Safe & Unsafe Materials for the Laser Cutter

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UNSAFE (NEVER CUT THESE MATERIALS)

WARNING: Because many plastics are dangerous to cut, it is important to know what kind you are planning to use.

Material	**DANGER!**	**Cause/Consequence**
PVC (Poly Vinyl Chloride)/vinyl/pleather/artificial leather	Emits pure chlorine gas when cut!	Don't ever cut this material as it will ruin the optics, cause the metal of the machine to corrode, and ruin the motion control system.
Thick (>1mm) Polycarbonate/Lexan	Cut very poorly, discolor, catch fire	Polycarbonate is often found as flat, sheet material. The window of the laser cutter is made of Polycarbonate because *polycarbonate strongly absorbs infrared radiation!* This is the frequency of light the laser cutter uses to cut materials, so it is very ineffective at cutting polycarbonate. Polycarbonate is a poor choice for laser cutting.
ABS	Emits cyanide gas and tends to melt	ABS does not cut well in a laser cutter. It tends to melt rather than vaporize, and has a higher chance of catching on fire and leaving behind melted gooey deposits on the vector cutting grid. It also does not engrave well (again, tends to melt).
HDPE/milk bottle plastic	Catches fire and melts	It melts. It gets gooey. Don't use it.
PolyStyrene Foam	Catches fire	It catches fire, it melts, and only thin pieces cut. This is the #1

		material that causes laser fires!!!
PolyPropylene Foam	Catches fire	Like PolyStyrene, it melts, catches fire, and the melted drops continue to burn and turn into rock-hard drips and pebbles.
Fiberglass	Emits fumes	It's a mix of two materials that can’t be cut. Glass (etch, no cut) and epoxy resin (fumes)
Coated Carbon Fiber	Emits noxious fumes	A mix of two materials. Thin carbon fiber mat can be cut, with some fraying - but not when coated.

SAFE MATERIALS

The laser can cut or etch. The materials that the laser can cut materials like wood, paper, cork, and some kinds of plastics. Etching can be done on almost anything, wood, cardboard, aluminum, stainless steel, plastic, marble, stone, tile, and glass.

Cutting Material	**Max thickness**	**Notes**	**WARNINGS!**
Many woods	1/4"	Avoid oily/resinous woods	Be very careful about cutting oily woods, or very resinous woods as they also may catch fire.
Plywood/Composite woods	1/4"	These contain glue, and may not laser cut as well as solid wood.	
MDF/Engineered woods	1/4"	These are okay to use but may experience a higher amount of charring when cut.	
Paper, cardstock	thin	Cuts very well on the laser cutter, and also very quickly.	
Cardboard, carton	thicker	Cuts well but may catch fire.	Watch for fire.
Cork	1/4"	Cuts nicely, but the quality of the cut depends on the thickness and quality of the cork. Engineered cork has a lot of glue in it, and may not cut as well.	Avoid thicker cork.

Acrylic/Lucite/Plexiglas/ PMMA	1/2"	Cuts extremely well leaving a beautifully polished edge.	
Thin Polycarbonate Sheeting (<1mm)	<1mm	Very thin polycarbonate can be cut, but tends to discolor badly. Extremely thin sheets (0.5mm and less) may cut with yellowed/discolored edges. Polycarbonate absorbs IR strongly, and is a poor material to use in the laser cutter.	Watch for smoking/burning
Delrin (POM)	thin	Delrin comes in a number of shore strengths (hardness) and the harder Delrin tends to work better. Great for gears!	
Kapton tape (Polyimide)	1/16"	Works well, in thin sheets and strips like tape.	
Mylar	1/16"	Works well if it's thin. Thick mylar has a tendency to warp, bubble, and curl	Gold coated mylar will not work.
Solid Styrene	1/16"	Smokes a lot when cut, but can be cut.	Keep it thin.
Depron foam	1/4"	Used a lot for hobby, RC aircraft, architectural models, and toys. 1/4" cuts nicely, with a smooth edge.	Must be constantly monitored.
Gator foam		Foam core gets burned and eaten away compared to the top and bottom hard paper shell.	Not a fantastic thing to cut, but it can be cut if watched.

Cloth/felt/hemp/cotton		They all cut well. Our "advanced" laser training class teaches lace-making.	Not plastic coated or impregnated cloth!
Leather/Suede	1/8"	Leather is very hard to cut, but can be if it's thinner than a belt (call it 1/8"). Our "Advanced" laser training class covers this.	Real leather only! Not 'pleather' or other imitations!
Magnetic Sheet		Cuts beautifully	
NON-CHLORINE-containing rubber		Fine for cutting.	Beware chlorine-containing rubber!
Teflon (PTFE)	thin	Cuts OK in thin sheets	
Carbon fiber mats/weave that has not had epoxy applied		Can be cut, very slowly.	You must not cut carbon fiber that has been coated!!
Coroplast ('corrugated plastic')	1/4"	Difficult because of the vertical strips. Three passes at 80% power, 7% speed, and it will be slightly connected still at the bottom from the vertical strips.	

ETCHING

All the above "cuttable" materials can be etched, in some cases very deeply.

In addition, you can etch:

Material	**Notes**	**WARNINGS!**
Glass	Green seems to work best...looks sandblasted.	Only FLAT GLASS can be engraved in our cutter. No round or cylindrical items.
Ceramic tile		
Anodized aluminum	Vaporizes the anodization away.	
Painted/coated metals	Vaporizes the paint away.	
Stone, Marble, Granite, Soapstone, Onyx.	Gets a white "textured" look when etched.	100% power, 50% speed or less works well for etching.

IDENTIFYING UNKNOWN PLASTICS

To risk stating the obvious, the first step in identifying a piece of plastic should be to look for a label.

SPI #	Abbreviation	Name	Example Use	Density (g/mL)
1	PETE/PET	Polyethylene terephthalate	Water bottles	1.37-1.45
2	HDPE	High-density polyethylene	Milk jugs	0.93-0.97
3	PVC	Polyvinyl Chloride	Pipe	1.3-1.45
4	LDPE	Low-density polyethylene	Saran wrap	0.91-0.94
5	PP	Polypropylene	Food containers	0.85-0.94
6	PS	Polystyrene	Model kits	1.05
9	ABS	Acrylonitrile butadiene styrene	Lego bricks	1.04

Assuming your sample has no label that would indicate its composition, then, the test which offers the best combination of safety, utility, and convenience is probably density. If your sample is made of a single material, solid through and through, its density can be checked against a set of reference liquids of known densities by simply dropping the sample in a small vial of each liquid: If it floats, it is less dense than the reference, and if it sinks, it is more dense than the reference. Polyethylenes and polypropylenes float in water (density = 1 g/mL), for instance, while most other plastics sink. Among heavier-than-water plastics, ABS and PS will float in glycerin (density = 1.26 g/mL), but PETE and PVC do not.

Other useful tests for discriminating plastics are the Beilstein copper wire test (which indicates the presence of chlorine, e.g. in PVC), susceptibility to acetone (most plastics besides polyethylene and polypropylene will become “tacky” on exposure), and whether the plastic turns white under stress, e.g. when bent (PVC whitens; PET does not).