



# Lists of Materials Available to be machined or printed at Hubs

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⚙️ Status	Done
🎯 Project	🎯 <u>Heat Fiber Bundle Mounting Block</u>
🏷️ Tags	

Goal: Find low thermal conductivity and high melting point material that can either be 3d printed or CNC. This would cover the chip instead of a metal cover.

## CNC Plastics:

Material	Sub-Material	Maximum Service Temperature ( C )	Thermal Conductivity
POM (Delrin/Acetal)	Acetal Copolymer (POM-C)	82-90C	0.31 - 0.39
POM (Delrin/Acetal)	Acetal Copolymer (POM-C) FDA	100 - 140	0.31 - 0.39
POM (Delrin/Acetal)	Acetal Homopolymer (POM-H)	76.9 - 96.9	0.221 - 0.35
POM (Delrin/Acetal)	Acetal Copolymer (POM-C) ESD	100 - 140	0.3
FR-4	FR-4	122 - 145	0.29 - 0.34
ABS	ABS	61.9 - 76.9	0.188 - 0.335
Nylon	Nylon 6	90 - 130	0.294 - 0.306
Nylon	Nylon 6 30% Glass Filled	90 - 131	0.445 - 0.463
Nylon	Nylon 6/6 30% Glass	150	

	Filled		
Nylon	Nylon 6 Flame Retardant	85	
PMMA (Acrylic)	PMMA (Acrylic)	70 - 80	0.19 - 0.2
PTFE (Teflon)	PTFE (Teflon)	250 - 270	0.23 - 0.5
<u>Polycarbonate</u>	<u>Polycarbonate</u>	temperature 101 - 144	0.189 - 0.218
Polyethylene	HDPE	113 - 129	0.461 - 0.502
Polyethylene	UHMW-PE	80 - 110	0.19 - 0.197
PVC	PVC	85 - 100	0.133 - 0.144

### 3D Printing:

- They don't list thermal conductivity for the 3D printing materials.
- Stack exchange link has some from a review paper (They don't link the paper)
  - <https://3dprinting.stackexchange.com/questions/11043/what-is-the-thermal-conductivity-of-various-3d-printing-filaments>

All values are in W/(m\*K).

- PLA: 0.13
- HIPS: 0.20
- ABS: 0.25
- PETG: 0.29
- PEEK: 0.25
- PLA with copper: 0.25 ([see discussion](#))
- PETG with 40% graphite: 1.70 (anisotropic)
- [TCPoly](#): 15
- Steel (not a 3dprintable plastic): 10 - 50

**Table 1**  
TCs of some well-known polymers at room temperature [1-3].

Polymer name	$k$ [W/(m · K)]
High density polyethylene (HDPE)	0.44
Polyphenylsulfone (PPSU)	0.35
Poly(ethylene vinyl acetate) (EVA)	0.34
Poly(acrylonitrile-butadiene-styrene) copolymer (ABS)	0.33
Low density polyethylene (LDPE)	0.30
Polyphenylene sulfide (PPS)	0.30
Poly(butylene terephthalate) (PBT)	0.29
Polytetrafluoroethylene (PTFE)	0.27
Nylon-6.6 (PA66)	0.26
Nylon-6 (PA6)	0.25
Polyetheretherketone (PEEK)	0.25
Polytetrafluoroethylene (PTFE)	0.25
Poly(dimethylsiloxane) (PDMS)	0.25
Polysulfone (PSU)	0.22
Polymethylmethacrylate (PMMA)	0.21
Polycarbonate (PC)	0.20
Polyvinyl chloride (PVC)	0.19
Polyvinylidene difluoride (PVDF)	0.19
Epoxy resin	0.19
Poly(ethylene terephthalate) (PET)	0.15
Polystyrene (PS)	0.14
Polypropylene (PP)	0.12
Polyethylene (PE)	0.11
Polyimide, Thermoplastic (PI)	0.11

- Melting Points for various materials on Hubs:
  - Nylon 12 = 188 C
  - PEI
    - Thermal conductivity 0.24 W/mK
    - **ULTEM 9085 Stratasys = heat deflection temperature of 167°C.**
    - **ULTEM 1010 Stratasys = heat deflection temperature of 216°C.**
  - TPU (Flexible) = 225 C

**Conclusion:**

**Requirements:**

The heating box for the fiber bundle mount must have a max working temperature greater than 150C at least. Thermal conductivity can then be taken into account.

### **Box Options:**

PTFE Teflon is a CNC plastic that meets this requirement and has a low thermal conductivity compared to Aluminum.

There is some 3d printable materials such as the melting points listed above that may be a cost effective alternative.

Easy and cheap: Make box out of PCBs, using either solder or tape.

The box can then be lined with an insulation layer from McMaster to further increase the thermal resistance of heat leaving the inside of the box.

### **Mounting Block to Optical Stage Options:**

Any high temperature plastic spacer is ideal to maximize the thermal resistance the mounting block has to the optical stage.

PTFE: <https://www.mcmaster.com/95630A241/>

[https://www.matweb.com/search/datasheet\\_print.aspx?  
matguid=4e0b2e88eeba4aaeb18e8820f1444cdb](https://www.matweb.com/search/datasheet_print.aspx?matguid=4e0b2e88eeba4aaeb18e8820f1444cdb)

PEEK: <https://www.mcmaster.com/93785A400/>

[https://www.matweb.com/search/datasheet\\_print.aspx?  
matguid=2164cacabcde4391a596640d553b2ebe](https://www.matweb.com/search/datasheet_print.aspx?matguid=2164cacabcde4391a596640d553b2ebe)