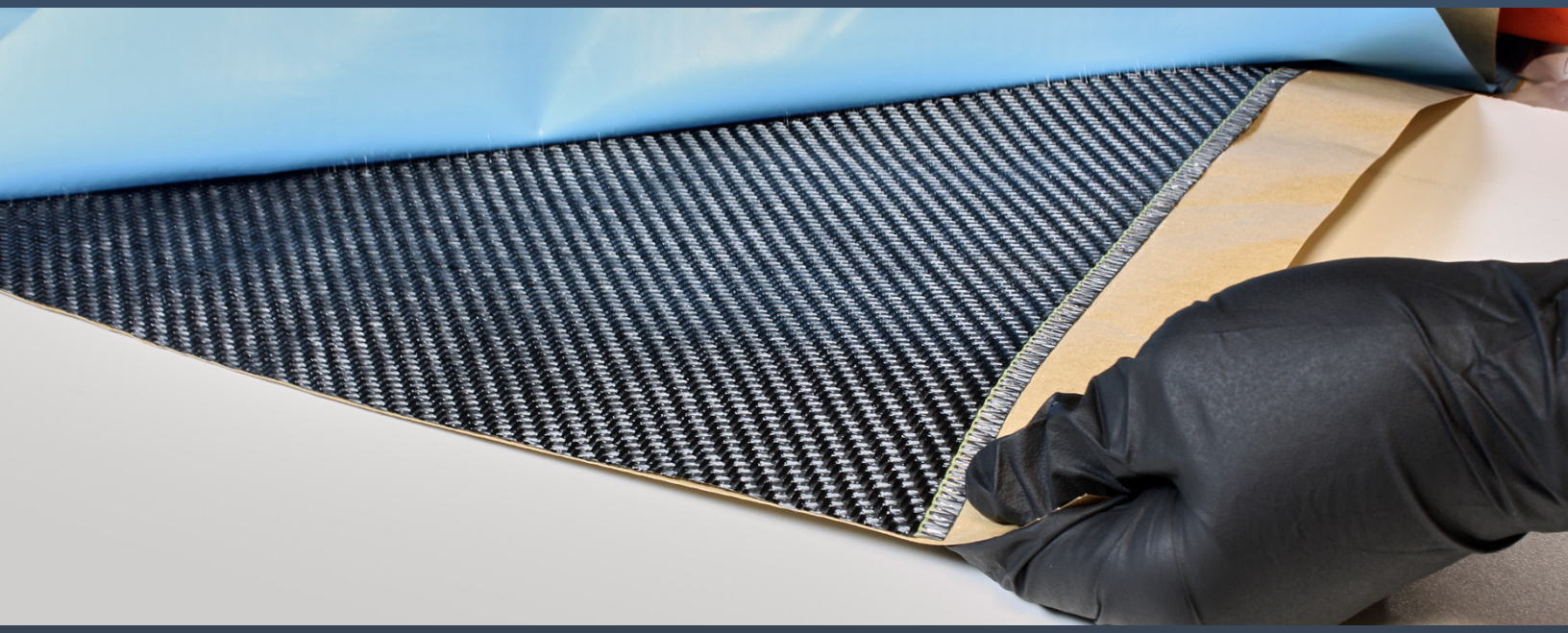
COMPOSITE ENVISIONS KNOWLEDGE CENTER
PRACTICAL AND INSIGHTFUL COMPOSITES INFORMATION



WHAT IS PREPREG - EXPLANATION, ADVANTAGES AND DISADVANTAGES

COMPOSITE ENVISIONS

WHAT IS PREPREG

INTRODUCTION

“Prepreg” is broad terminology in composite fabrication used for describing fabrics that are pre-impregnated with a fully curable, mixed resin system during manufacture. Prepregs are often regarded as the most advanced system of composite fabrication. By simply adding a mold, heat, and pressure, use of prepreg fabrics virtually eliminate process variation found in traditional layups or vacuum infusion processes. As a result, prepregs have revolutionized composite fabrication as we know it and are most often chosen for achieving the highest performance characteristics in fiber reinforced structures.

Carbon Fiber, Kevlar, and Fiberglass are the most used fabrics in Prepreg reinforced composites. Historically, Prepregs most popular use was aerospace and aviation applications. As technology has advanced, prepregs fabrics are now more affordable and have found additional market value in high performance applications of automobile manufacture and racing, boating, sporting goods, and even construction.

Prepregs are a calculated combination of reinforcing fabric paired with a semi-cured resin system that is most often Epoxy based. This matrix, a calculated weight ratio for prepregs is responsible for achieving the light-weight performance characteristics in a composite laminate. Prepregs can achieve a ratio as low as 35% resin, which is unheard of with any other layup methods.

Basic prepreg selection is based on characteristics such as fiber, tow size, and weave selection, all of which are similar features to that of traditional fabrics. Prepregs will often come with a defined “cured ply thickness” and density in addition to providing the precise fiber to resin ratio. The resin added to the fabric also doubles to make layup processes much more effective as they carry a tack in making layup more effective.

Because resins in prepregs flow and cure in a different manner than infusion or traditional layup methods, they require pressure and heat for cure. Once a layup of prepreg fabrics has been completed, it must then be cured by a combination of heat and vacuum. This is often referred to as a cure cycle performed inside an oven or an autoclave. For complex laminates, an autoclave, like a large pressure cooker, provides pressure far beyond vacuum alone. General epoxy prepregs are commonly cured between 250F and 350F.

ADVANTAGES OF PREPREG

Peerless Mechanical Performance: Its simple, an optimized fiber to resin ratio provides the best mechanical properties in the lightest weight for a composite design or fabrication. Prepregs provide just that.

Process Robustness: Prepregs provide a much cleaner and easier processing from ply cut

to demold. Clean and easy ply cut of prepregs result in accurately ply shapes that are then easily laid up into mold surfaces. No longer is there a sticky mess of resin coming from your gloves while trying to layup large plys of complex surfaces while handling brushes or squeegees. No longer is there even resin mixing, no working times down to the min to worry about, no complicated system of resin feed lines, no worrying if the spray adhesive will affect a part's surface finish. The list is nearly endless with it comes to reducing man hours, touch times, and efficiency of composite fabrication processes.

Unmatched Repeatability & Uniformity: Process robustness and consistency go together in effectively fabricating repeatable high-quality parts. Prepregs mitigate process variation as it is optimized with features such as tack, cured ply thickness, and a debulking capability that make even the most complicated laminates easier. Prepregs are consistent, simply pull the backing from the cut plys and lay it into the mold, conforming the ply to the mold as needed. Once the layup is complete, the bagging and curing process is much less complicated than that of an infusion process.

Co-cure > Secondary Cure: One large advantage to using prepregs in composites lies in the ability to co-cure many aspects of a composite laminate in one shot. Co-curing adds to the high-performance capability because co-cured laminates share stronger bonds than that of secondary bonds. Products such as film adhesives allow core bonded composites to be made in one cure run with the prepreg fabric layers. In addition, large core pieces can be joined via syntactic films, lighting strike protection can be added to the surface of conductive materials and other film adhesives can be used to provide a higher quality surface finish. In short, many of vacuum infusion and traditional layup shortcomings are made simple using prepreg products.

DISADVANTAGES OF PREPREG

Cost: Of course, prepregs cost more than a fabric and a resin. High performance aside, when unmatched repeatability and process robustness are met with a high demand of parts to be fabricated prepregs may still come out to be the best financial option. All options should be weighed when selecting the best option for the composite.

Out-Time / Storage / Handling / Shelf Life: There are different quality aspects of prepregs to consider when using prepregs, such as a more complicated storage and out time system when prepregs are not frozen. Storage life is still relevant, however the added aspects how long it can be exposed to room temperature environments without product degradation are critical aspects of a prepreg system. This is not necessarily a disadvantage, but a system must be developed to track the history of a prepreg ensuring the investment in its performance and quality.

Need for additional equipment: A freezer capable of holding rolls of material and a controlled oven or autoclave system capable of achieving ramp rates needed to properly

cure prepregs are the bare minimum needed for fabricating parts from prepregs. The cost and setup time of these alone can add up quickly.

STORAGE OF PREPREGS

When prepregs are not being processed through ply cut or layup, they are stored in a freezer at or below 0F. Bags are often sealed in a moisture proof bag with a desiccant to prevent exposure to moisture. Prepregs must be completely thawed before processing. It is best practice to mitigate time out of the freezer as prepregs do carry limits on “out-time” before the precured resin system will become dry and unusable for composite fabrication.

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