



Processing Guidelines*

Using Innegra Fiber Technology in Composites

What is Innegra S Fiber?

- Olefin-based chemistry
- Multi-filament yarn
- Ductile (Flexible)
- Lightest fiber commercially available
- Fiber contains micro-voids
- Hydrophobic
- Deniers ranging from 625 to 3800 available
- Black or White available
- Low dielectric constant and dissipation factor
- Low elongation

What is Innegra H Fiber?

- Hybrid yarns containing Innegra S and other high modulus yarns
- Multi-filament yarn
- Available in a wide range of deniers from 925 to 10,000 depending on the yarns involved.
- Available in a variety of fiber combinations of Innegra S with carbon, basalt, glass or aramid

Why use Innegra Fiber Technology?

- Increase Toughness
- Improve Impact Resistance
- Decrease Weight
- Improve Damage Tolerance
- Increase Vibration Dampening

In what formats is Innegra available?

- 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 another high modulus fiber)
- 0/90 Bi-axials, Multi-axials
- Uni-Directionals
- Scrim
- Prepregs
- Braids

Which fabric should I choose**?

Fabric Type	What it can do...	Tips for fabrication/ What to expect...
Innegra H Co-mingled	<ul style="list-style-type: none"> - Add bulk - Add toughness 	Encapsulate fabric with resin. Expect slower processing time to get full wet out Use lower viscosity resin.
Innegra S Co-Wovens	<ul style="list-style-type: none"> - Maintain thickness - Add toughness - Reduce weight 	Ensure full wet out.
Flat/ Spread Tow	<ul style="list-style-type: none"> - 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.
100% Innegra Fabric	<ul style="list-style-type: none"> - Add toughness - Decrease weight 	Innegra is a ductile material and will not contribute to stiffness or rigidity in an application. We, therefore recommend that you use a high modulus fiber for your mechanical strength.

**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.

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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.

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.

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.

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.

Resin Usage with Innegra vs. Other Materials

Resin calculation should be based on part volume, not by weight because 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.

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.

For a list of resin recommendations, please see our website www.innegrates.com/technical

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.

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 preferred), 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.