



Flexibles

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# Background

Thermoplastic Polyurethanes (TPU) are a category of materials that feature rubber-like mechanical properties.

Parts made from TPU tend to stretch and flex easily while maintaining their original shape.

This unique property of TPU enables it to fulfill a variety of applications that require flexibility.

Though flexible, TPU is a tough material. It features a hardness that is comparable to PETG depending on the specific TPU used.

This makes it as useful in harsher industrial applications as it is in gentler environments.

When flexibility is key, TPU is the best material for the job.

# Applications

TPU's flexibility is the driver for most of its applications. This flexibility comes into great use in footwear where a cushion is needed for a shoe's sole.

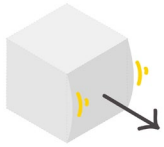
Wheels and tires are another example where TPU's flexibility shines. TPU is a good choice for phone cases and handles by providing a softer grip & a dampening effect.

In industrial uses, it excels for grommets & dampers where traditional rubber is too weak. TPU's hardness and flexibility enables it to endure for a long time.

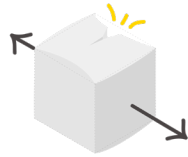
- > Footwear
- > Wheels and Tires
- > Phone Case
- > Handles
- > Grommets & Dampers
- > Gaskets

# Material Properties

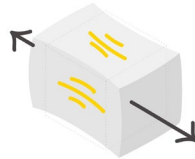
## Mechanical



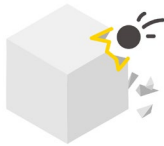
Young's Modulus  
26 MPa



UTS  
39 MPa



Tensile Elongation  
580 %



Impact Strength  
19.1 J/m

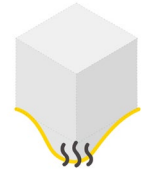


Shrinkage  
-

## Thermal



Glass Transition  
-24 °C

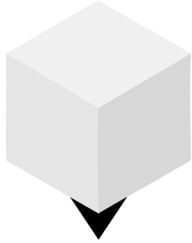


Heat Distortion  
49 °C

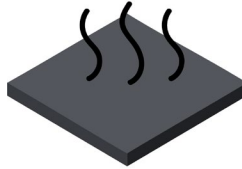


Decomposition  
-

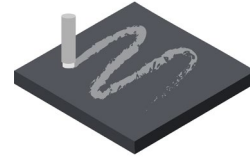
# Printer Settings



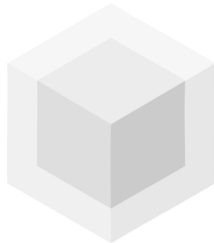
**Extruder Temperature**  
225-240 °C



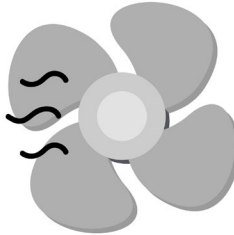
**Heated Bed Temperature**  
45-60 °C



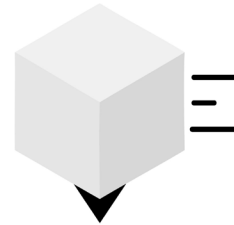
**Bed Adhesion**  
Glue stick - Optional



**Enclosure**  
No



**Fans**  
On



**Printing Speed**  
3,000 mm/min

# Sustainability

TPU recycling does exist, but the ability to recycle 3D printed TPU parts remains uninvestigated.

Usually TPU recycling involves breaking down a specific TPU product and reusing its material in the same application it came from.

For example, polyurethane foam from mattresses tends to be recycled into new mattresses.

# Flexibles Validated Suppliers



NinjaTek  
NinjaFlex



NinjaTek  
Cheetah



NinjaTek  
Armadillo



Taulman  
PCTPE



Black Magic  
3D Scorpion



Polymaker PolyFlex  
TPU 95



MakeSolid  
FlexSolid



Gizmo Dorks  
TPU



CoexFlex  
60D TPE



CoexFlex  
40D TPE



# Questions?

Please, do not hesitate to reach out to **support@re3d.org** via email or visit **re3d.org/support** if you have any more questions about Flexibles.

# Want to validate your material?

Would you like to see your material listed as a validated supplier? Our engineers welcome your 2.85mm spools! Email **info@re3d.org** for more information.

# Sources

- <https://www.simplify3d.com/support/materials-guide/flexible/>
- <https://www.tiertime.com/tpu-shoe/>
- <https://felfil.com/3d-printing-airless-bicycle-tire-with-tpu-bigrap-project-felfil/?v=5ea34fa833a1>
- <https://learn.adafruit.com/iphone-x-ninjaflex-pla-bumper-case/3d-printing>
- Simon R.G. Bates, Ian R. Farrow, Richard S. Trask, Compressive behaviour of 3D printed thermoplastic polyurethane honeycombs with graded densities, *Materials & Design*, Volume 162, 2019, Pages 130-142, ISSN 0264-1275, <https://doi.org/10.1016/j.mat-des.2018.11.019>
- <https://polyurethane.americanchemistry.com/Polyurethane-Recycling/>