Structures and Processing Guidelines* for Innegra™

INNEGRA TECHNOLOGIES™

*Processing Guidelines

These are general guidelines for using Innegra Fiber Technology in composites. Each composite part and process to make it is unique with numerous steps and variables to consider. Following these guidelines does not guarantee a perfect, finished part.

Available Reinforcements of Innegra™

- 100% Innegra™ S woven fabrics
- Spread tow
- Co-Mingled fabrics (woven fabrics made with Innegra™ H yarns)
- Co-Woven fabrics (Innegra™ S yarns woven with a high modulus fiber)
- 0/90 Bi-axials
- Multi-axials
- Uni-Directionals
- Scrims
- Prepregs
- Braids
- Knits
- Staple fiber

Composite Processing Guidelines of Innegra™

Selecting the Appropriate Fabric *

Fabric Type	What it can do…	Tips for fabrication/ What to expect…
100% Innegra Fabric	Add toughness Decrease weight	Innegra is a ductile material and will not contribute to stiffness or rigidity in an application. Therefore, we recommend that you use a high modulus fiber for your mechanical strength.
Innegra S **Co-Wovens**	Maintain thickness Add toughness Reduce weight	Ensure full wet out.
Innegra H **Co-mingled**	Add bulk Add toughness	Encapsulate fabric with resin. Expect slower processing time to get full wet out Use lower viscosity resin.
Flat/ Spread Tow	Thinner laminates Add toughness	Expect slower processing time. Infuse from top, down in fabric direction, not side to side. Consider using veil or prepreg to get best bond. Expect less inter-laminar shear due to less resin.

*Fabric design and permeability are important factors when using Innegra. Permeability will allow resin to flow through the material and encapsulate the fiber promoting better adhesion. Fabrics with low permeability could potentially inhibit resin flow causing poor adhesion.

Composite Processing Guidelines of Innegra™

Selecting the Resin Type and Usage

Recommended Resin Types

Epoxy and vinyl ester resins have been used successfully in commercial applications.

After your bench top test, determine the best timing for wet out, then work closely with your resin manufacturer or distributor to determine the best resin system.

Lower viscosity resins tend to work better than higher viscosity systems because they wet-out the fabrics faster and anchor into the fiber nano-bridges.

Be sure to match the elongation of the resin with the elongation of the fiber/fabric.

If you cannot change resins, evaluate the resin flow & saturation of fabric in your bench top test, then with this information determine the appropriate number of resin ports to ensure proper wet out of the part.

Resin Usage with Innegra vs. Other Materials

*Resin calculation should be based on part volume, not by weight b*ecause Innegra fiber has a significantly lower density than glass and other fibers. It has a higher volume for equivalent weight.

Use your bench top test to determine if you need to increase or decrease resin content when using Innegra vs current materials. You can typically expect to use 5-8% more resin due to the bulk of Innegra fiber.

Add resin slowly to ensure full wet out. Innegra will still look white after fully wet out. The change is subtle.

Tint resin as you normally would when using Innegra in a composite.

Composite Processing Guidelines of Innegra™

Cutting Innegra™ Fabrics, Processing Temperature, Bench Top Testing

Cutting Innegra Fabrics

We recommend taping edges of fabric prior to cutting.

Serrated blade shears work better than flat blade shears. Electric rotary cutters work as well.

Laser cutting will also work, but it will fuse fabric edges and can cause hard beading.

Processing Temperature <150 C/302 F

Proceed with caution at temperatures above 150 C/ 302 F. Be sure to take into account the resin exotherm when setting process conditions. The exotherm temperature needs to be at or below 150 C/ 302 F as well.

Bench Top Testing

When using any new material, we always recommend a quick bench top test with the fully formulated resin before laying up a part to determine how your environment (temperature, humidity and barometric pressure) affects the resin and fabrics. This test will also help you determine resin flow rates.

Composite Processing Guidelines of Innegra™

Wet Lay up, Closed Molding, Vacuum Bagging

Closed Molding

For the same weight, Innegra fabrics are thicker than glass/carbon fabrics. Design the mold using the fabric CPT (cured ply thickness) to obtain proper resin content.

Over compaction will result in a dry laminate.

Vacuum Bagging

We recommend that you pull vacuum for a few minutes (10-15) before introducing resin to the fabric to pull the air and moisture out of the voids in the Innegra fibers.

Composite Processing Guidelines of Innegra™

Finishing Practices

Finishing	Best Practices
Cutting	Innegra composites can be cut into any shape or size. Finish any “fuzzy” edges with a heat gun, flame dressing or hot knife. Be careful not to burn the resin.
Sanding	When laying up, cut Innegra short on an edge that needs to be sanded, so you only sand resin, not fabric.
Drilling	If Innegra is deep inside the part, drill as usual. If Innegra is near surface: Drill in the 250-500rpm range, Use a new, sharp bit (carbide pre-ferred), Stabilize the part and the drill, ideally use a drill press with part clamped down. If no drill press available, clamp the part down and use a drill guide. Finish any “fuzzy” edges with a heat gun, flame dressing or hot knife. Be careful not to burn the resin.
Painting	Always epoxy prime epoxy parts. Composite parts containing Innegra can be painted on resin rich surfaces or another option is to finish your part with a thin glass veil for ease of painting.