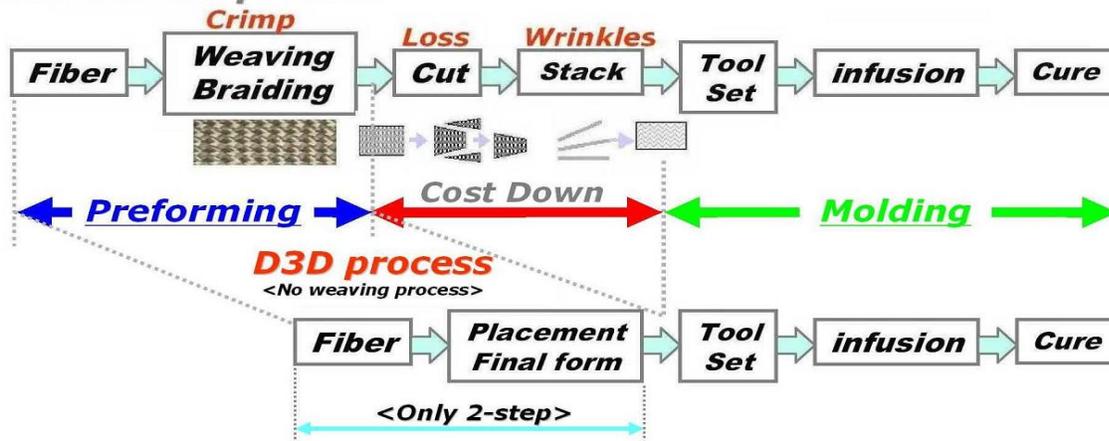


3D Preforms – advanced materials

D3D dry fiber preform method:

Decreasing the number of preforming operations in liquid resin molding/infusion (LRM/LRI) processes is important for cost reduction. The unique process called “D3D” (developed by Shikibo), is a direct manufacturing method to produce the near net shape preforms from the unidirectional dry fibers. It consists of only two processes, dry fiber placement and assembly to the final form. It is much easier and quicker than other conventional weaving or braiding processes.

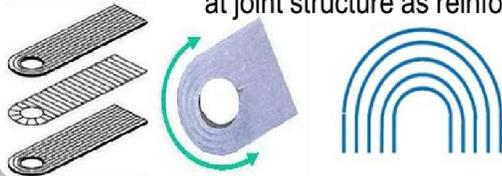
General LRI process



D3D eliminates the cutting stage and minimizes the loss of raw material. In-plane fibers can be arranged in any direction along the principal structure pattern without cutting fibers. We can offer preforms of various shapes such as curved beams, tapered cylinders or hemispherical structures. Any cross sections such as L, U, Z shapes and T or I shaped long curved beams, of typical use for primary aircraft structures can be made.

Round fiber

The fiber can be aligned around the hole at joint structure as reinforcement.



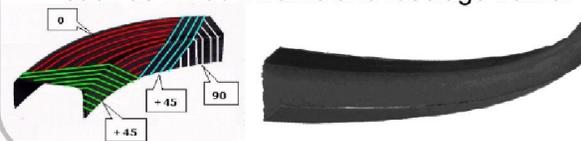
Multi fiber placement

The fiber pattern can be chosen in any direction, length and ply thickness according to specification.



Curved beam structure

Since the fiber pattern design is not limited, curved beam composite structures can be provided such as window frame and fuselage frame.



Thick & Thin components

We can provide any size preform:
 - Thin panel for space applications.
 - Thick structural parts for aircraft applications.



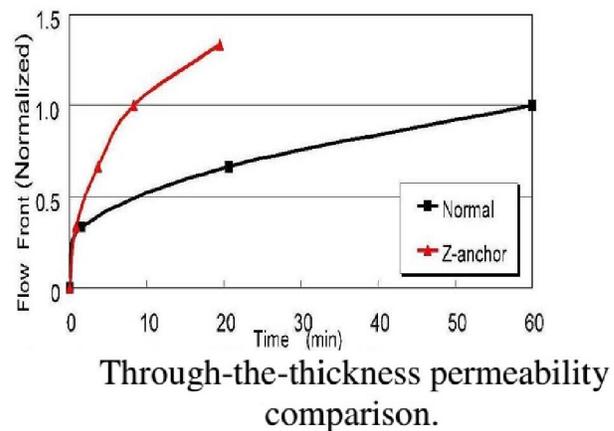
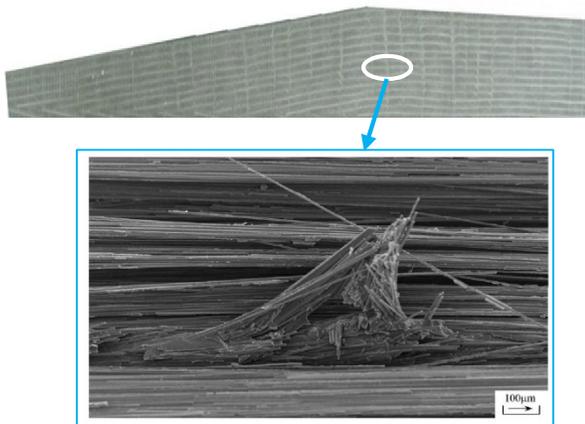
Multiple methods including Zanchor™

Composite Alliance Corp offers the *Ziplus service package*, which is the registered name for our combined preform methods and services. It is tailored to customer needs according to our expertise in the D3D technology, Z directional fiber reinforcement processes (**Zanchor™**, stitching, Z pinning, bundle/filament insertion), single bundle alignment and 3D orthogonal woven preforms even with ceramic fibers.

Zanchor™ process for Z direction reinforcement:

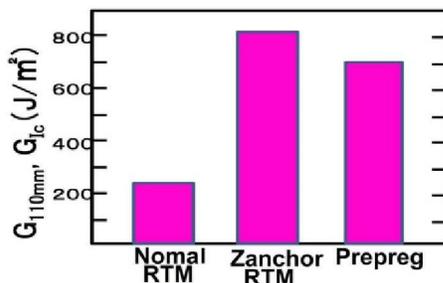
The Zanchor process is a novel through-thickness reinforcement technique in which in-plane yarns are entangled with each other using special needles. There are many proven benefits to this process such as:

- Improves compression-after-impact (CAI) strength
- Limits impact delamination propagations
- Dramatically increases the permeability of the entangled fiber structure



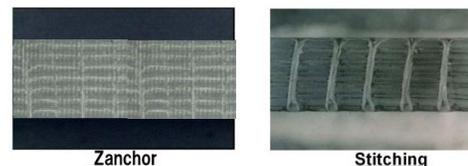
Zanchor reinforcement contributes to not only significantly improving interlaminar fracture toughness but also resistance to fatigue delamination/ increase in the fatigue threshold in CFRP laminates.

Carbon Fiber Reinforced Plastics (CFRP) have excellent in-plane properties. They are used in aerospace to achieve lighter-weight more efficient structures. However inter-laminar strength is still one of the design limiting factors in composite laminate structures.



Using stitching and Z-pinning to manufacture through-thickness-reinforced composites enables increased interlaminar strength with minimal effects on in-plane properties. However **Zanchor™** provides greater benefits at reduced manufacturing costs, beyond the limitations of conventional weaving or braiding techniques used for 3D composites.

Comparison between Zanchor and Stitching



Zanchor shows better characteristics.

- More homogeneous.
- Easy control of the degree of reinforcement.