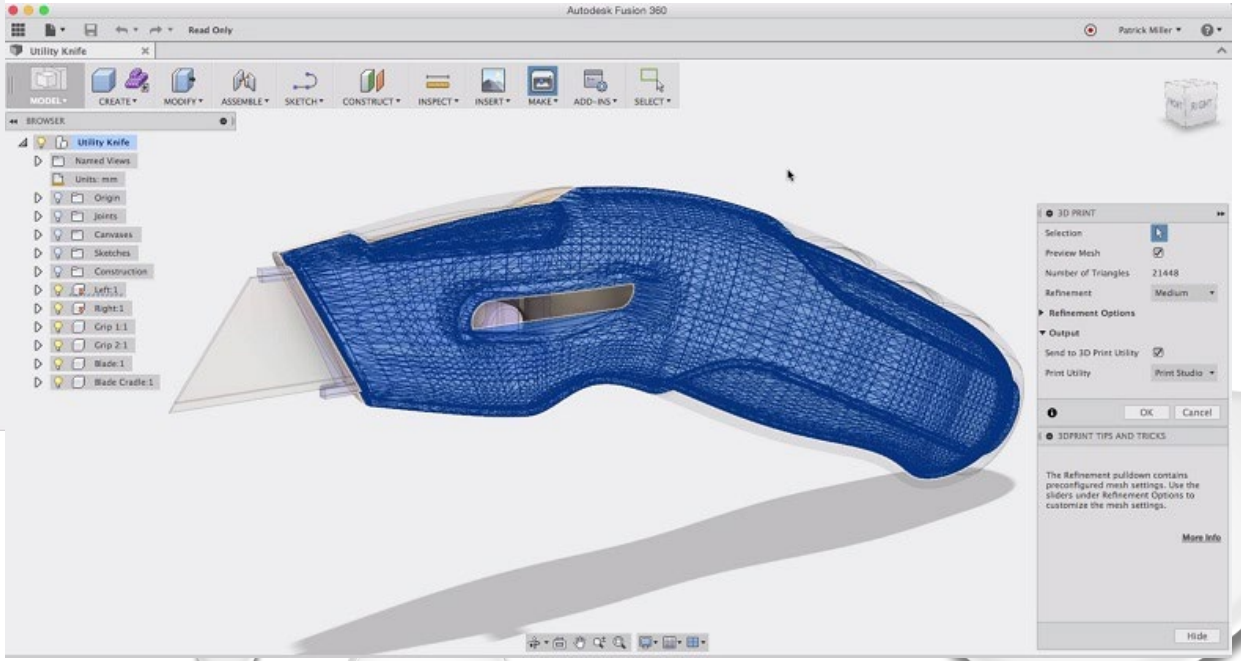
3D Modeling Rules for 3D Printing

As with any other program, Fusion 360 users need to make sure to stick to certain design rules when it comes to 3D printing. A 3D model might look perfect on your screen, but would not be able to exist as a geometrical object in the real world. This is a problem in particular for programs mostly used by visual artists and game developers. Luckily for us, Fusion 360 is mainly used by industrial designers to create functional parts. That's why the transition from virtual 3D model to actual 3D print is quite easy with this software.

- Wall Thickness: Printers need information about how thick you intend the wall of your object to be (or if you want to print a completely solid model). Therefore, when turning a 3D model into a real 3D print, the wall thickness or volume information of the model is needed. You simply cannot print an object that has a 'paper-thin' wall without substance.
- Watertight: A printable model must not have any holes in its surface. Ask yourself the question: if I were to put water inside my model, would it flow out? If that's the case, then you need to find those holes and close them. Sometimes this process is also called 'creating a manifold model'
- Grouped Models: While it is possible to export several bodies in a single STL file (so-called grouped models), we recommend you to export one model at a time

Now that your design is ready for 3D printing, select the MAKE command.





Now select the body that you intend to print by clicking on it.

File Resolution of 3D Print

On the right-hand side of your screen, you will see a window with additional 3D printing settings to choose from. These are mainly about the resolution of your 3D print. A very low resolution will make the print look somewhat pixelated. A resolution that is too high will make the file very – or even too heavy – to handle.

Besides the pre-defined resolution options of “low, medium or high”, you can click on “Refinement Options” to customize the settings.

File Type of 3D Print

At the bottom of the settings window, you can decide upon the “output” of your 3D print.

You can either export it as an STL file (the most popular 3D printing file format) or continue with Autodesk’s print studio to prepare this model for the 3D printer. If you go for the latter option, the selected body will be exported from Fusion 360 and imported to a newly opened Autodesk print studio window.

https://youtu.be/Uzg0VJuBA9s

Original Prusa i3 MK3


Ultimaker 3

SLA Yazıcı

Sinterlem
e

ABS

ABS is a low cost material, great for printing tough and durable parts that can withstand high temperatures.

PLA

PLA is the go-to material for most users due to its ease-of-use, dimensional accuracy, and low cost.

Flexible

Flexible filaments, commonly referred to as TPE or TPU, are known for their elasticity allowing the material to easily stretch and bend.

HIPS

HIPS is a lightweight material most commonly used as a dissolvable support structure for ABS models.

PETG

PET and PETG filaments are known for their ease of printability, smooth surface finish, and water resistance.

Nylon

Nylon is a tough and semi-flexible material that offers high impact and abrasion resistance. It is an ideal choice for printing durable parts.

Carbon Fiber Filled

Carbon fiber filaments contain short fibers that are infused into a PLA or ABS base material to help increase strength and stiffness.

ASA

ASA is a common alternative to ABS and is great for outdoor applications due to its high UV, temperature, and impact resistance.

Polycarbonate

Polycarbonate is known for its strength and durability. It has very high heat and impact resistance making it an ideal choice for tough environments.

Wood Filled

Wood filaments combine a PLA base material with cork, wood dust, or other derivatives, giving the models a real wooden look and feel.

Metal Filled

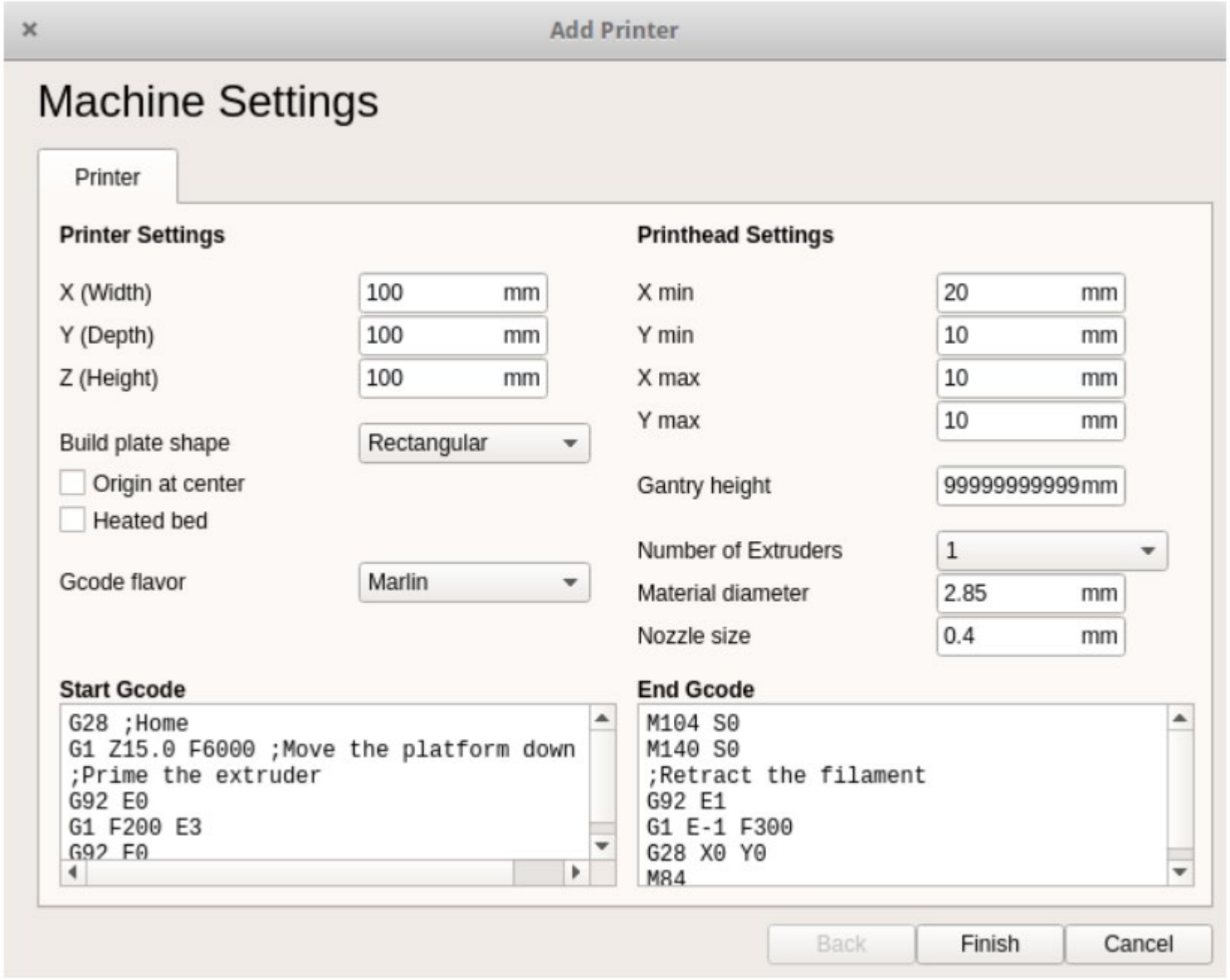
Metal filled filaments are made by mixing a fine metal powder into a base material, providing a unique metallic finish and added weight.

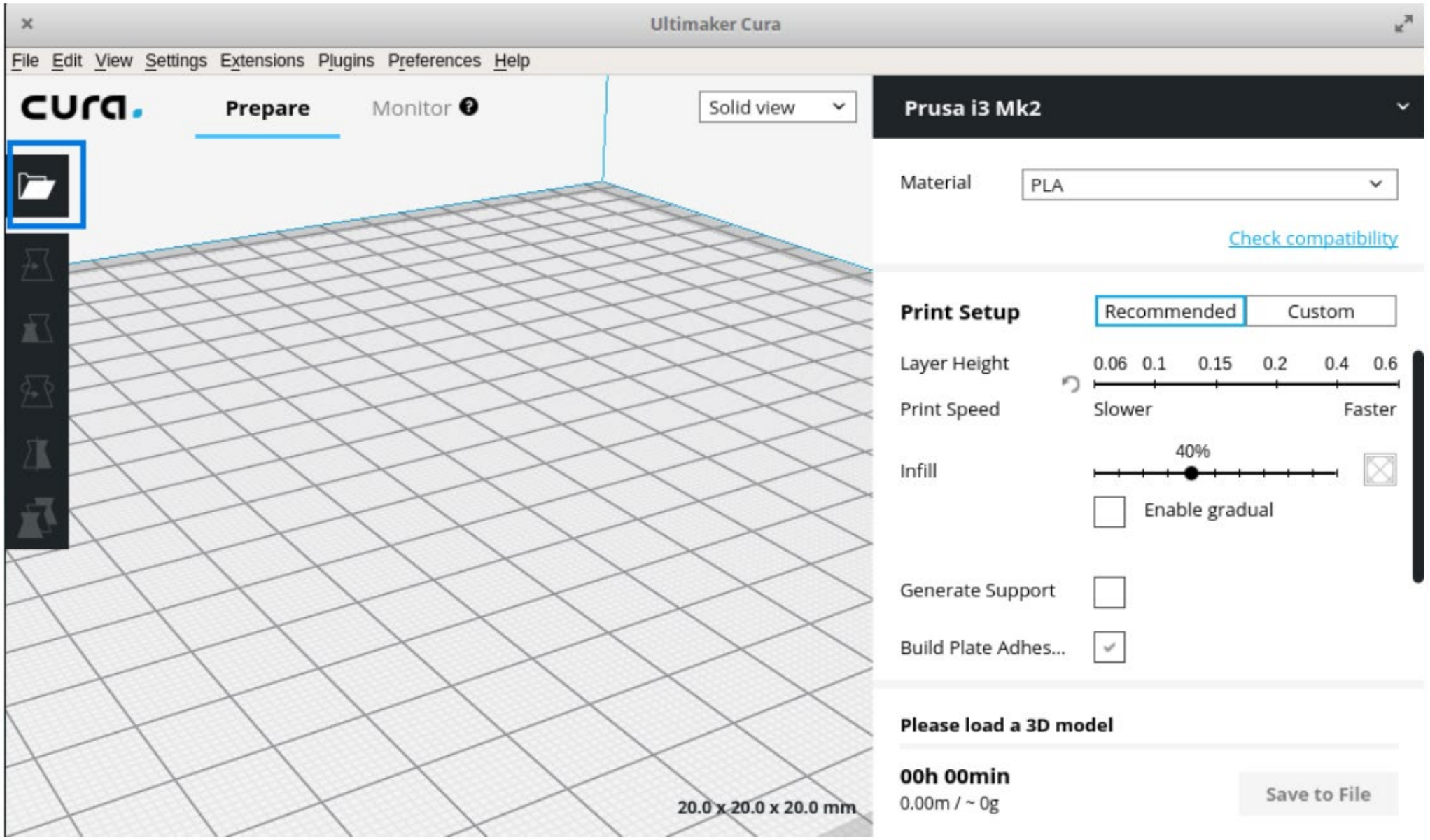
PVA

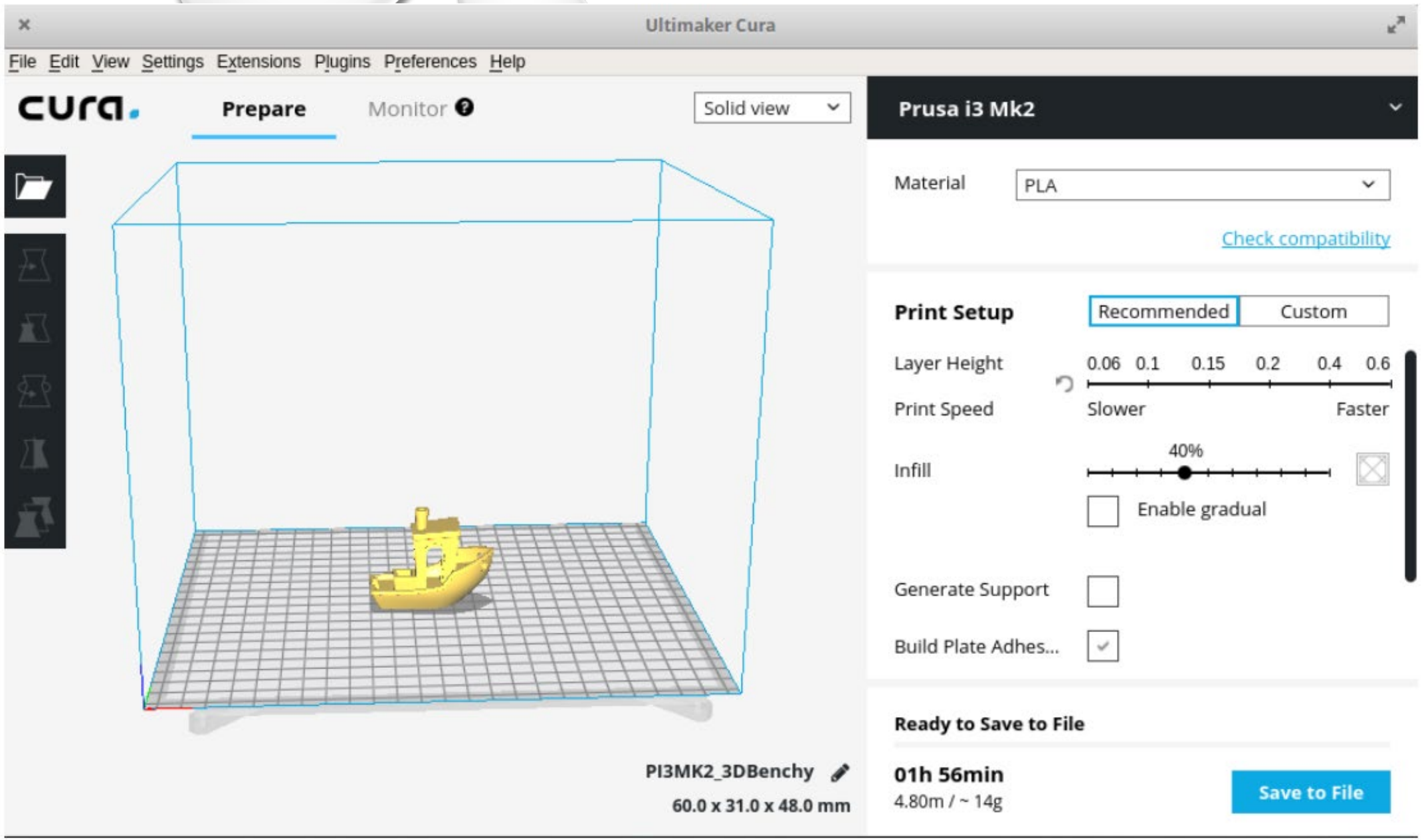
PVA is commonly known for its ability to be dissolved in water and is often used as a support material for complex prints.

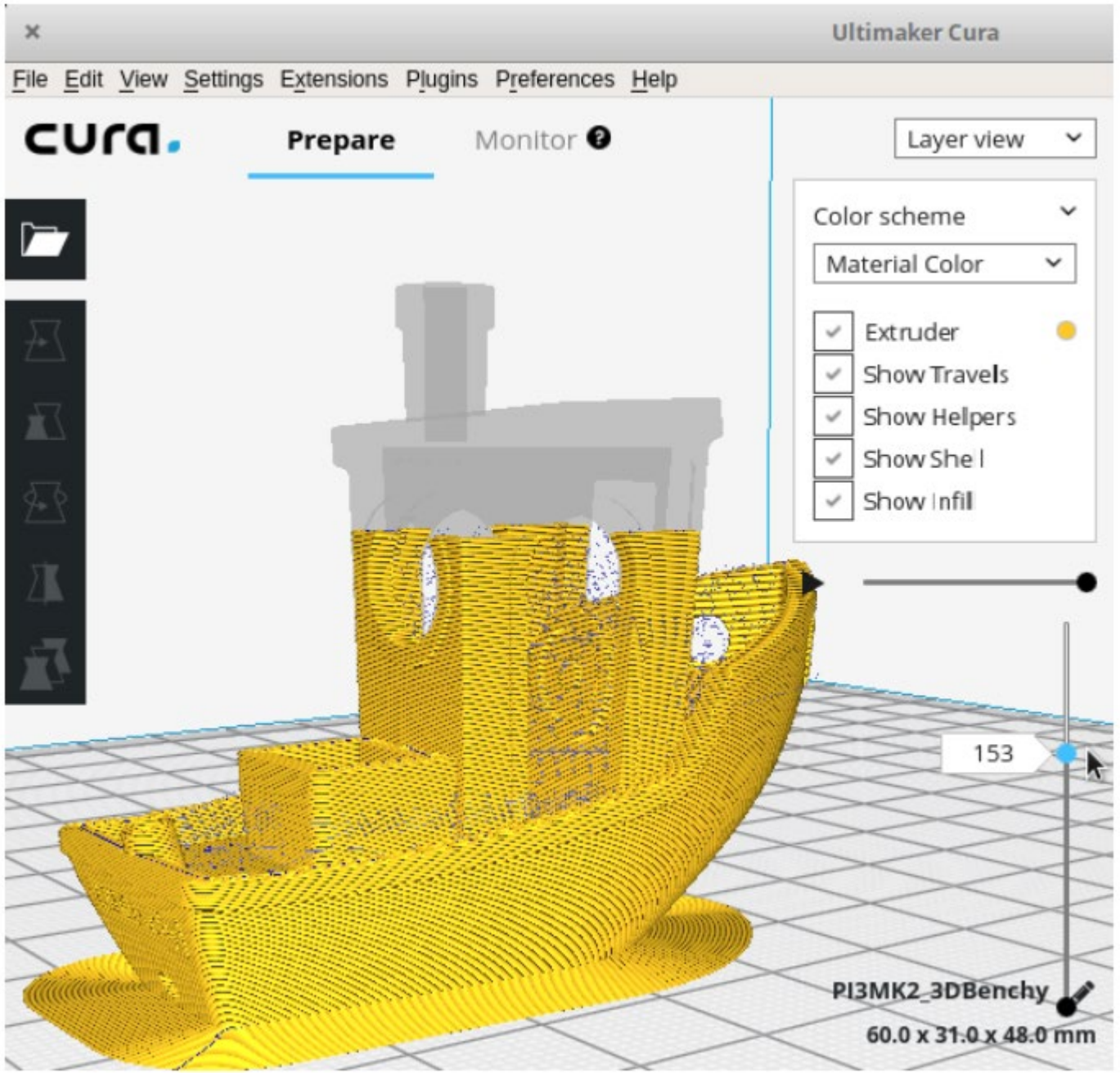
- **CURA SOFTWARE**
- CURA SLİCES 3D MODELS. IT TRANSLATES THE 3D STL, OBJ OR 3MF FİLE İNTO A FORMAT THAT THE PRİNTER CAN UNDERSTAND. FUSED FİLAMENT FABRİCATİON (FFF) 3D PRİNTERS PRİNT ONE LAYER UPON ANOTHER TO BUİLD UP THE 3D OBJECT. CURA 3D TAKES THE 3D MODEL AND WORKS OUT HOW THOSE LAYERS ARE PLACED ON THE PRİNT BED AND CREATES A SET OF İNSTRUCTİONS FOR THE PRİNTER TO FOLLOW — LAYER ON LAYER.
- CURA GENERATES İNSTRUCTİONS FOR YOUR 3D PRİNTER. THEY ARE CALLED G-CODE, A TEXT DOCUMENT THAT ENDS WİTH THE FİLE EXTENSİON .GCODE. OPEN THE FİLE AND YOU’LL ACTUALLY BE ABLE TO READ THROUGH QUİTE A BİT OF THE CODE AND UNDERSTAND WHAT İT’S TELLİNG THE PRİNTER TO DO.

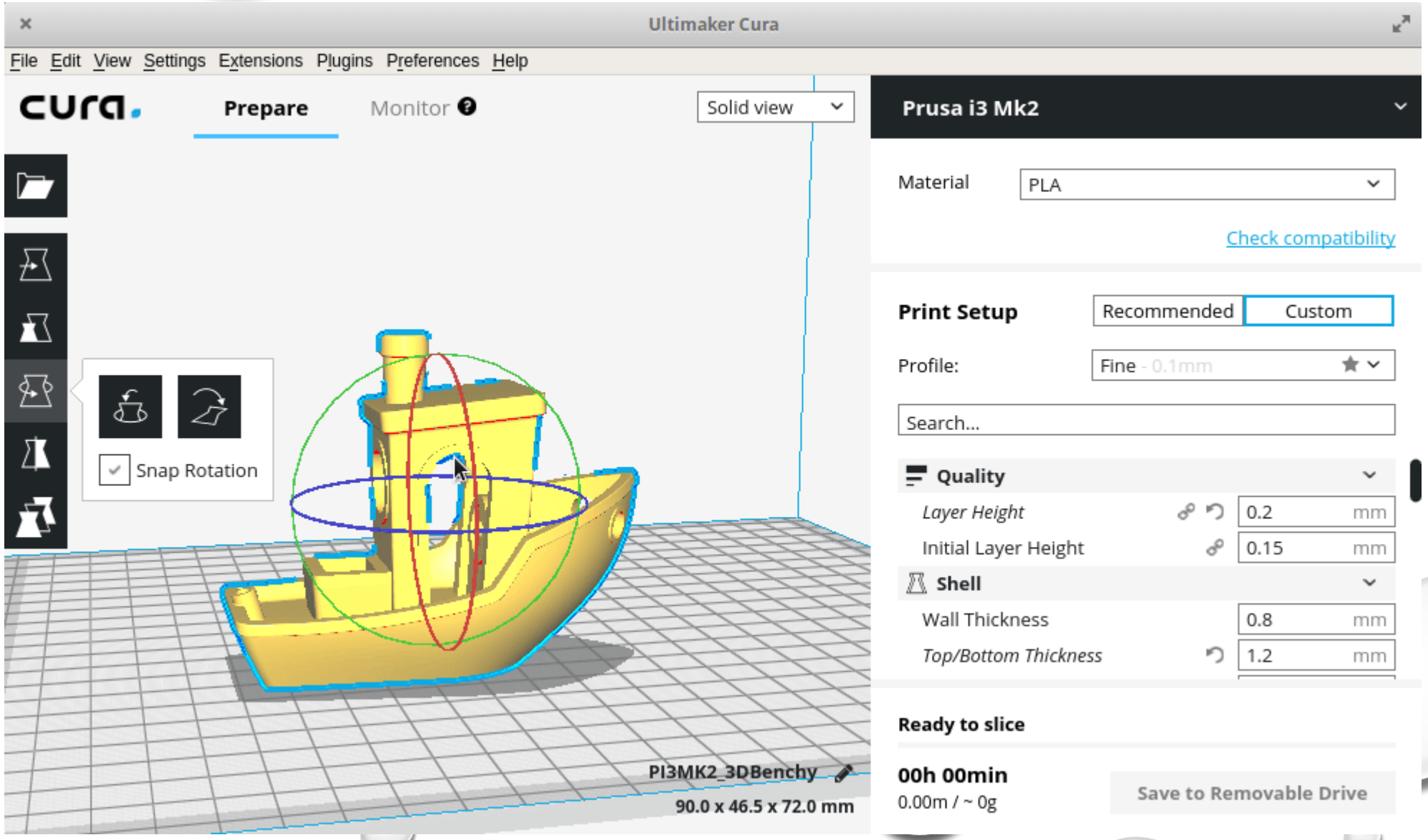
```
G0 F7200 X19.698 Y28.262 Z.36
G1 F1500 E0
G1 F1350 X22.467 Y26.175 E0.15654
G1 X23.338 Y25.568 E0.20447
G1 X24.246 Y25.027 E0.25218
```

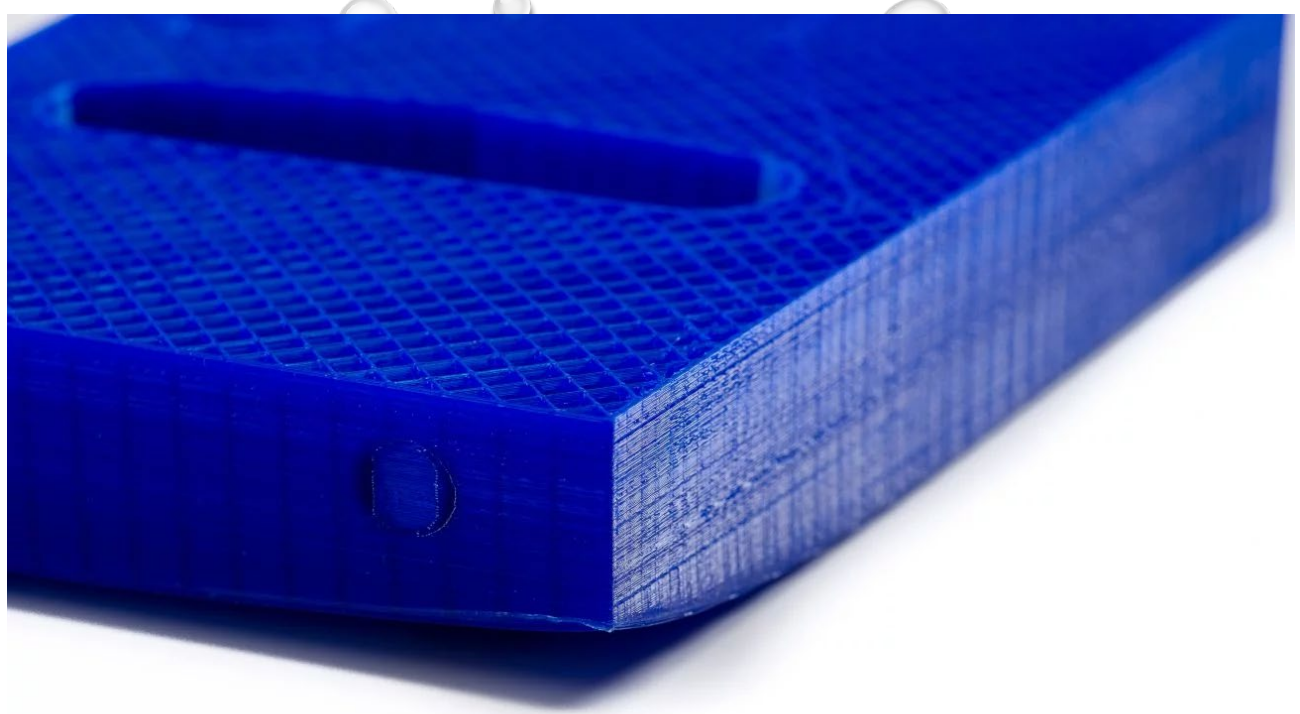

Add Printer
Machine Settings
Printer
Printer Settings
X (Width) 100 mm
Y (Depth) 100 mm
Z (Height) 100 mm
Build plate shape Rectangular
Origin at center
Heated bed
Gcode flavor Marlin
Printhead Settings
X min 20 mm
Y min 10 mm
X max 10 mm
Y max 10 mm
Gantry height 99999999999 mm
Number of Extruders 1
Material diameter 2.85 mm
Nozzle size 0.4 mm
Start Gcode
G28 ;Home
G1 Z15.0 F6000 ;Move the platform down
;Prime the extruder
G92 E0
G1 F200 E3
G92 E0
End Gcode
M104 S0
M140 S0
;Retract the filament
G92 E1
G1 E-1 F300
G28 X0 Y0
M84
Back
Finish
Cancel


Ultimaker Cura
File Edit View Settings Extensions Plugins Preferences Help
cura.
Prepare
Monitor
Solid view
Prusa i3 Mk2
Material
PLA
Check compatibility
Print Setup
Recommended
Custom
Layer Height
0.06 0.1 0.15 0.2 0.4 0.6
Print Speed
Slower
Faster
Infill
40%
Enable gradual
Generate Support
Build Plate Adhes...
Please load a 3D model
00h 00min
0.00m / ~ 0g
Save to File
20.0 x 20.0 x 20.0 mm


Ultimaker Cura
File Edit View Settings Extensions Plugins Preferences Help
cura
Prepare
Monitor
Solid view
Prusa i3 Mk2
Material
PLA
Check compatibility
Print Setup
Recommended
Custom
Layer Height
0.06 0.1 0.15 0.2 0.4 0.6
Print Speed
Slower
Faster
Infill
40%
Enable gradual
Generate Support
Build Plate Adhes...
PI3MK2_3DBenchy
60.0 x 31.0 x 48.0 mm
Ready to Save to File
01h 56min
4.80m / ~ 14g
Save to File


Ultimaker Cura
File Edit View Settings Extensions Plugins Preferences Help
cura.
Prepare
Monitor
Layer view
Color scheme
Material Color
Extruder
Show Travels
Show Helpers
Show She l
Show Infil
153
PI3MK2_3DBenchy
60.0 x 31.0 x 48.0 mm


Ultimaker Cura
File Edit View Settings Extensions Plugins Preferences Help
cura
Prepare
Monitor
Solid view
Snap Rotation
Prusa i3 Mk2
Material
PLA
Check compatibility
Print Setup
Recommended
Custom
Profile:
Fine - 0.1mm
Search...
Quality
Layer Height
0.2
mm
Initial Layer Height
0.15
mm
Shell
Wall Thickness
0.8
mm
Top/Bottom Thickness
1.2
mm
Ready to slice
00h 00min
0.00m / ~ 0g
Save to Removable Drive
PI3MK2_3DBenchy
90.0 x 46.5 x 72.0 mm



References:

1- https://www.simplify3d.com/support/materials-guide/
2- https://i.materialise.com/blog/en/fusion-360-3d-printing-tutorial/
3- https://www.autodesk.com.tr/products/fusion-360/students-teachers-educators
4- https://all3dp.com/1/cura-tutorial-software-slicer-cura-3d/

Summary :)

Technical Drawing

* Solidworks
* Fusion 360
* Free CAD
* Auto CAD
* by hand
* ...

Save File: STL, G-code, M-code, ...

CAM Programs: CURA, Special, ...

Printing Machine

* Sintering
* 3D Printer
* CNC
* Freeze
* Laser Cutting
* Wood Milling
* ...

Final Product: Sanding, Polishing, Acetone, Painting, ...