



# Laser Material Safety Information

Not all materials are the same. We therefore made a list of materials that can and can't be laser cut at the Fablab Arnhem. Some reasons for this are that the materials simply won't cut, cause a fire hazard, or release toxic fumes. These toxic fumes can enter the laser room even though our laser cutters have an air extraction system. For these reasons, the materials below are prohibited because health and safety concerns are our number one priority.

*\*This list is continuously updated. However, if a material is not on the list, it doesn't mean that it can be cut. Always contact a Fablab employee if you are uncertain about a material or want to bring your own materials. The material safety data sheet (**MSDS**) may help determine if a material is safe to laser cut or not based on the combustion byproducts under the firefighting measures section. The following paper also helps with simple tests to identify polymers: [link \(http://www.chymist.com/Polymer%20Identification.pdf\)](http://www.chymist.com/Polymer%20Identification.pdf)*

*Important note: We have made every effort to thoroughly research the information in this document, but no rights can be derived from it.*

**\*Check last page for sources**

# Unsafe Materials

## Do not cut

The materials below should not be cut or always need supervision from a Fablab employee.

Material	Danger	Consequence
PVC (Poly Vinyl Chloride) /vinyl/artificial leather	Emits pure chlorine gas when cut! (Halogens should never be cut: fluorine, chlorine, bromine)	Don't ever cut this material as it will damage the optics, electronics, and causes the metal of the machine to corrode.
ABS	Can emit cyanide gas and tends to melt.	ABS does not cut well in a laser cutter. It tends to melt rather than vaporize and leaves behind melted deposits that may catch fire. It also does not engrave well (again, tends to melt).
Delrin (POM)	Delrin contains formaldehyde. (it's a great material for gears, but it's advised to use a cnc cutter)	Contains formaldehyde (a known carcinogen) in the smoke.
MDF	Builds up a lot of smoke during cutting and the glue may release formaldehyde.	The smoke damages the optics and the formaldehyde gas is toxic.
HDPE	It melts and may catch fire.	HDPE melts like cheese and becomes a gooey mess.
Epoxy	Burns / smokes / toxic fumes such as cyanide	Items coated in Epoxy, or cast Epoxy resins must not be used in the laser cutter. ( also see Fiberglass )
Fiberglass (also applies to coated carbon fiber mats)	Difficult to cut / emits fumes.	Fiberglass is very hard to cut and the resin releases toxic fumes.
Polystyrene / polypropylene foams	May catch on fire.	These foam materials melt and easily catch on fire.
Polystyrene (HIPS)	Bad smell and styrene gas is a known carcinogen.	Cheap and it cuts reasonably well (despite raised edges and discoloring). Some Fablabs

		therefore do cut it, but we don't due to the smell in combination with the risk of releasing styrene gas.
Plastics containing fire retardants	Often contains halogens such as bromine.	More difficult to cut and releases toxic fumes.
PTFE/Teflon	Emits (a small amount of) hydrogen fluoride when cutting.	Hydrogen fluoride damages the lenses of the laser. It's questionable if the material reaches high enough temperatures to release these fumes, but we won't risk it.
Neoprene	Emits hydrogen chloride	This 'wetsuit' material emits toxic hydrogen chloride.
Polyimide (PI) / Kapton	Our CO2 laser is not powerful enough to cut this material.	Very thin sheets may work reasonably well.
Polyethylene (PE)	Releases formaldehyde (toxic fumes).	Polyethylene is one of the most common plastics in the world, but unfortunately releases formaldehyde when exposed to lasers.
Polyurethane / PU (PUR)	Releases Hydrogen Cyanide gas.	Even though it cuts well, we won't because of health and safety concerns.
Polyamide / Nylon	This material also has a CN (carbon-nitrogen) bond and therefore release Hydrogen Cyanide gas.	Hydrogen Cyanide is extremely toxic.

# Difficult Materials

## Caution

The materials below can be cut, but do need some precautions.

Material	Notes	Extra
Thick Polycarbonate / Lexan (>1mm)	Cuts very poorly, discolor, & may catch fire.	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.
PETG	Cuts well, but you get a lot of discoloration on the edges and the smell is very bad.	Make sure to let vent well after laser cutting (keep the lid closed for at least 5 minutes).
EVA Foam	Just like other foams, make sure to cut fast and watch for burning.	Cut as fast as possible to prevent burning. Always stay with the machine.
Rubber (difficult because not all rubbers are the same. Some laser grade rubber is possible).	Always make sure to use non-chlorine rubbers (difficult to find). Also make sure that no benzene is released).	Use laser grade rubbers. Many stamp rubbers are not laser grade and contain chlorine. High power lasers also may cause rubbers to emit benzene which is a known carcinogenic.

# Safe Materials

## Okay

The materials below are perfectly suited for laser cutting.

Material	Notes	Extra
Many woods (except MDF)	Avoid oily / resinous woods	Be careful cutting oily woods, or very resinous woods as they also may catch fire.
Cardboard / Paper	Cuts very fast, but keep an eye on thick corrugated cardboard.	Thick corrugated cardboard must be watch closely as it may catch fire in some instances. However, most cardboards cut perfectly fine.
Cork	Cuts nicely, but the quality of the cut depends on the thickness and quality of the cork.	Mostly, the cut depends on the glue used as a binder.
Acrylic/Plexiglass/PMMA	Cuts extremely well with a nice polished edge.	Smells when cut, so let it vent for at least 3 minutes.
Real leather	Smells like burning hair when cut, so let the laser vent before opening after cutting.	Only use real leather! (Not chrome tanned leather). Fake leather often contains PVC.
PLA sheet material	Engraves and cuts well.	Might be difficult to find.
Natural cloth / Hemp / Cotton	Cuts well	Use non-coated / non-impregnated materials.
Felt (without polyester)	There are a lot of different types of felt. Wool felt is the safest, but smells. Other types of felt may contain acrylics, wood pulp, petg and polyester.	Use only felts without polyester (do your research). Cuts well, but your edges may discolor / harden depending on the base material.
Polypropylene Sheet material	Cuts well, but the edges are not perfectly flat.	Kerf tends to be a little wide.
Glass (only engraving)	Use the co2 laser for glass engraving/etching.	Engraving only
RVS, Brass, Steel, Anodized aluminium (only engraving)	Use the fiber laser for metal engraving.	(our laser is not powerful enough for cutting)

# Extra Information

## CN Bonds

Materials containing Nitrogen bound to Carbon (a CN bond) such as nylon, ABS plastic, polyurethane and some acrylics will create hydrogen cyanide gas (HCN) when burned which is an extremely toxic gas absorbed through the skin and lungs that kills humans by preventing oxygen from getting to organs. Therefore, materials containing a CN bond should never be used in our laser cutters.

## Styrene

Materials containing styrene such as polystyrene (HIPS) and thermoset polyester can release styrene (or benzene) gas when laser cutting. This gas is a known carcinogen and causes damage to the central nervous system over time. Short term over exposure symptoms includes dizziness and rash.

## Composites

Fiberglass composites consist of fiberglass embedded in a polymer matrix, which is typically a thermoset polyester or an epoxy. Both polyester and epoxy give off toxic vapors when they thermally decompose. Styrene is used in thermoset polyesters and epoxies may release HCN gas. Dry carbon fiber (without resin) can be laser cut at very slow speeds.

# Sources

## First of all: MSDS (Material Safety Data Sheets) of materials

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