

CHOMARAT

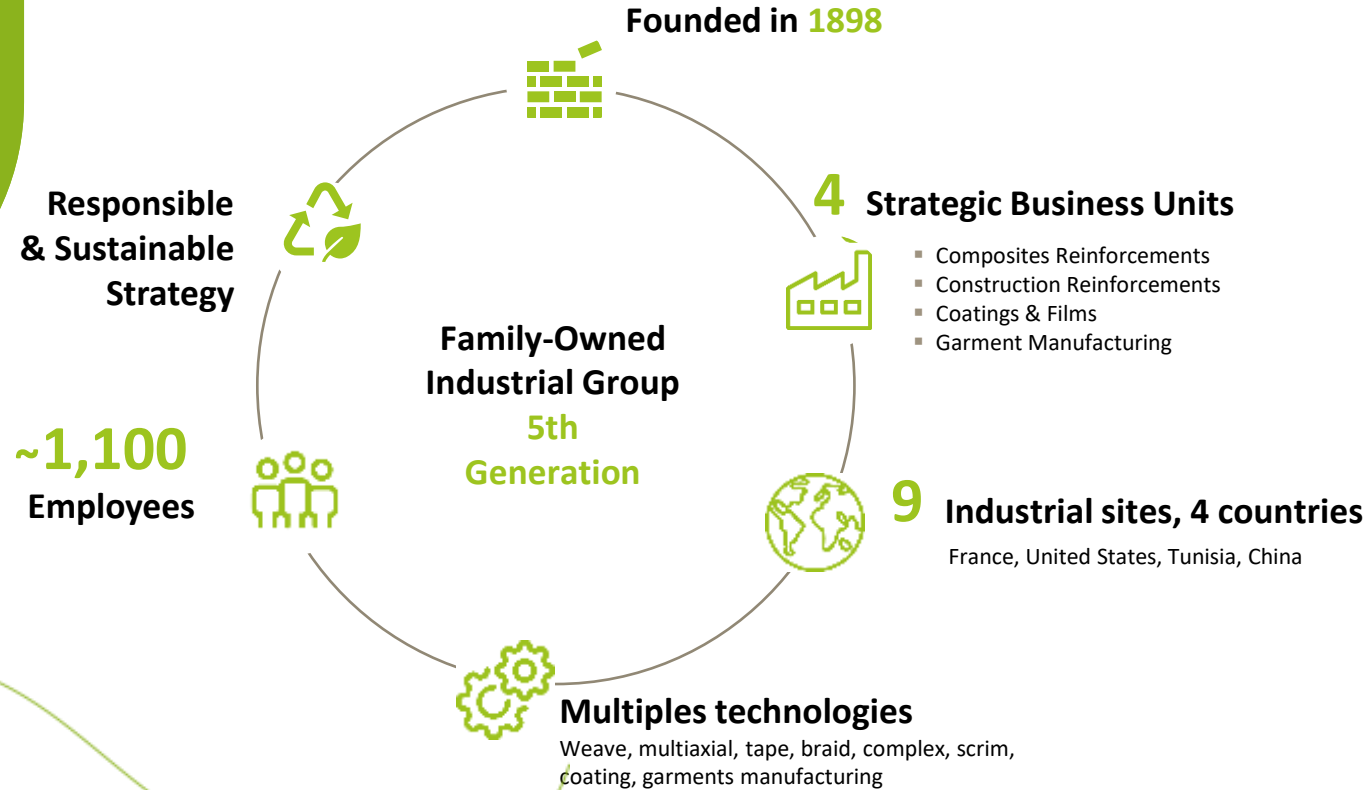
Anchored in the future



Carbon Fiber Fabrics and Product
Solutions for Advanced Composites

Ashley Duncan

Group CHOMARAT



Our Industrial Sites in the World

CHOMARAT FRANCE

3 sites in Ardèche

- **Composites** Reinforcements (glass/carbon)
- **Construction** Reinforcements
- **Coatings & Film**

CHOMARAT TUNISIA

2 sites in Grombalia (Tunis)

- **Composites** Reinforcements (glass)
- **Garment Manufacturing**

CHOMARAT NORTH AMERICA

3 sites in Anderson (SC)

- **Composites** Reinforcements (glass/carbon)
- **Construction** Reinforcements

CHOMARAT CHINA

1 site in Taicang (Shanghai)

- **Composites** Reinforcements (glass/carbon)



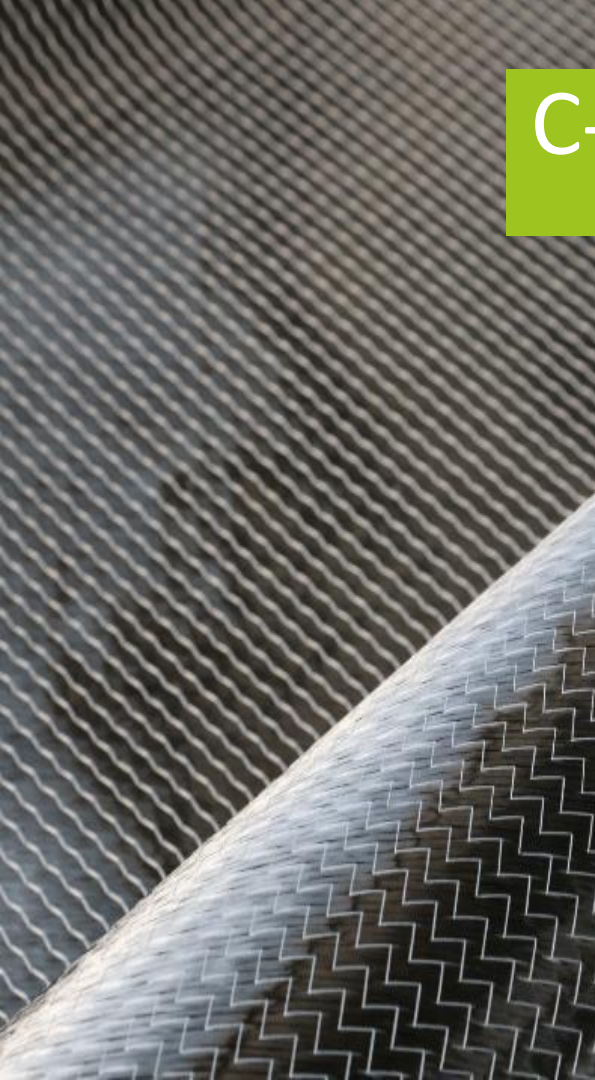
Chomarat Product Highlights – Today's Presentation

- About CHOMARAT
- C-PLY™ - Carbon Multiaxial NCF
- C-WEAVE™ - Woven Carbon Fabric
- G-FLOW™ - Structural Fiberglass Flow Media
- Rovicore™ - Reinforcement Mat Closed Mold

A close-up photograph of carbon fiber fabric, showing a diagonal twill weave pattern. The fabric is dark grey/black with lighter grey lines forming a repeating 'V' or 'Z' shape. The lighting creates a slight sheen and highlights the texture of the fibers.

C-PLY™

CARBON MULTIAXIAL NCF



C-PLY™ - NCF Multiaxial Carbon Fabrics

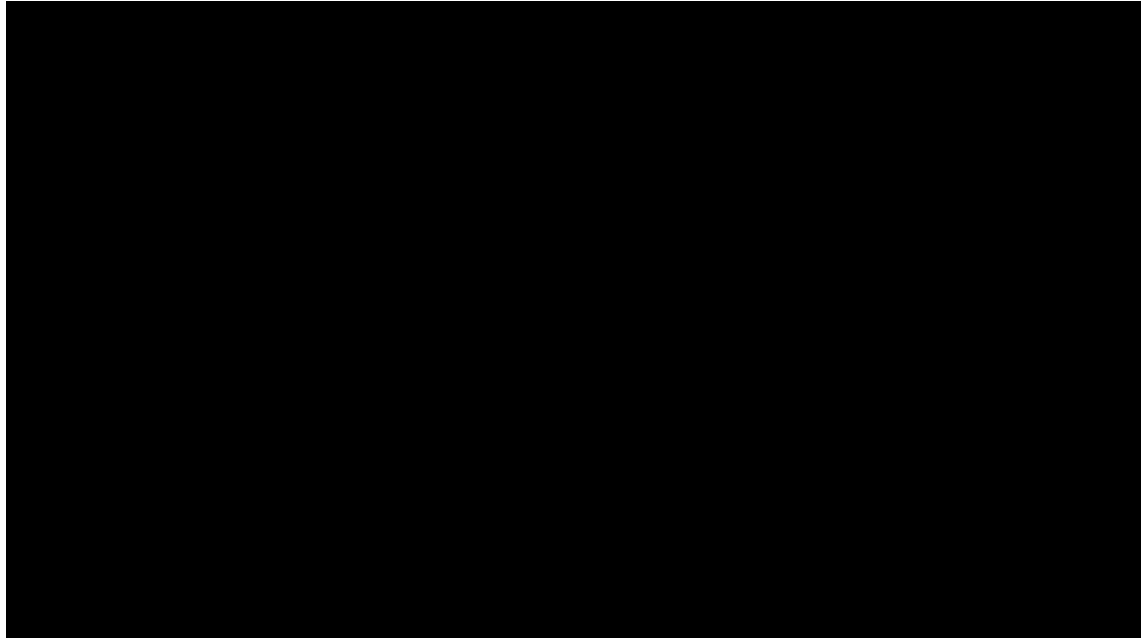
Range and description

- Leading edge carbon NCF multiaxial reinforcement allowing structural design benefits.
- Most advanced technology and tow spreading process.
- Unidirectional and multi-directional plies stitched together (BX, BT, TL, Q)
- Shallow angles capability
- Weight range: 50 gsm to 300 gsm per ply

Benefits

- Performance level competes with best UD prepregs
- Weight savings with tougher and stronger laminates.
- Optimization of layer construction

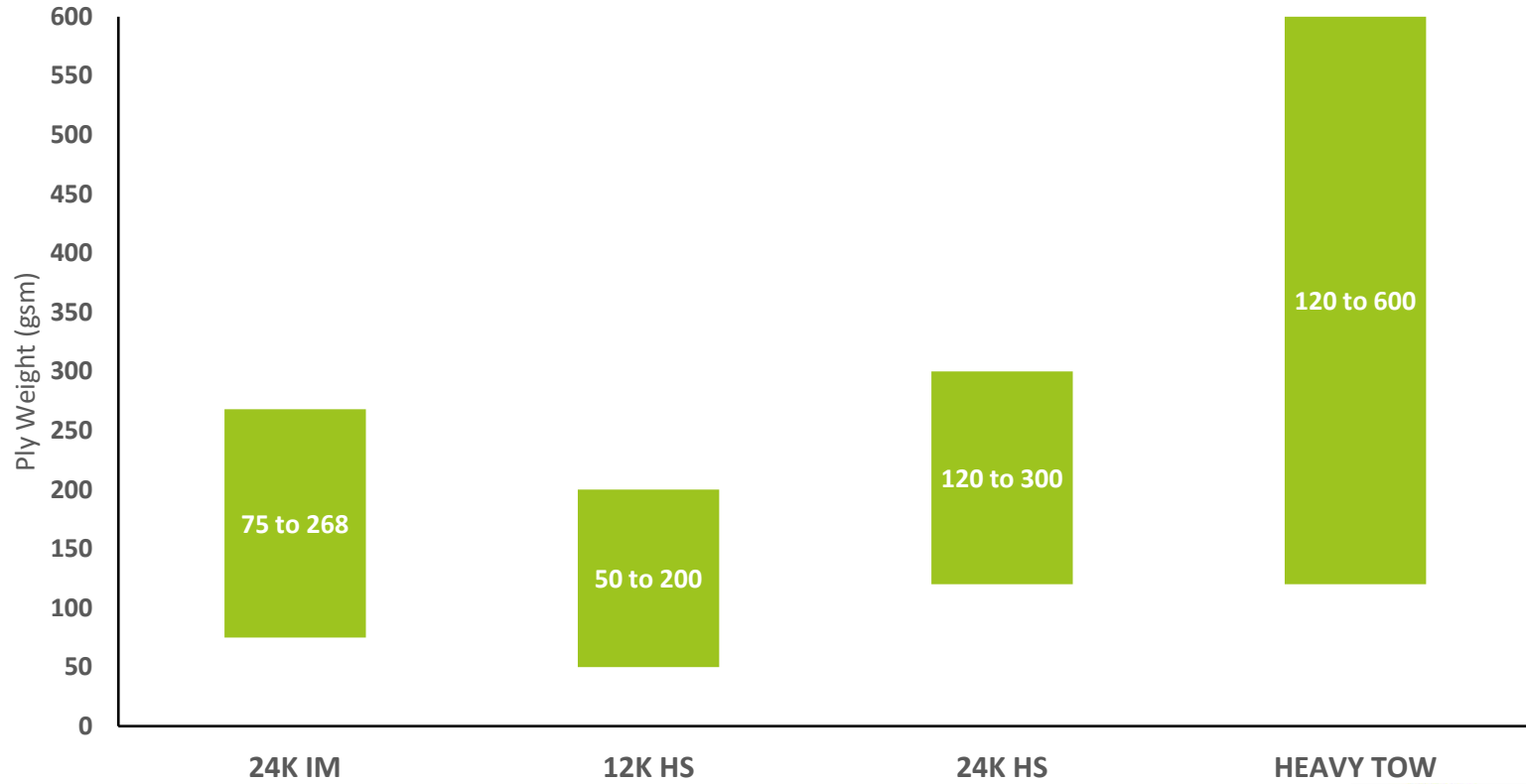
C-PLY™ : advanced Carbon NCF Technology



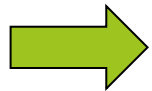
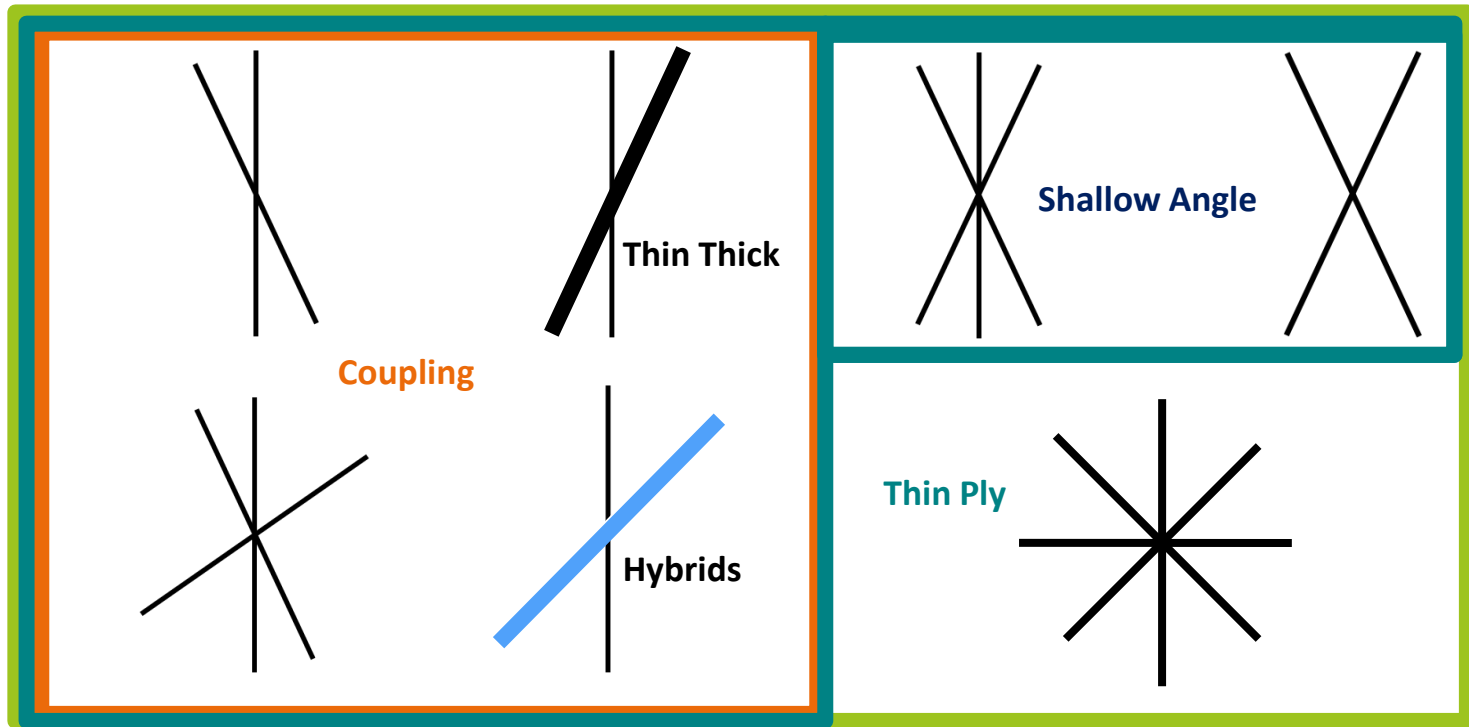
A traditional NCF is made by bundles of fibers – C-Ply SP is made by deposit of dry spread UD tapes. The tapes can be made on-line or off-line.



C-PLY™, Ply Weight Capabilities



C-PLY™, A Large Range of Possibilities



We make C-PLY™ constructions with **adapted fiber orientations** to optimize part performance: UD, BX, BT, TL, TT, QX ...



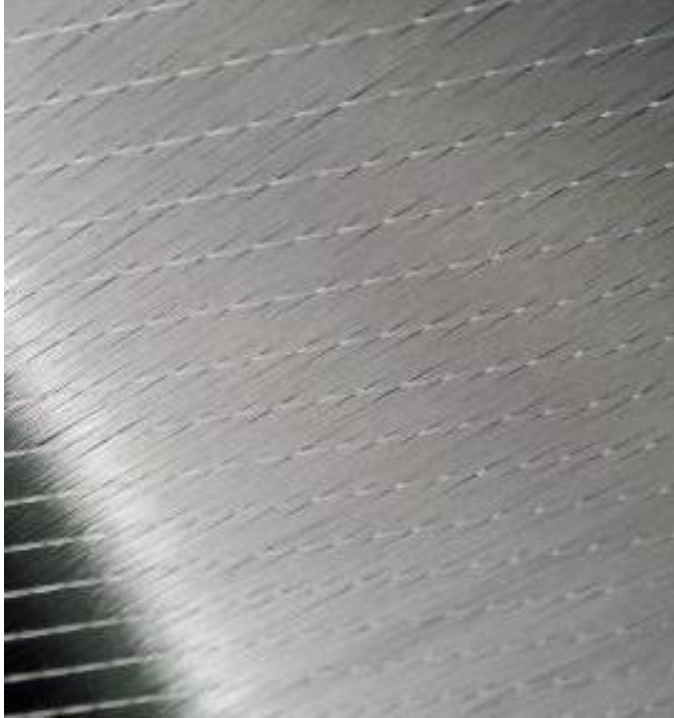


C-PLY™ Specialties

- C-PLY™ Thin Ply
- C-PLY™ Shallow Angles



C-PLY™ Thin Ply



“Outperforming existing solution using woven fabrics or standard NCF”

Thin Plies laminate benefits:

- More homogenous laminate to avoid early micro-cracks and warpage
- Weight saving with tougher and stronger laminates
- Extended fatigue life
- Performance level compete with best UD prepregs
- Higher impact strength.



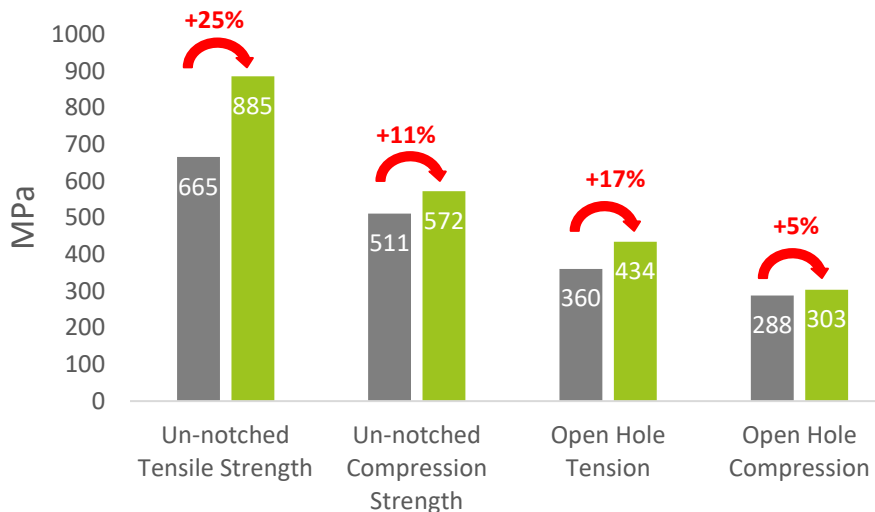
C-PLY™ Thin Ply vs carbon fabric: improved mechanical performance*

*Niar test data prepreg : C-PLY T700S vs 3K Carbon woven fabric

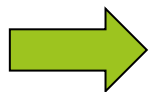
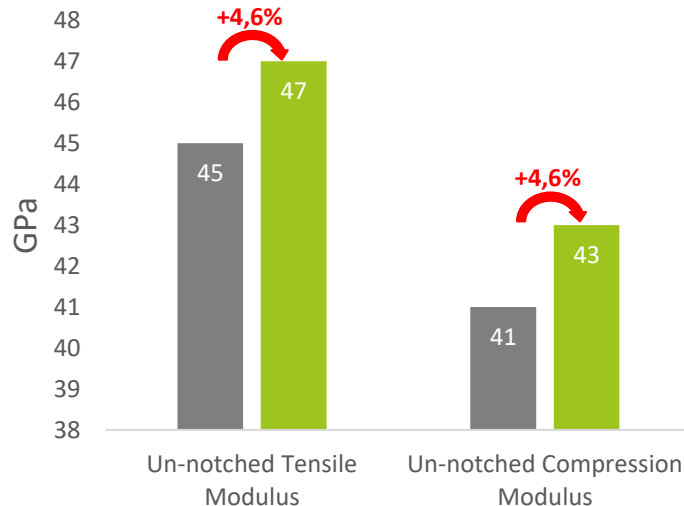
■ Toho 193 HTS40 3K Plain Weave

■ C-PLY 150 CT3,4 12K T700 HS 0/-45 Quasi

Tensile strength



Tensile modulus



C-PLY™ Thin Ply enables drastic performance gain:
weight and cost savings

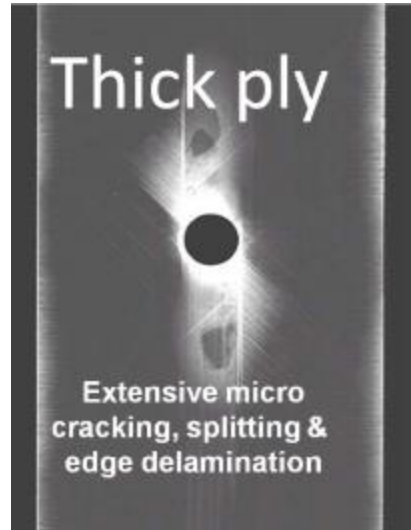


C-PLY™ Thin Ply: Extended fatigue life

Open Hole Tension Fatigue at Room Temp

X-ray pictures after 73,000 cycles of tensile fatigue

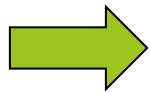
Laminate thickness = 3.2 mm



Ply thickness = 0.12 mm



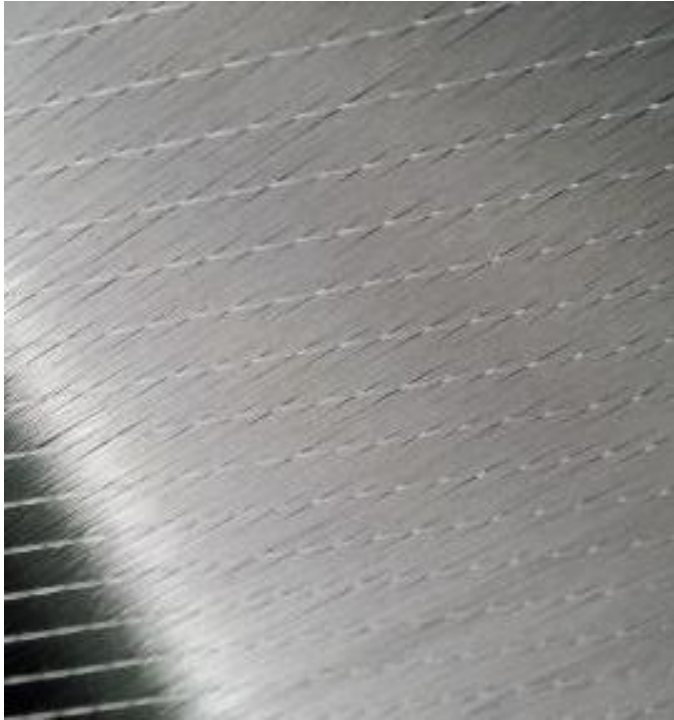
Ply thickness = 0.04 mm



Laminates made with C-PLY™ Thin Ply are **stronger & tougher**

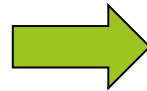
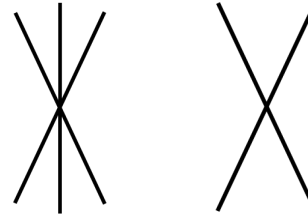


C-PLY™ shallow angles



Shallow angles for part with preferred loading direction:

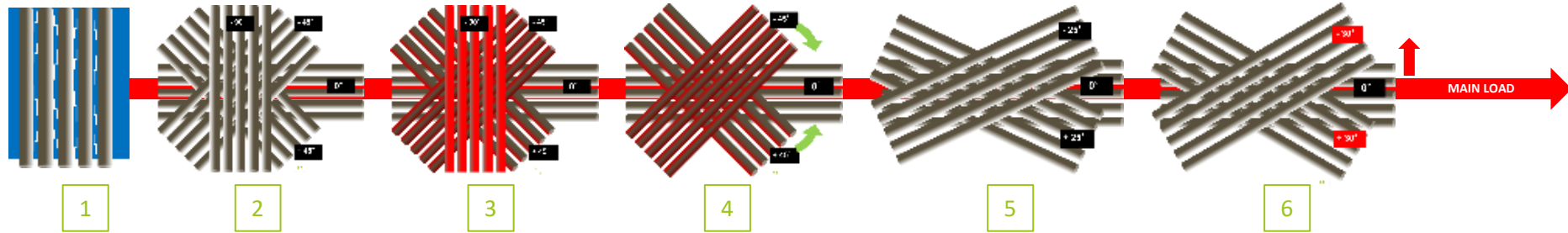
- Optimized fiber directions
- Extended fatigue life (micro-crack free laminates under load cycles)
- One direction lay up with C-PLY™ (up to 10 time faster on ATL)



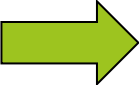
Cost & weight savings



Shallow angles benefits for parts with preferred loading direction



1. When fibers are 90° compared to the main load, fibers don't take the load and...Micro-cracks occur very early
2. Quasi-isotropic
3. 90°, 45°, -45° plies are micro-cracking → remove 90° ply
4. +/- 45° plies don't work in harmony with 0° ply for such laminates
5. Shallow angle plies at 30° work nicely with the 0° plies.
6. Off Axis Angle adaptable to Transverse Load

 **Micro-cracks free, fatigue performance improved & weight saving**

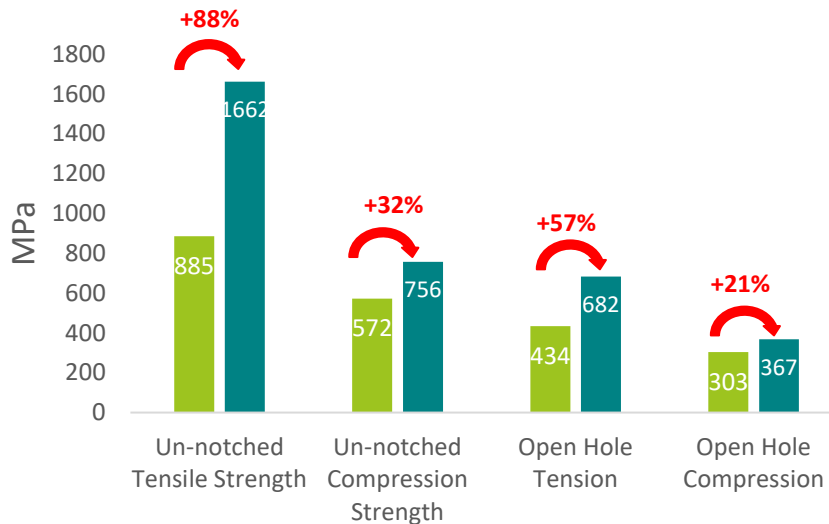
Shallow angles benefits for parts with preferred loading direction*

*Niar test datas prepreg C-PLY T700S quasi vs 0/+30

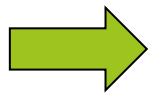
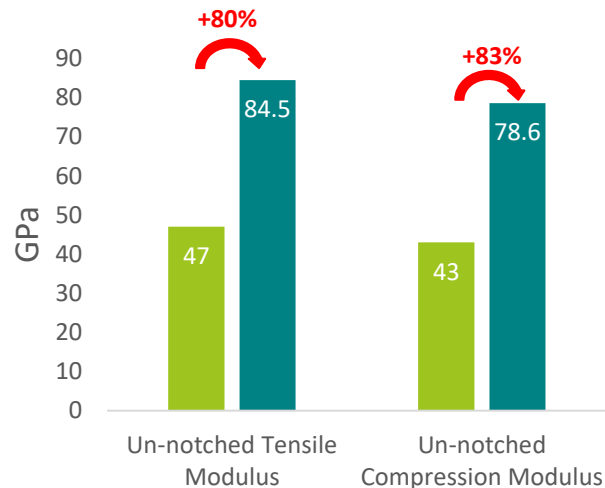
C-PLY 150 CT3,4 12K T700 HS 0/-45 Quasi

C-PLY 150 CT3,4 12K T700 HS 0/+30

Tensile strength



Tensile modulus



Shallow angles: drastic mechanical performance improvements for further weight and cost savings



Dash X UAV with C-PLY™

Weight and performance benefits

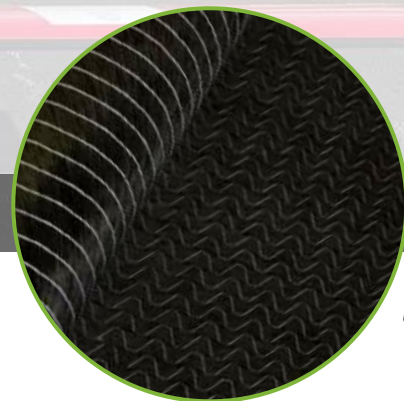
C-PLY™ is in the wings, horizontal stabilizers, vertical fin

- Thin plies for a homogenous laminate: maximized performance
- Customizable ply angles : no undesired “off-axis” ply angles
- Hand-placeable in open soft tooling using out-of-autoclave processes
- Vacuum infusible with epoxy at aerospace grade fiber volume fractions

Key Benefits:

- Tailored reinforcement : strength and stiffness tailored for the load
- Extremely high performance very cost effectively

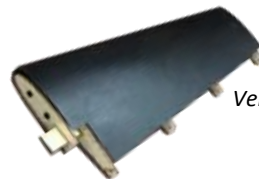
➔ **The first deployable UAV for tactical aircraft**



C-PLY™
Unbalanced
angle

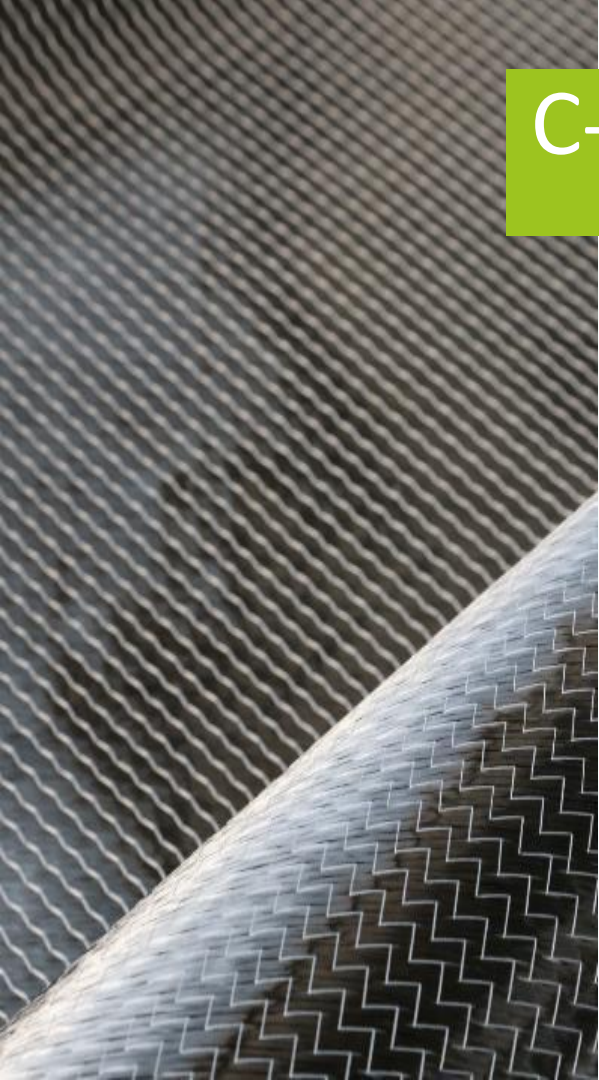


«The Dash X is the first Class II UAV capable of being carried and deployed from tactical jet aircraft » Bob S.Skillen,
Chief Engineer VX Aerospace



Vertical tail

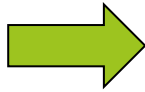




C-PLY™ - NCF Multiaxial Carbon Fabrics

Benefits Summary

- Designed for optimized laminate construction
- Thin plies & shallow angles can be incorporated
- Weight savings with tougher and stronger laminates.
- Improves production efficiency



**C-PLY™ enables part performance gain,
weight and cost savings**



C-WEAVE™

Carbon Fiber Woven Fabrics



C-WEAVE™ - Woven Carbon Fabrics

Range description

- C-WEAVE™ is a bi-directional (0°/90°) warp & weft woven carbon fabric
- C-WEAVE™ is well-suited for performance and cosmetic applications
- Width range : 50" Standard. 60" availability on select products
- Weight range: 198gsm to 800gsm
- 198 gsm fabrics using Toray T300 & Hexcel AS4C 3K fibers

Benefits

- Outstanding visual quality for cosmetic parts.
- Available with stabilizer veil to improve handling characteristics.
- Excellent fiber alignment and flat weft yarn insertion.
- Ideal for Prepreg, Infusion, RTM, HLU processes.

C-WEAVE for Body Panels

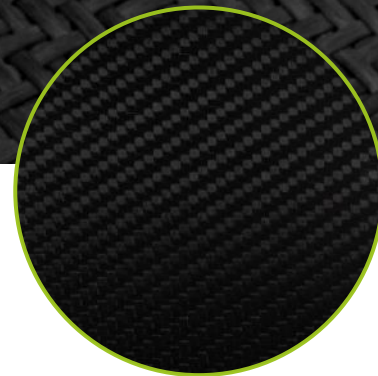
High Quality carbon fabrics for cosmetic applications

- C-WEAVE 205T and 245T with Toray T300 3K fiber
- Mechanical performance & Consistency - less shrinkage and resin rich area
- High drapability
- C-WEAVE Hset - stabilized carbon veil

Key Benefits:

- Low weft distortion
- Perfect optical effect
- Weight reduction

➔ High cosmetic requirements



C-WEAVE™ 245Tgsm



Range Rover
SVR C-Weave
245T

Tooling & Sheet Applications



Typical Tooling Layup Materials

Skin Layer – 3k options

- CWEAVE 198T
- CWEAVE 205T
- CWEAVE 245T

Bulking Ply - 12k, 24k options

- CWEAVE 670T 12k
- CWEAVE 800T 24k
- C-PLY QX785

G-FLOW™ is a **structural reinforcement** which by its innovative design, adds permeability during the infusion process without adding an external or internal flow media .

- Mechanical Performances as standard structure
 - **G-FLOW™** replaces an external flow media and a structural reinforcement (0/90°)
- Cost saving for same mechanicals and permeability performances
 - Reduce preparation time
 - Less waste
 - Less disposal costs
- Need to built the laminate construction according to

G-FLOW™ bringing both **structural** and **flow performances**

G-FLOW™ - 500L and 980L

General info : infusion process & limitation

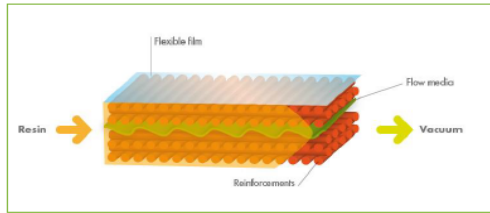


Fig 1: Infusion with Internal Flow media

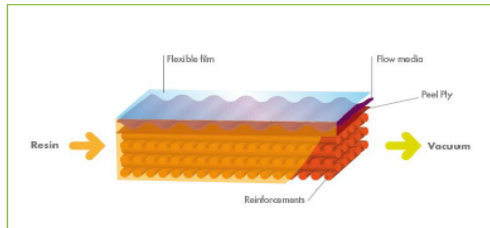


Fig 2: Infusion with External Flow media

- In the infusion process, the migration of the resin through the textile structure is possible thanks to the **permeability** of the reinforcement.
- In order to increase these permeability values, 2 infusion options :
 - **Internal flow media** (such as CFM)
 - Limitation : high resin consumption (leading to low Fibre Volume Fraction)
 - **External flow media** (such as « green mesh »)
 - Limitation : Consumables, resin consumption, implementation time
- The solution from CHOMARAT :
 - **G-FLOW™**, a structural internal flow media (patent pending)

New Product Introduction: C-FLOW™

**We're excited to unveil C-FLOW™,
the carbon version of G-FLOW™.**

- Introduced at JEC 2026
- Engineered for Closed Mold Processes
- Outstanding resin flow
- Ideal for high performance composite manufacturing
- When combined with CHOMARAT C-PLY carbon NCF reinforcements, offers optimal infusion performance especially on very thick parts.

ROVICORE™

Reinforcement mat made with a synthetic non-woven core and chopped glass fibers mechanically stitched together providing;



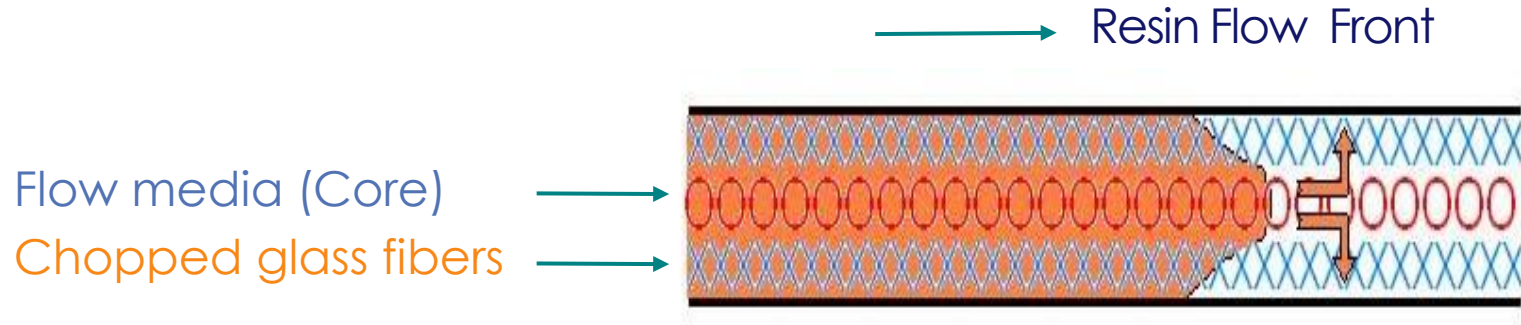
Conformability

Permeability

Adaptability

Process efficiency

ROVICORE™ ADVANTAGES



- High permeability through the core
- Different constructions and areal weights allow single-layer construction, saves time and labor
- Coreglass™ available – blend of synthetic + glass fiber (flow media core) increase mechanical property

→ **Makes injection and laminate wet out easier**

CHOMARAT

Anchored in the future

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