



Study and Development of Composite Ropes Concept

Tom Sun*, Anthony DeLima**, Rafael Chou*

* Samson

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FORTE
Carbon Fiber Products
www.fortecarbon.com



Part I - NEW PRODUCT

Tension Tow-Preg

by Anthony DeLima

DEFINITION:

- A READY-TO-BRAID OR CABLE, SOFT, PLIABLE, THERMOPLASTIC PRE-PREG YARN CAPABLE OF QUASI-COMPOSITE AND COMPOSITE PROPERTIES



Tow-Preg Construction/Manufacturing

- Deconstruct yarn
- Impinge Thermoplastic material (matrix)
- Re-construct yarn tow
- Form and set re-assembled yarn tow



CHEMISTRY

Simply put, the thermoplastic matrix is based on a foundation thermoplastic in combination with a cross-linkable thermosetting co-agent or co-polymer.

Co-polymer modifications allow broad-based formulary latitude.



FORMULARY VARIATIONS

- Strain range from 8% – 300%
- Hardness range from Shore A to Shore D
- UV stability
- Color dispersions
- Cold temperature crack resistance
- Flame retardants
- Antifungals
- Specific chemical resistance
- Abrasion resistance
- Nano modifications, conductivity



MATERIAL PROCESSING & HANDLING

- Thermoplastic matrix and co-polymers are cross-linked by exposure to heat.
- Cross linking the thermoplastic matrix can be done either before or after the cable assembly is complete.
- Plastic properties are achieved in as little as 30 seconds.
- Unheated tow-preg will remain as a soft pre-preg indefinitely. Refrigeration is NOT required.



PROCESSING TECHNIQUES

- Braiding
- Winding
- Parallel core/cross head extrusion
- Cabling
- Continuous lamination



FIBERS AND FABRICS

- All structural fibers including; carbon, Kevlar, Twaron, Technora, Zylon, Vectran, glass, boron, silicon carbide, Dacron
- Customer specific blends of the above
- Fabric serving tapes and stitch-bonded up to 60" wide



INDUSTRIES AND APPLICATIONS

- Ballistics
- Synthetic semiconductive cables
- High modulus tethers
- Umbilical strength members
- Strengtheners for fiber optics
- Torsion tension members
- Sporting goods
- Signal transparent tension members



Competitive Products

- Thermosetting tow-pregs
- Twintex (comingled materials)
- Gordon/Gurit (filament tapes)



Part II - Composite Ropes

by Tom Sun and Rafael Chou

- Technology
- Process
- Products
- Properties



Basic Concepts

- A composite rope as strong as steel but more flexible and lighter weight with other superior properties to synthetic lines



Design considerations

- Fiber selection
- Resin selection
- Process and assembly formation
- Termination



Proprietary process to smooth the twisted towpreg



rough



smooth

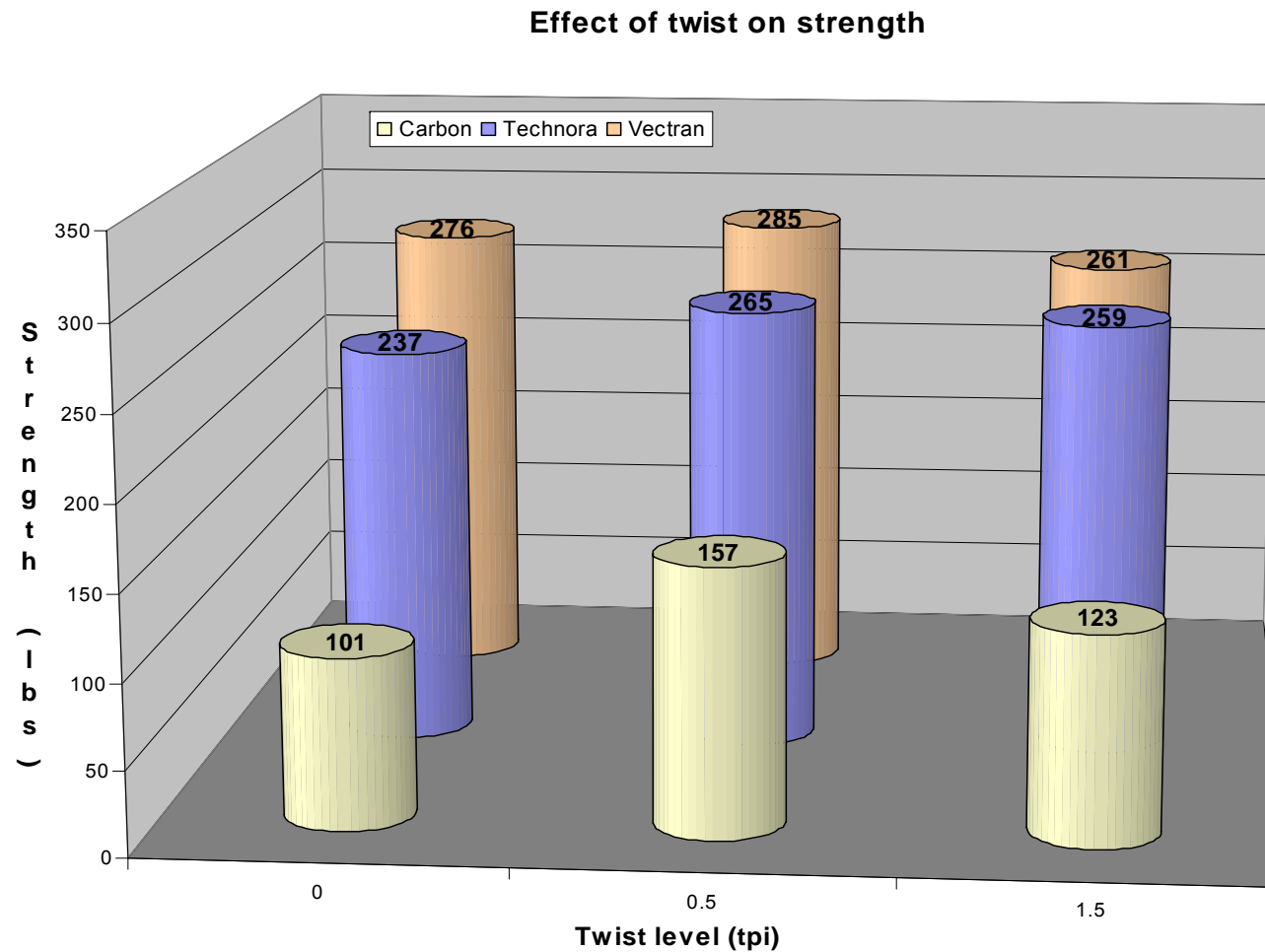


Samples of 7x7 Technora and Carbon Composite Ropes (3/8")





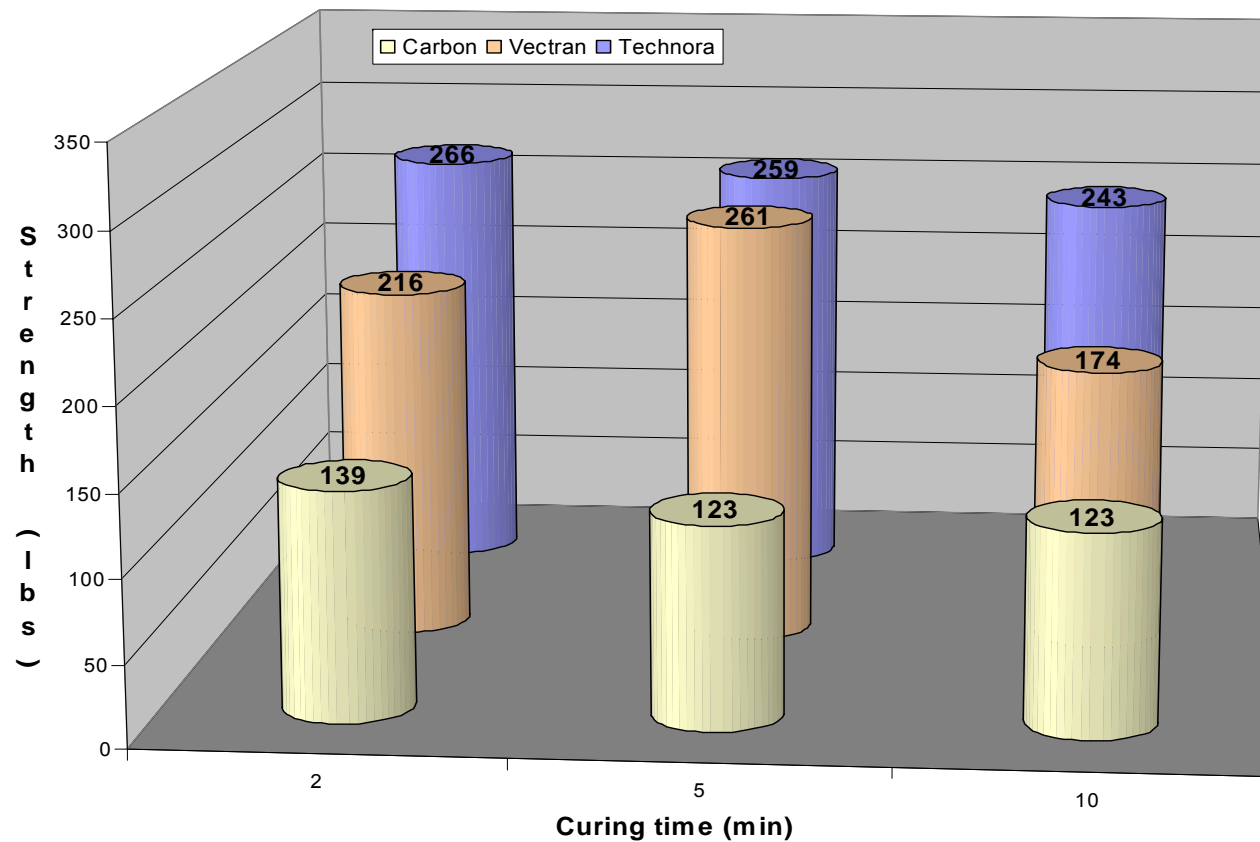
Effect of Twist on the Towpreg Strength





Effect of Curing Time on the Towpreg Strength

Effect of curing time on strength





Works in Progress

- Various Constructions
- Fiber/Resin Ratio
- Termination
- Properties Determination
- IP



Questions ???