TCR™ Prepreg

TCR™ Towpreg
Winding Delivery System
Optimization
Winding Delivery System Optimization

The delivery system that makes prepregs run smoothly is slightly different from a wet winding system.
Winding Delivery System Optimization

Special Requirements for Towpreg Filament Winding

- Must have higher fiber tension than wet winding (at the spool and mandrel/part)
- Requires rollers for the complete fiber path
- Should have a swiveling, or powered delivery head
- Does not require dust particle or fume extraction system
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Towpreg Delivery System Specifications

• Tensioners
• Rollers
• Delivery head
• Facilities requirements (creel box, ventilation/pressurization, freezer, etc.)

The following pages provide details of each specific above.
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**Tensioners**

- Fiber take-up capability to keep tension on the spools and part at all times

- Every direction change has the possibility of detensioning the fiber. If this occurs the fiber could...
  - Wrinkle and break or weaken
  - Become misaligned, creating a gap or lap
  - Become loose and not nest properly
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Tensioners continued…

• TCR recommends Rewind Tensioners

  • CTC mechanical tensioners with dancer bar take-up will also work but are NOT as consistent.

  • Tensioners should have the capability of 10 lb tension for use with 12K carbon fiber and up to 20 lb tension if needed for larger tow (24K - 60K fiber), based on part design.

  • Tension should be maintained to ensure proper fiber nesting and good fiber unspool.

  • Tensioners may be housed in a cabinet that is remote or in a cabinet that travels with the delivery head.

  • There is no need for long distance, space-wasting, remote tensioner creels.
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Tensioners continued…

An important characteristic necessary for repeatable products is to have **CONSTANT CONTROL** tension over the **COMPLETE** path of the fiber.

Examples of available Rewind Tensioner Systems
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Rollers

• Each individual roller must take the fiber all the way to the final delivery roller, where the towpregs come together, onto one smooth roller.

• The fiber should have a straight path from roller to roller in order to keep the towpreg flat like ribbon.

• Shoulders should not be used on the rollers, as this will cause folding and twisting of the towpreg.

• Fiber path changes should be on the same plane so that the entire width of the fiber travels the same distance at equal tension.
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Rollers continued...

• Each individual roller must take the fiber all the way to the final delivery roller, where the towpregs come together, onto one smooth roller.

• Made from non-stick materials:
  • Teflon
  • Glass- or bronze-filled Teflon (more durable than Teflon)
  • Teflon-coated aluminum or Teflon-coated steel, etc. (uncoated stainless steel or aluminum will also work, but not as well)

• Need bearings
  • Ball or roller bearings work best
  • Bushings will also work, but tend to wear out more quickly
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DELIVERY SYSTEM USING A FIXED CREEL AND REWIND OR TAKE-UP TENSIONERS

11-in.-Long Smooth Roller (1.5-in. Dia)

1.5-in.-Dia Rollers With 5/8-in. Radius Groove

These Rollers Move With the Head

Spool
Winding Delivery System Optimization

Rollers continued…

Glass- and Bronze-filled Teflon Rollers  Teflon and Non-coated Stainless Steel Rollers
Winding Delivery System Optimization

Rollers continued…

Examples of roller types

Roller No. 1
- 1.5-in.-diameter shoulder
- 1.25-in. diameter at bottom of groove
- Width of roller: 0.50 in.
- Width of groove: 0.125 in.
- Standard bearing: 0.875-in. diameter
  (Used in delivery head for final fiber alignment. Groove width should match fiber bandwidth. If used before delivery head, groove width should be slightly wider than fiber bandwidth.)

Roller No. 2
- 1.5-in.-diameter shoulder
- 1.25-in.-diameter at bottom of groove
- Width of roller: 0.50 in.
- Width of groove: See sketch
- Standard bearing: 0.875-in. diameter
  ("Universal" roller which can be used anywhere before delivery head.)
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Delivery Head

• Powered or free-castoring

• Towpreg will make constant twist when changing from horizontal to vertical, etc., but fiber direction changes should be accomplished by moving in and out of roller set of “S” rollers on same plane

• Multiple towpregs may be combined at the last roller or on the mandrel itself
Winding Delivery System Optimization

Delivery Head continued…

Powered Delivery Head

Simple Castoring Delivery Head
Deliver System Review

• Towpreg winding is simple and efficient when the basics are followed:
  • Tensioners with take-up capability
  • Tension is ~10 lbs (4.5 kgs)
  • Rollers are used throughout
  • Towpreg fiber path is carefully aligned
  • Castoring or powered delivery head is used
  • Use TCR™ Towpreg