Which Cloth Should I Choose?

Understanding the Pros and Cons of Different Composite Materials.

In the diverse world of composite materials, selecting the right cloth is essential for the performance and success of your project. This article provides insights into the pros and cons of various materials including fiberglass, carbon fibre, Kevlar®®, as well as other options available on the EC Fibreglass Supplies website.

1. Fibreglass: The Versatile Choice.

Pros: Affordable, versatile, compatible with various resins. Available in very light weight options such as 25g and 28g which are ideal for model aircraft etc and up to 200g, which is excellent for sheathing plywood canoes and kayaks when combined with an epoxy resin. Also available in rolls of matting, these are randomly laid 2" cut strands held together with a binder, an emulsion binder for Polyesters/Vinylesters and a Powder bound version for Epoxy Resins.

Fibreglass has been the staple of the composites industry since the 1950's, Fiberglass is lightweight, has moderate tensile and compressive strength and is tolerant of both impact damage and loading.

Fibreglass is perfect for a wide range of applications that are not expected to need the added strength and durability of the higher priced fabrics.

Cons: Less strength per square metre than higher priced cloths, uses more resin and can have a rougher finish the heavier the weight.

Other Considerations: Although it can be used with most resin systems, fibreglass cloth is best used with epoxy resins. As with all the woven fabrics mentioned in this article, if multiple layers are bonded using lesser performance resins such as polyester, layers may be prone to delamination upon impact or stress.

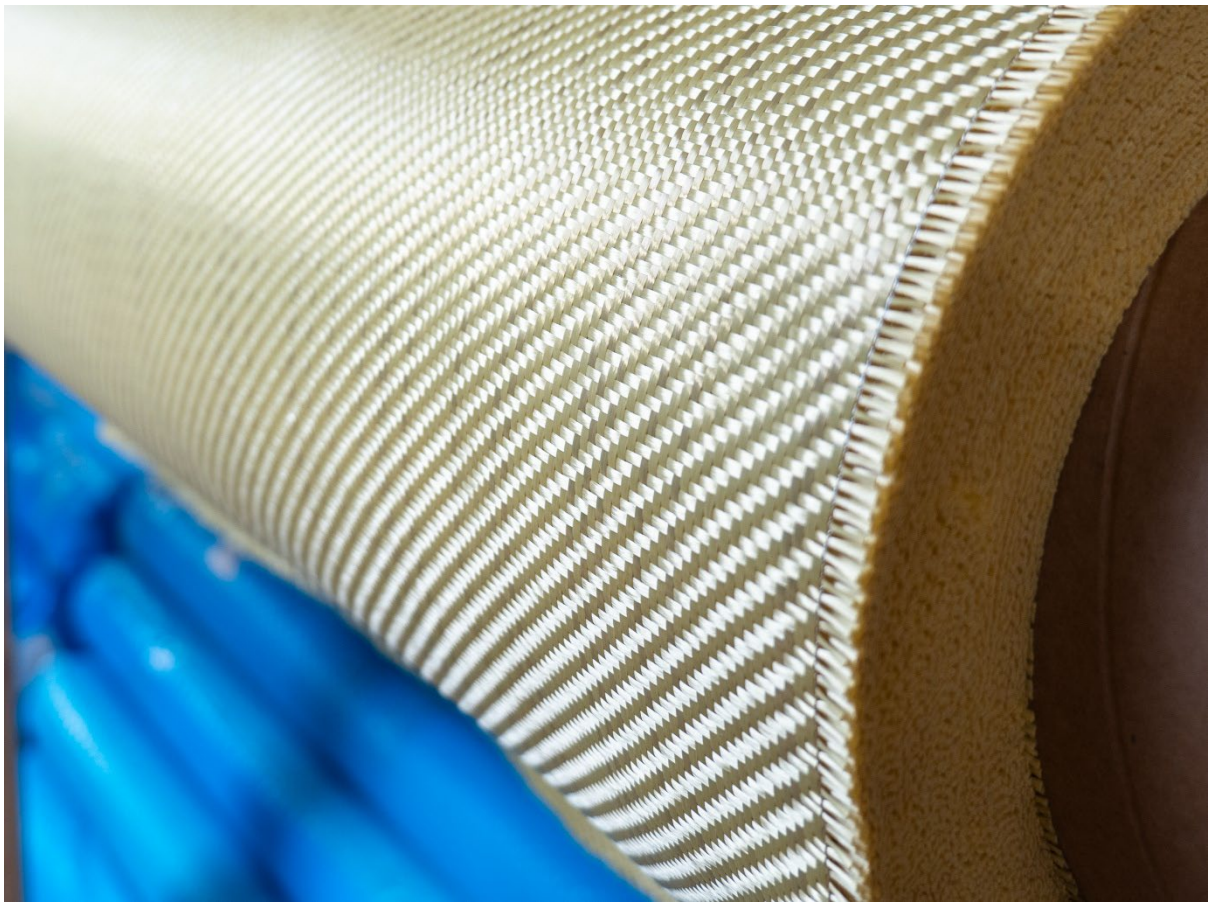
2. Carbon Fibre: The High-Performance Option.

Pros: Excellent strength-to-weight ratio with sleek aesthetics. It has both high stiffness and strength compared to glass fibres of similar weight per square metre, so perfect for much lighter weight panels with less flex. It is Corrosion resistant and has good X-ray transparency, Low CTE (Coefficient of Thermal Expansion), Chemical resistivity, Thermal and electrical conductivity.

Cons: Higher cost requires precision in handling as well as specific moulding techniques such as resin infusion processes.

Other Considerations: carbon fibre is a conductive material. Due to its conductive capability, it is best to keep electronic devices away from any dust fibres produced from carbon fibre.

3. Kevlar®: The Tough Contender.

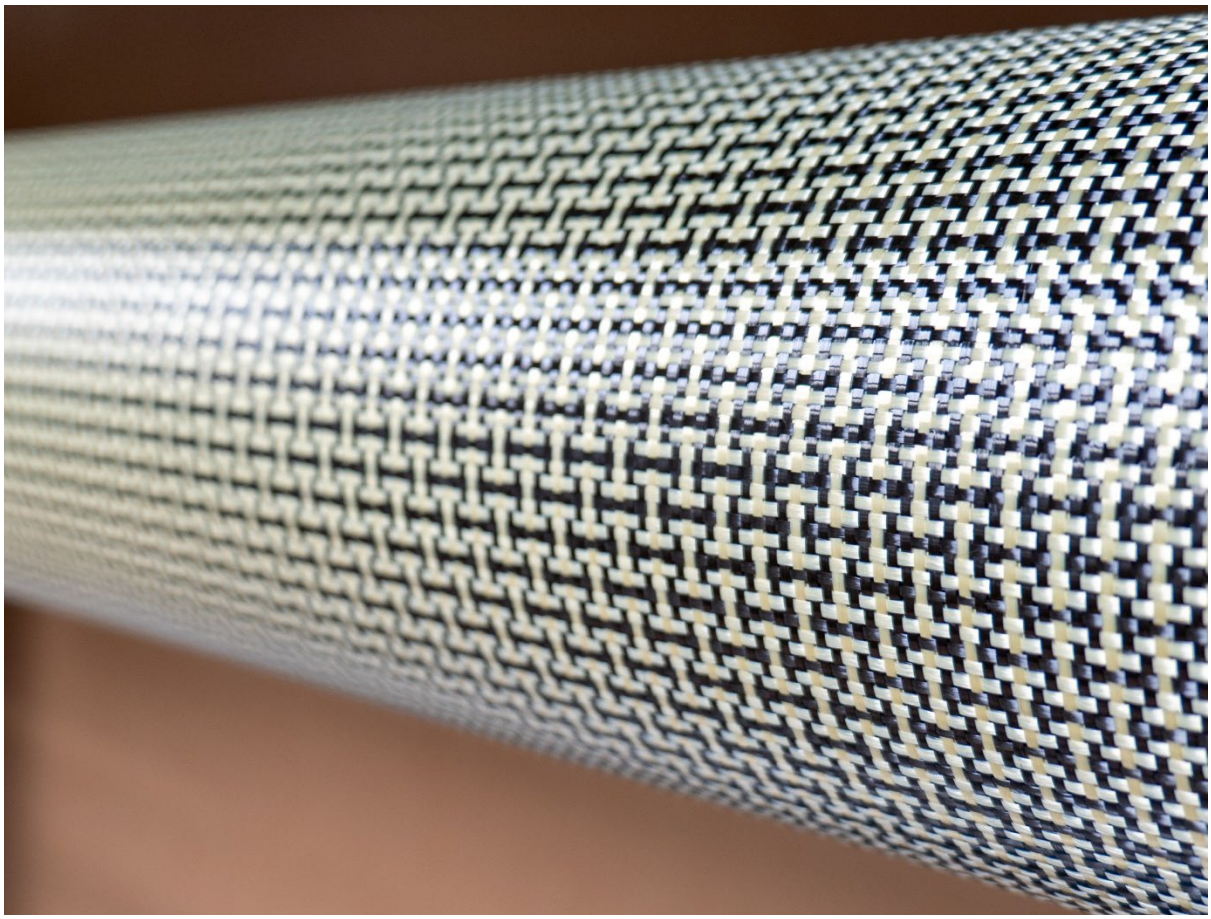


Pros: Great impact resistance, superior tensile strength, lightweight. The tensile strength of Kevlar® is over eight times greater than that of steel of equal weight. It also withstands the extremes of temperature as well as the effects of salt water and other natural occurring chemicals.

Cons: Difficult to cut and sand, absorbs moisture. Kevlar® can lose some of its strength with UV exposure.

Other Considerations: due to this material being difficult to cut you will require specialist scissors such as our Kevlar® shears to cut this material.

4. Hybrid Fabrics: The Best of Both Worlds.



Pros: Combined Properties, Hybrid fabrics, like carbon-Kevlar® mixes, combine the benefits of different materials, offering both strength and impact resistance.

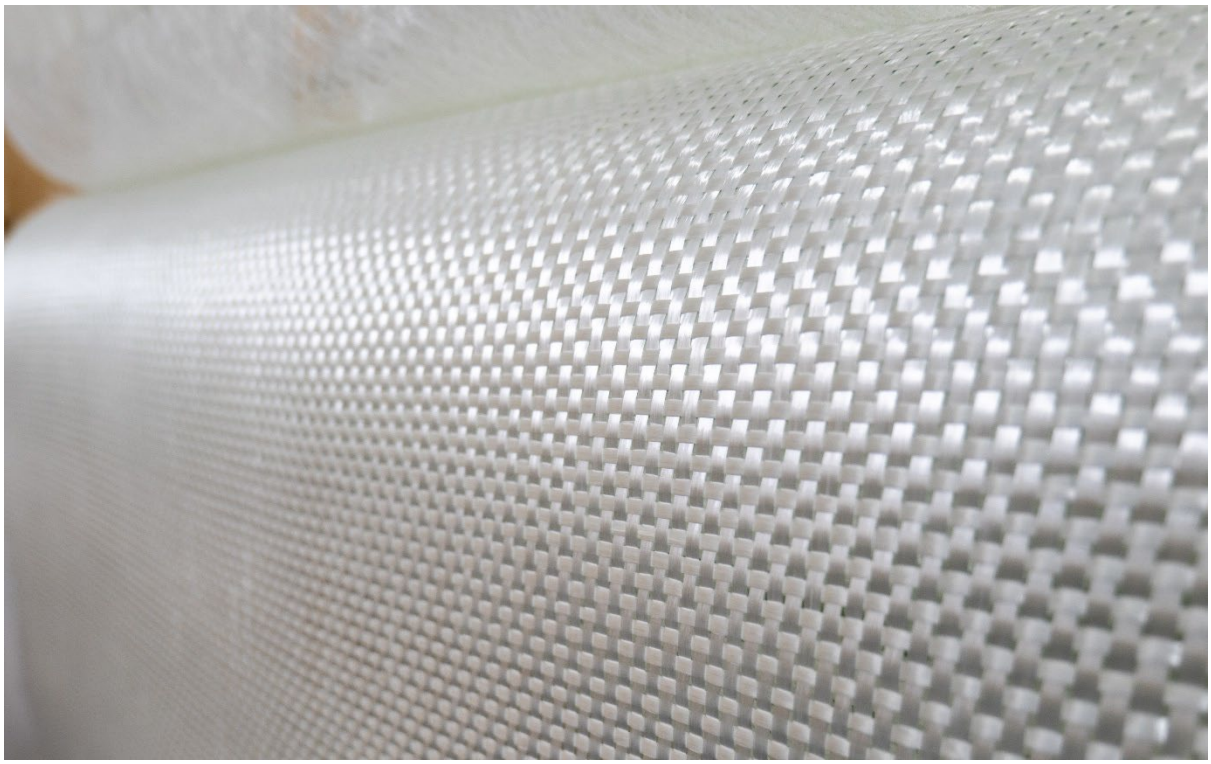
Versatility in Applications: Suitable for varied applications where the properties of both fibres are desired.

Cons: Cost can be more expensive than using a single type of fabric.

Complexity in Handling: Requires understanding the properties of both materials for effective use.

Other Considerations: If hybrid materials contain Kevlar®, which is difficult to cut, you will require specialist scissors such as our Kevlar® shears to cut this material.

5. Woven Roving: The Heavy-Duty Fabric.



Pros: High Strength: Excellent for building high-strength moulds and parts.

Thickness: Adds bulk and strength quickly in laminate structures.

Cost: A less expensive alternative to some fabrics.

Cons: Easily frays after being cut especially if trying to cut to a certain shape, be gentle when handling as weave can slip out easily once cut. However, some spray binding products can be used along the cut line to reduce this.

Resin Consumption: Requires more resin than some of the high-performance materials.

Other Considerations: If applying multiple layers of this material back-to-back it is best to use epoxy resin. If multiple layers are bonded using lesser performance resins such as polyester, layers may be prone to delamination upon impact or stress. However, you can use this material with polyester if you sandwich the layers between chopped strand matting as is often seen within a marine composite such as in a boat hull.

6. Innegra: The Innovative Lightweight Solution

Pros: Impact Resistance: Innegra is known for its excellent impact resistance, making it ideal for applications where durability is crucial.

Weight Advantage: It is significantly lighter than most other fibres, beneficial for applications where weight saving is a priority.

It also has vibration damping properties, excellent dielectrics (zero electrical conductivity) and is also hydrophobic, which makes it ideal for repelling moisture rather than absorbing and wicking into a laminate: a common cause of osmosis in GRP products such as boat hulls which spend a lot of time in water.

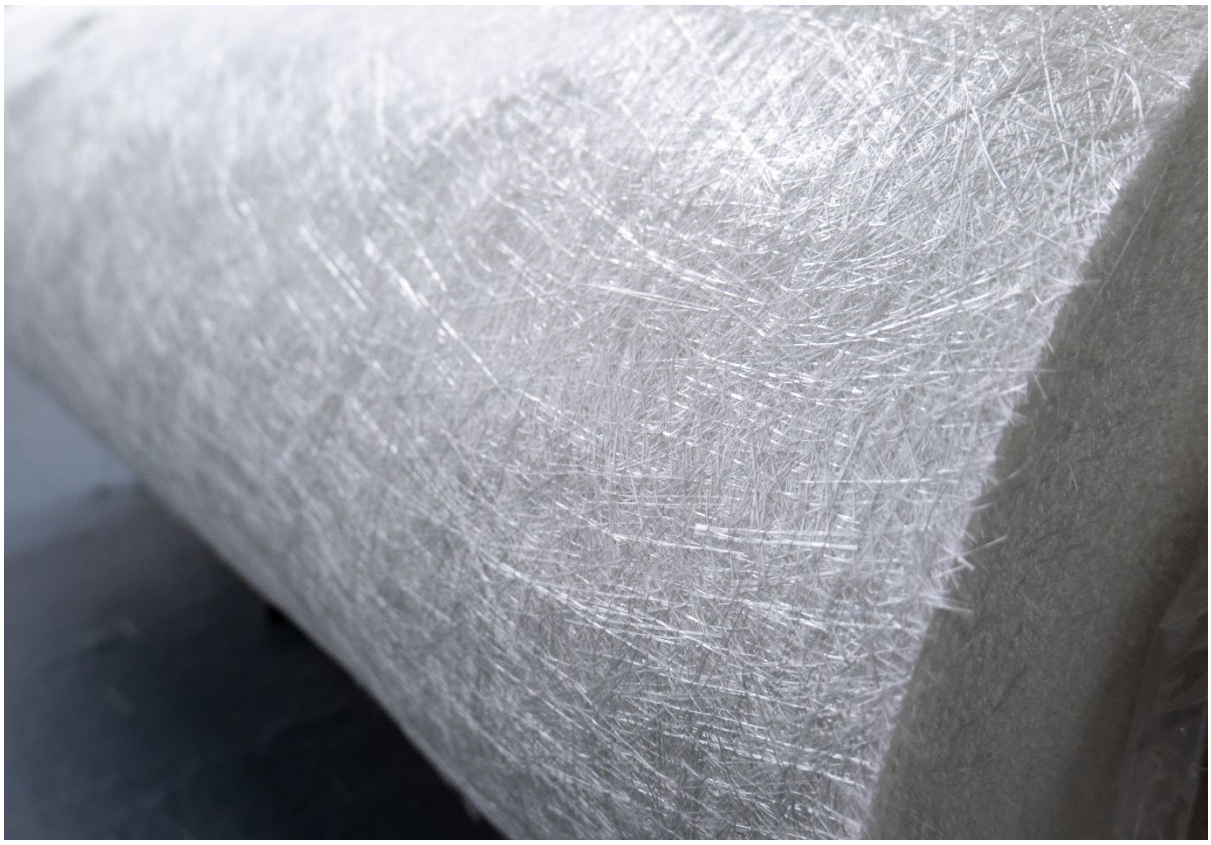
UV Stability: Innegra is resistant to UV degradation, making it suitable for outdoor applications.

Cons: Lower Strength: While it excels in impact resistance, Innegra is not as strong as carbon fibre or Kevlar® in tensile strength.

Cost: It can be more expensive than traditional fiberglass but offers unique properties that justify the price for certain applications.

Other Considerations: This material is lower in cost than other reinforcement materials and is often used in composite canoes, kayaks and other water sport or high impact sports equipment, so it is a great material for impact resistance and affordability. If applying multiple layers of this material back-to-back it is best to use epoxy resin. If multiple layers are bonded using lesser performance resins such as polyester, layers may be prone to delamination upon impact or stress.

7. Metycore: The Reinforced Mat for Quick Lamination.



Pros: Easy to Use: Metycore is designed to conform easily to shapes, making it ideal for complex closed moulds, resin infusion and vacuum bagging.

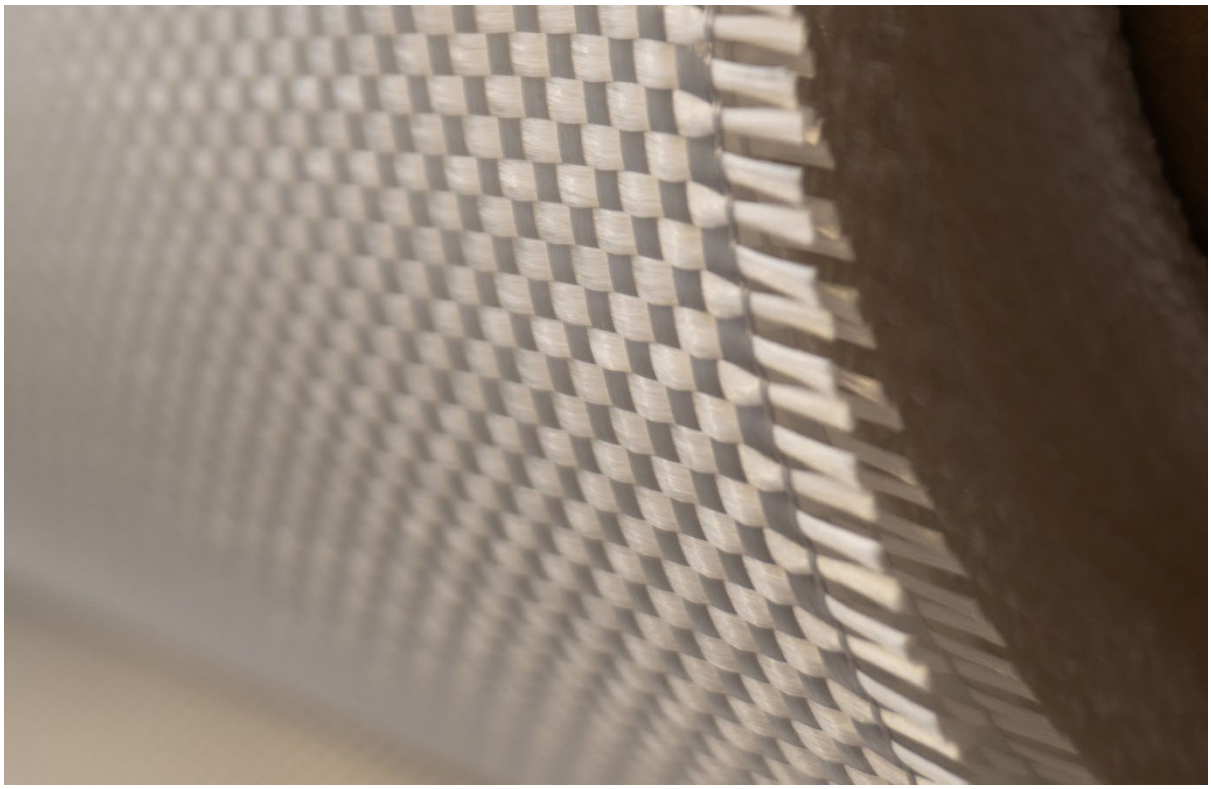
Fast Wet-Out: Engineered core sandwiched between two layers of chopped strand mat to help the resin traverse the laminate with maximum speed and precision.

Cons: Specific Applications: Primarily beneficial for specific applications like large structures or marine hulls. Cannot be laminated the traditional open mould way.

Cost: May be more expensive than traditional mats due to its specialized nature.

Other Considerations: This material needs to be used in close mould applications such as RTM or Vacuum infusion. Lower viscosity Resins are necessary.

8. Diolen: The Durable and Impact Resistant Fibre.



Pros: High Impact Resistance: Diolen offers excellent resistance to impact, making it suitable for products requiring high durability. It is also more economically priced than that of Kevlar® if you want high impact resistance without abrasion resistance.

Flexibility: It has good flexibility, which can be advantageous in certain manufacturing processes and applications.

Cons: Strength Profile: While it has good tensile strength, it may not match the high-performance characteristics of carbon fibre or Kevlar®.

Other Considerations: although it does not have the abrasive resistance of Kevlar® this is a very high impact resistant material at a much lower cost than Kevlar®, so if you don't need abrasive resistance this material is worth considering. It is often used in containers manufactured for carrying life rafts. The diolen protects the container from breaking during impact with the sea, therefore ensuring the container cannot break and puncture the life raft. If applying multiple layers of this material back-to-back, it is best to use epoxy resin: if multiple layers are bonded using lesser performance resins such as polyester, layers may be prone to delamination upon impact or stress. However, you can use this material with polyester if you sandwich the layers between chopped strand matting as is often seen within a marine composite such as in a boat hull.

Conclusion

Choosing the right fabric for composite projects is a balance between material properties, cost, and the specific requirements of the application. From the versatility of fiberglass to the advanced properties of materials like Innegra and Diolen, each option offers unique advantages. Understanding the pros and cons of these materials is key to selecting the most appropriate fabric for your project, ensuring you achieve the desired performance, durability, and finish.

In addition to selecting the right type of composite material, understanding the benefits of different weaves is crucial for optimizing the performance of your project.

The next section explores the characteristics of various weaves such as plain weave, twill weave, triaxial, biaxial, and quadriaxial:

WHICH Weave should I choose?

1. Plain Weave: The Classic Pattern.

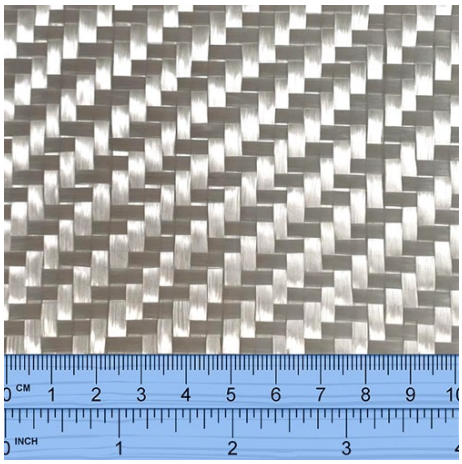
Pros: Stability: This traditional over-and-under weaving pattern offers stability and maintains its shape well.

Ease of Handling: Plain weave fabrics are easier to handle and lay-up, especially for beginners or complex shapes.

Cons: Limited Drapeability: Less flexible compared to other weaves, it can be more challenging to conform to complex curves.

Thickness: This weave can create a thicker laminate, which might be a concern in weight-sensitive applications.

2. Twill Weave: The Flexible Choice.



Pros: Drapeability: Offers better conformability to curved surfaces compared to plain weave.

Aesthetics: Twill weave has a distinct diagonal pattern, often preferred for its visual appeal.

Cons: Cost: A little more expensive than plain weave fabrics.

Fraying: Can fray more easily when cut, requiring careful handling.

3. Biaxial Weave: The Strength-Oriented Fabric.

Pros: Strength in Two Directions: With fibres running at 0° and 90° or + - 45 degrees, biaxial weaves offer excellent strength in two main directions.

Efficient Load Transfer: Ideal for applications requiring efficient load distribution across two axes.

Cons: Limited Drapeability: Not as conformable to complex shapes as other weaves in the heavier versions.

Specific Use Cases: Best suited for applications where loads are known and can be aligned with the fibre directions.

4. Triaxial Weave: Multidirectional Strength.

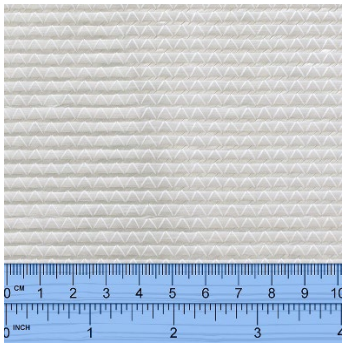
Pros: Multidirectional Strength: Features fibres running in three directions, providing strength and stiffness in multiple axes.

Reduced Layup Time: The multidirectional layout can reduce the need for multiple layers, saving time in the layup process.

Cons: Complexity: More complex to handle compared to simpler weaves.

Cost: Often more expensive due to its specialized nature.

5. Quadriaxial Weave: The Versatile Performer.



Pros: Multiaxial Strength: Combines fibres in four directions, offering excellent strength and stiffness in various orientations.

Design Flexibility: Useful in complex designs where loads are distributed in multiple directions.

Cons: Handling and Cost: More expensive and can be more challenging to handle due to its complexity.

Weight: Tends to be heavier, which might be a consideration in weight-sensitive applications.

Conclusion.

Each weave type offers unique benefits suited to different applications in composite manufacturing. The choice of weave should be aligned with the specific requirements of your project. Understanding these options helps in creating composites that are not only strong and durable but also tailored to the performance needs of the product.