MULTIAXIAL NON-CRIMP FABRIC REINFORCEMENTS

Brochure | **Multiaxial Non-Crimp Fabric (NCF) Reinforcements** | **May 2020**

OUR CURIOSITY FUELS YOUR POSSIBILITY

Strong, lightweight, and versatile. Owens Corning® composite solutions have transformed industries. From construction to transportation to energy — there's no telling where our next innovation will reach.

We aren't just a world leader in glass science — we innovate productivity, performance, durability, and design flexibility. Our influential innovations are a powerful combination of understanding emerging needs and responsibly creating next-generation solutions.

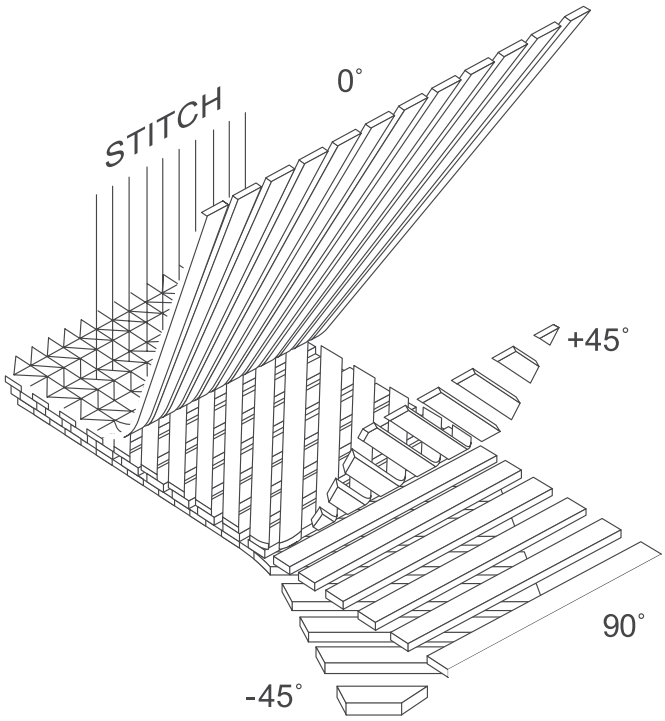
Advances in glass-based technical fabrics provide a full range of woven, knitted, and nonwoven technologies to the global composites industry. A powerful combination of expertise in glass science and state-of-the-art facilities empowers our team to partner with customers for the development of glass-specific, custom technical fabric products. Along with custom solutions, we're able to provide high-quality, competitive, standardized products to our customers, thanks to our quick and efficient supply chain management practices. Increase your productivity and throughput with our composites reinforcement expertise. Supported by a worldwide manufacturing platform that spans three dozen manufacturing facilities and research and development centers, we deliver locally engineered, customized solutions.

FURNACE & GLASS SCIENCE

INNOVATIVE CHEMISTRY

LOCALLY ENGINEERED

GLOBAL PLATFORM



REDEFINING MULTIAXIAL NON-CRIMP FABRIC REINFORCEMENTS

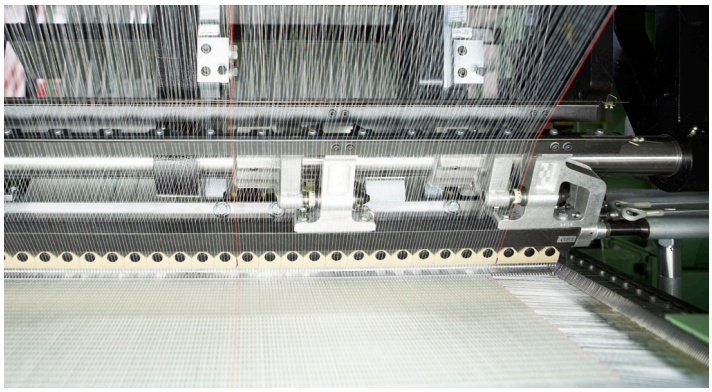
Multiaxial reinforcements are fabrics composed of two or more plies, or layers of unidirectional fibers, the optimal reinforcement configuration.

Each individual layer can be oriented on a different axis, and for this reason, the fabric construction or assembly is referred to as multiaxial.

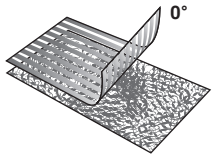
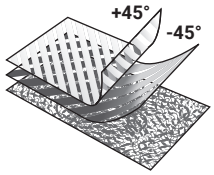
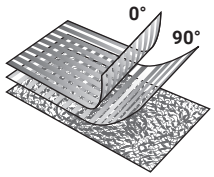
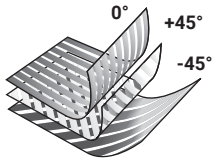
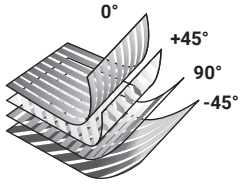
Depending on the number of layers and varying orientation and axis, a unidirectional, biaxial, triaxial, and quadriaxial architecture can be assembled into one non-crimp fabric (NCF) system.

The various layers are held together with a stitched thermoplastic (TP) yarn — typically polyester — which prevents crimping or undulations that can lead to loss of performance in the finished laminate. The stitching also enables easier handling as the fabric remains intact even when cut.

Straight non-crimped fibers within a multiaxial fabric system allow very good resin impregnation and wet-out, perfect for infusion and all closed-molding processes. The stitching helps the diffusion of resin vertically through the layers (Z-axis), thereby optimizing infusion rates.



PRODUCT RANGE FOR NON-CRIMP FABRIC MULTIAXIAL REINFORCEMENTS

PRODUCT	ORIENTATION AXIS	FEATURES	BENEFITS	
Unidirectional	0° (L) 90° (T)	• Maximized axial fiber content. • Improved longitudinal strength, stiffness and flex. • Economical method to deliver unidirectional reinforcement. • Improved strength without adding thickness at comparable stiffness.	• Reduced resin usage and part weight. • Finished parts perform under extreme tensile and flexural stress. • Lower finished part cost. • Enhanced performance from lighter laminates. • Offers design flexibility for wide range of applications.	
Biaxial	±45° (BX)	• Crimp-free construction. • Opposing ±45° fabric construction offers resistance to twisting. • Adjustable conformability behavior. • Reduces print-through.	• Improved fiber alignment and mechanical properties. • Finished parts perform under extreme shear and torsion stress. • Improved placement in complex parts. • Enhanced aesthetics with material and labor savings. • Improved print-though as well as cost-effective secondary bonding and handling. • Offers solutions for a wide range of applications.	
Biaxial	0°/90° (LT)	• Crimp-free construction. • Optimized directional fiber content. • High bidirectional strength, stiffness, and flex. • Reduces print-through. • Can be combined with various mats (continuous filament mat, wet-formed mat, chopped strands, and veil).	• Improved fiber alignment and mechanical properties. • Reduced resin usage and part weight. • Improved performance from lighter laminates. • Improved laminate surface quality. • Enhanced aesthetics with material and labor savings. • Offers solutions for a wide range of applications.	
Triaxial	0°/±45° (TLX) ±45°/90° (TTX)	• Crimp-free construction. • Optimized directional fiber content. • Three-layer construction reduces the number of steps in lay-up. • Reduces print-through. • ±45° fiber content offers resistance to twisting.	• Improved fiber alignment and mechanical properties. • Reduced resin usage and part weight. • Reduced fabrication costs of steps. • Enhanced aesthetics with material and labor savings. • Excellent balance of axial strength and shear resistance. • Offers solutions for a wide range of applications.	
Quadriaxial	0°/±45°/90°/±45° (QX)	• Crimp-free construction. • Optimized directional fiber content. • Four-layer construction reduces the number of steps in lay-up. • Reduces print-through. • Multiaxial reinforcement.	• Improved fiber alignment and mechanical properties. • Reduced resin usage and part weight. • Reduced fabrication costs. • Enhanced aesthetics with material and labor savings. • Quasi-isotropic properties. • Offers solutions for a wide range of applications.	

CHARACTERISTICS AND END USE APPLICATION

PRODUCT	ORIENTATION AXIS	CHARACTERISTICS	END USE APPLICATIONS	
Unidirectional	0° (L) 90° (T)	Designed for applications requiring a high concentration of reinforcement in only one direction by placing continuous fibers in either a 0° or 90° axis. Fibers are held in place by either interweaving a lightweight hot melt yarn to lock the unidirectional fibers in place or by stitching the fibers in place using a stitch yarn. The input fibers are designed to give controlled wet-out and excellent laminate properties.	Great for demanding applications with a high aspect ratio (length-to-width ratio) such as wind blades, poles, and stringers and are also commonly used in FRP pipe and fittings for increased strength. Useful in applications where a discrete area requires additional strength or stiffness. Wrapping of existing structural components, such as columns and beams with unidirectional fabrics, could also greatly increase the lifespan and performance of these critical load-bearing members.	
Biaxial	±45° (BX)	Stitch-bonded composite reinforcement combining equal amounts of continuous fiber oriented in the +45° and -45° directions in a single fabric, offering off-axis reinforcement without the need to rotate other materials on a bias. Conformability behavior can be adapted to part shape and processing requirements. The input fibers are designed to give controlled wet-out and excellent laminate properties.	Structural laminates, including marine panels, wind blades, and recreational sporting equipment such as snowboards.	
Biaxial	0°/90° (LT)	Stitch-bonded, non-crimp, composite reinforcement comprised of unidirectional warp (0°) and weft (90°) plies that can be engineered for specific applications requiring different ratios of warp-to-weft reinforcement. The input fibers are designed to give controlled wet-out and excellent laminate properties.	High performance structural laminates including boat hulls, truck and trailer panels, wind blades, recreational sporting equipment, and bridge decks.	
Triaxial	0°/±45° (TLX) ±45°/90° (TTX)	Stitch-bonded, non-crimp, composite reinforcements, combining either a warp (0°) or weft (90°) ply with double bias (±45°) plies into a single multiaxial fabric. The input fibers are designed to give controlled wet-out and excellent laminate properties.	For applications requiring a combination of axial and off-axis reinforcement, including wind blades, boat hulls, storage tanks, trailer panels, and pultruded profiles such as bridge decks.	
Quadriaxial	0°/±45°/90°/±45° (QX)	Stitch-bonded, non-crimp, composite reinforcement, combining warp (0°), weft (90°), and double bias (±45°) plies into a single multiaxial fabric. The input fibers are designed to give controlled wet-out and excellent laminate properties.	For applications requiring quasi-isotropic performance such as heavy structural laminates for boat hulls and decks, trailer panels, shipping containers, and pultruded profiles.	

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