

**COMPOSITE ENVISIONS KNOWLEDGE HUB
PRACTICAL AND INSIGHTFUL COMPOSITES INFORMATION**



SAFETY 101 WHEN WORKING WITH COMPOSITES



***COMPOSITE
ENVISIONS***



INTRODUCTION

When working with Composites, it's important to follow some safety protocols. Before starting any project, knowing the chemicals that are being used is of utmost importance. Especially with any new process, access and read all safety data sheets associated with any material being used.

Beyond the chemical elements used in composite work, there are a number of other potential hazards. This paper will cover the most common dangers when working with composites and insure that you're safe and healthy at the end of your project.

PLYCUT / LAYUP SAFETY

Plycut and Layup hazards mainly occur from cutting fabrics or during resin application processes. Keeping a clean working environment adds to any safety regime for fabrication of composites. Remove any unneeded tools or clutter before fabric is ever pulled from the bag. During fabric plycut it is important to keep a careful watch of hands and eyes. Whether using scissors, a razor blade, or ply cutting machine, there is always a chance of injury and proper care must be taken. For plycut, cut resistant gloves are recommended for processes in which an open blade will be used for cutting fabric or prepreg. Finding a type that fits snugly but allows for flexibility will aid in a comfortable & safe process. Special attention to proper eye care during plycut and layup is of utmost importance. One can overcome a slight cut very easily, but eyes are sensitive and do not heal quickly. Eye safety in composite fabrication is relatively easy. Always wear eye protection. Avoid rubbing any chemicals in or around eyes or skin.

During layup, Epoxy resins have been known to cause skin irritation or rashes in instances. Sensitization affects skin differently with everyone. Some never notice any irritation while others have broken out in an allergic reaction to resins. For this, disposable sleeves and nitrile gloves are made for layup purposes for skin protection. Gloves also keep FOD and other chemicals from encountering the layup process. Some epoxy hardeners are labeled as corrosive, always reference the product's SDS before starting any project. Disposable body suites are available for any job large or small, if needed.

Polyester resins do not carry a significant health threat in layup processes. Polyurethane resins, though not as commonly used, do pose a raspatory threat if sensitive. Proper use of a half faced raspatory mask should mitigate any posing issues.

Layup safety concerns can also be created with use of MEKP. (Methyl Ethyl Ketone Peroxide) While it is not a flammable liquid, it will still burn. It is an organic peroxide, and if ignited it is difficult to extinguish. Proper storage practices are to keep MEKP in a cool area, away from flammable liquids.



If working with heavier tools not anchored to the ground, movement or dropping of tools is a possible occurrence. Dependent on the situation, steel toed shoes should be worn when heavier tooling or motion of heavier layup objects are moving to keep feet from being crushed or broken. Lifts may also be used to aid in moving heavier tools and mitigate other ergonomic issues.

DEMOLD AND MOLD PREP SAFETY

Demold and Mold Prep safety are much like that of plycut and layup precautions. Keeping working areas clean, using cut resistant gloves, and wearing proper eye protection are all needed for demold or stripping of cured laminates. During demold processes, it is not the scissors or blade surfaces that could necessarily cause possible damage to fingers or skin. A cured laminate, whether fiberglass, Kevlar, or carbon fiber is SHARP along laminate edges. Thinner parts of the laminate's corners and cut ply edges all pose a risk of slicing through skin and flesh. In cases much worse than a simple papercut. Fabrication with chopped strand mat fiberglass also poses a risk as the fibers do not always carry uniformity. If are possibilities of the fiberglass fibers to be sticking straight up, out of the laminate. If skin is not protected it can go through skin with little to no force. Always wear proper eye protection as chips and resin bleed out can be common and pieces can fly into eyes.

Once the part is stripped or demolded, “de-flashing” the part as soon as possible is good practice. Using a right-angle sander and ~220 grit sandpaper, sand away any sharp edges on the composite laminate. This will make handling of the composite laminate much easier in the future.

Personal safety is of utmost importance in any process; however, part safety of a cured laminate is carries economic impacts as some composite parts can be highly fragile. Dropping some parts from only 3' have been known to scrap laminates. In addition, Murphy's law states that if it can happen, it will happen. Gravity tends to aid in dropping objects or chemicals onto laminates. Wrapping parts completely or around edges with bubble wrap will mitigate chances of damage. Best practice is keeping parts wrapped in bubble wrap when not in use, while being transported or being stored. Additional options include application of a “pool noodle” or polyethylene foam noodles around part edges.

Once part is “de-flashed” and properly stored in bubble wrap, mold prep will likely begin. Using a shop vac will aid in getting a mold cleaned of any loose resin and fabric that may have gotten loose on the tool's surface. Afterword application of a cleaning agent and / or mold release is needed. Hazards associated with mold releases are corrosiveness and flammability. Though some mold releases are neither, product safety must be adhered to per product's SDS. If mold cleaner / release cleaner is flammable, proper storage at room temperature in a well-ventilated area, along with keeping it away from any ignition sources is a must. It is best practice to keep flammable mold releases in their own designated cabinet



area, away from any other flammable liquids or ignition sources. Always refer to product's SDS for all safety related issues ensuring all proper care is taken. Chemically protective gloves are best practice when applying any release agent.

TRIM / DRILL / SANDING SAFETY

Trim & drill, and sanding safety is straightforward with a few additions from the above sections. Clean working environments, cut resistant gloves, safety glasses all help aid in providing personal protection when working with any composite. A clean working environment for machining composites generally includes an area dedicated to these processes. This area could be inside or out but should keep electrical components that are not needed and other media to a minimum.

Electrical vs Pneumatic tools are different from a safety perspective as must be protected as such. Use of pneumatic tools reduces the chance of electrical shock or fire hazards. Electric powered tools will tend to run hot as pneumatic tools will stay cooler. If using electrical tools, keep other connections away and isolated from cutting and sanding operations if possible. Using a single plug or use of an extension cord for an electrical tool is good practice. Keep dust away from electrical components as much as possible, mitigating possible hazards. When cutting thicker laminates, keep a watchful eye on the temperatures of the tools to make sure they do not overheat.

When doing any cutting, drilling, or sanding, dust becomes a hazard. It is best practice to eliminate possible sources of dust and fine particle exposure to lungs. Possible irritation from dust particles are caused by these processes. To mitigate dust accumulation, use of a down-draft booth is commonly used in many industrial applications. In addition, it is of utmost importance to keep accumulating dust particles from landing on any computer equipment or other possible electrical hazards.

However, downdraft booths are rather expensive. A cheaper alternative is using a shop vac or vacuum cleaner with a hose attached placed near the sanding or cutting area. This will draw the dust away from the area being sanded, keeping the area clean and keeping dust from irritating skin or lungs. Filters used in a shop vac should be capable of entrapping particle sizes of 0.2 microns or less as dust particles from carbon fiber and other materials can reach sizes of ~0.2 microns. (See materials list) Most filters listed under "fine-dust" will usually suffice for efficient particle collection.

As another added layer of safety, a barn fan or equivalent may be used across the part to propagate accumulating dust out and away from the immediate area of work being performed. This option is best utilized in an outdoor environment as dust particles would not be blown onto or into other pertinent surfaces.

Cleanliness in composites is a must.



Even with a shop vac handy, while working in a downdraft booth, and / or using a fan outdoors, a respirator should always be worn while any cutting, grinding, drilling or sanding processes are being performed. Endless options are these are available. Reusable options in a half face cover offer optimal protection against dust and other hazards while a simpler N-95 mask may suffice for smaller areas or while only drilling holes. It is important that the mask make intimate contact with skin as much as possible. Some cheaper masks or differing types do not make enough contact with the face, allowing dust to possibly irritate lungs or skin.

Part Safety: When drilling or cutting thicker laminates, pay caution as heat will accumulate quickly on cutting blades or drill bits. Wet sanding or cutting options will keep the composite cool while performing these tasks, though not always needed. After cut or drilling, do not immediately take off the bit or saw blade as it will be HOT! Wearing cut resistant gloves will also mitigate the chance of coming in direct contact with the potentially hot surface.

Tip: While sanding laminates, dust accumulation incoming to face or skin may be mitigated by simply swapping the direction of circular bits. If possible, have the diamond wheel or sanding block going into the laminate, away from whom is performing the cut. This will have particles going toward the floor instead of pieces and particles coming off the part and being blow into facial other bodily areas. Clear face shields may also be utilized to eliminate issues when chips or pieces of laminates come back toward facial areas.

Additional hazards as part of the process are possible exposure to unsafe noise levels as part of trimming laminates. It is advised to wear ear plugs when trimming or sanding laminates to reduce any effect on hearing.

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