INNOVATIONS FOR LIVING™

COMPOSITE SOLUTIONS

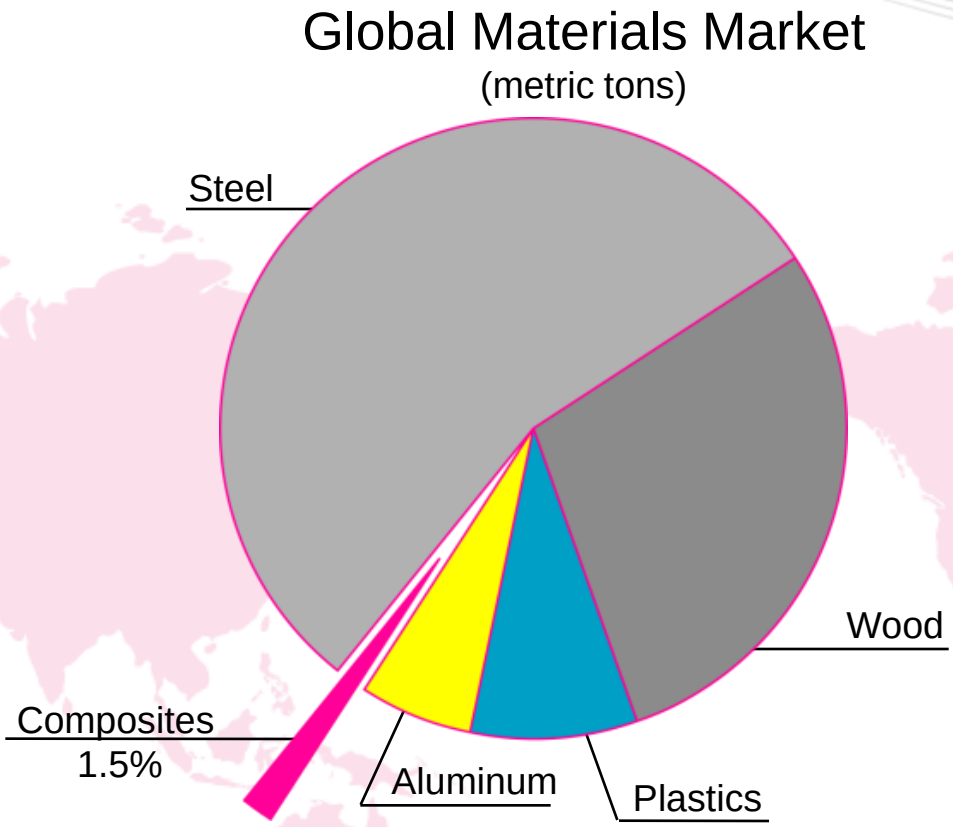
Strengthening the Pultrusion Market with High-Performance Glass Reinforcements

JEC Composites Show – PARIS 2011

Eric Dallies

OCV™ Reinforcements | OCV™ Technical Fabrics | OCV™ Non-Woven Technologies

Replacing Traditional Materials



Design engineers, composites fabricators, original equipment manufacturers and consumers are asking for materials and new solutions that push the limits of technology and bring better value to composites.

Source: Industry Statistics; E-Composites; Owens Corning Management Estimates

Owens Corning: Who We Are









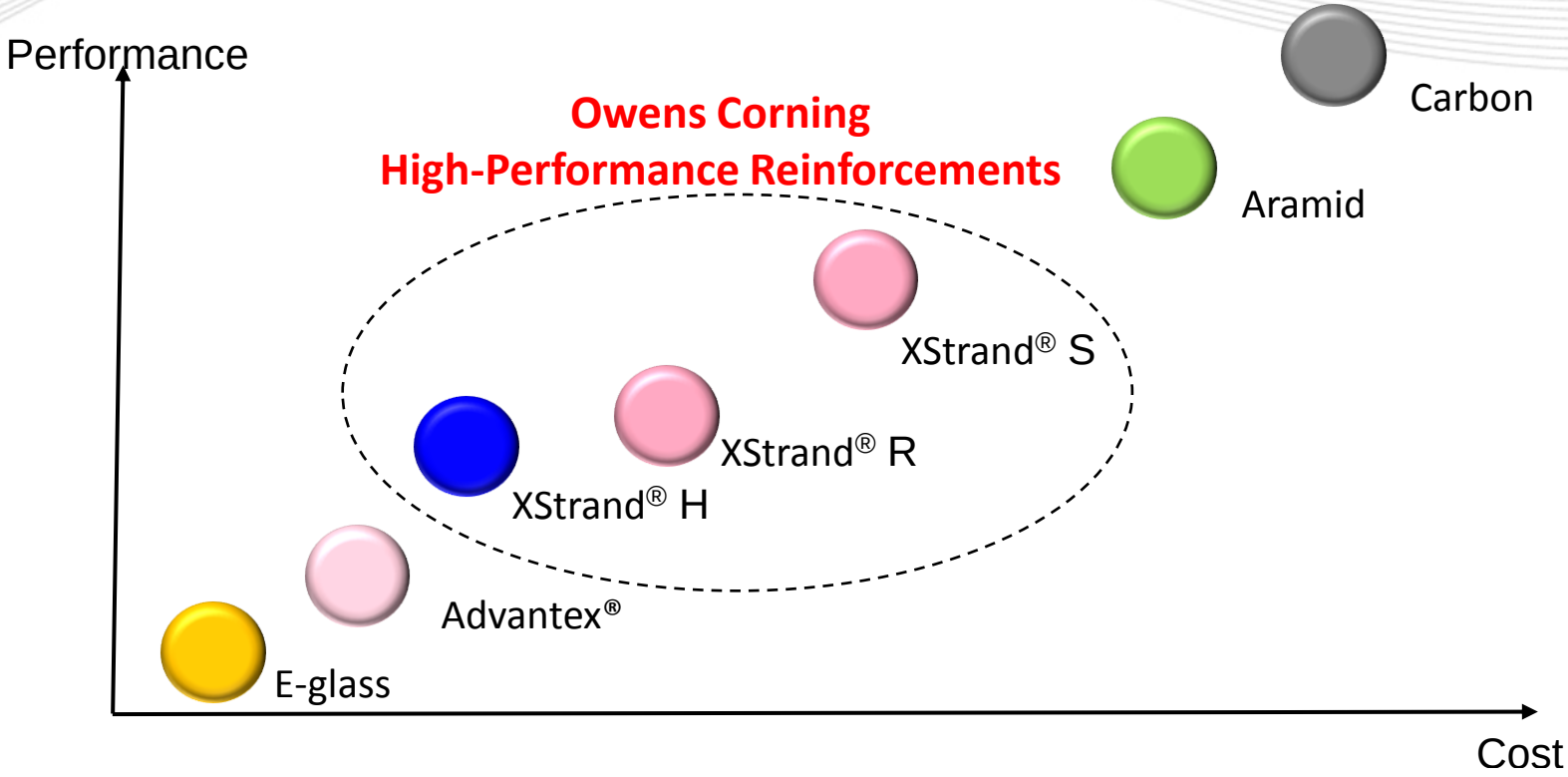
- Founded in 1938, Owens Corning is a leading global producer of residential and commercial building materials, glass-fiber reinforcements and engineered materials for composite systems
- 2010 sales: $5.0 billion
- 15,000 employees in 28 countries
- Fortune® 500 company for 56 consecutive years

Owens Corning Building Materials and Services	Owens Corning Composite Solutions
• Residential Insulation • Commercial & Industrial Insulation • Residential Shingles • Roofing Asphalts	Composite Reinforcements OCV™ Reinforcements OCV™ Technical Fabrics OCV™ Non-Woven Technologies

Owens Corning: A History in Glass Innovation …and a Bright Future

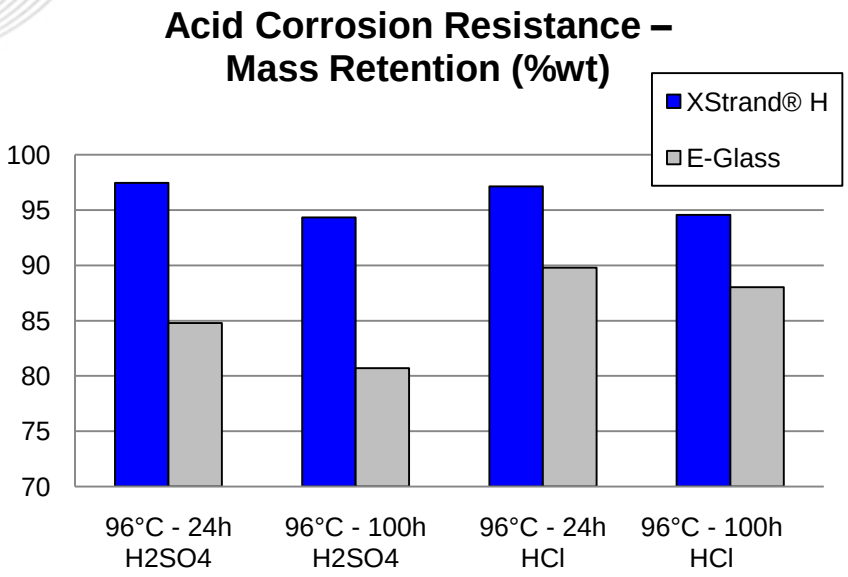
- 1939: Owens Corning invents E-glass
- 1968: Owens Corning develops S-2 Glass®
- 1980: Owens Corning develops E-CR corrosion resistant glass
- 1997: Owens Corning develops boron-free Advantex® glass
- 2006: Owens Corning develops High Performance Reinforcement (HPR) technology
  - Boron-free glass formulation that meets standards for R glass
- 2009: Owens Corning develops new S-glass formulation
- 2011: Owens Corning launches XStrand® H using H-glass technology and manufacturing

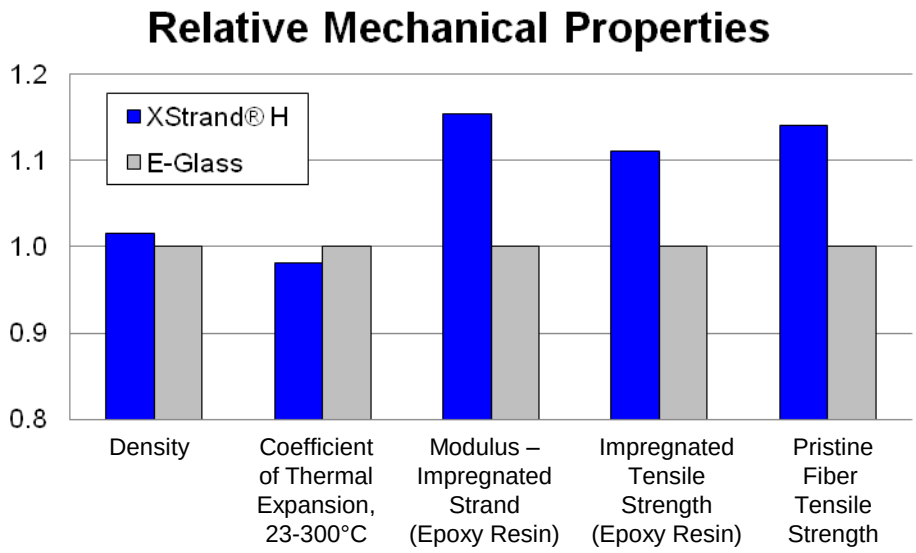
What is XStrand® H glass?



- XStrand® H reinforcement is a new generation of reinforcements manufactured with direct melt technology.
- XStrand® H glass is boron free and is classified as a high-strength R-glass as defined by ASTM C-162, DIN 1259 and ISO 2078.

Offers superior mechanical properties compared to E-glass

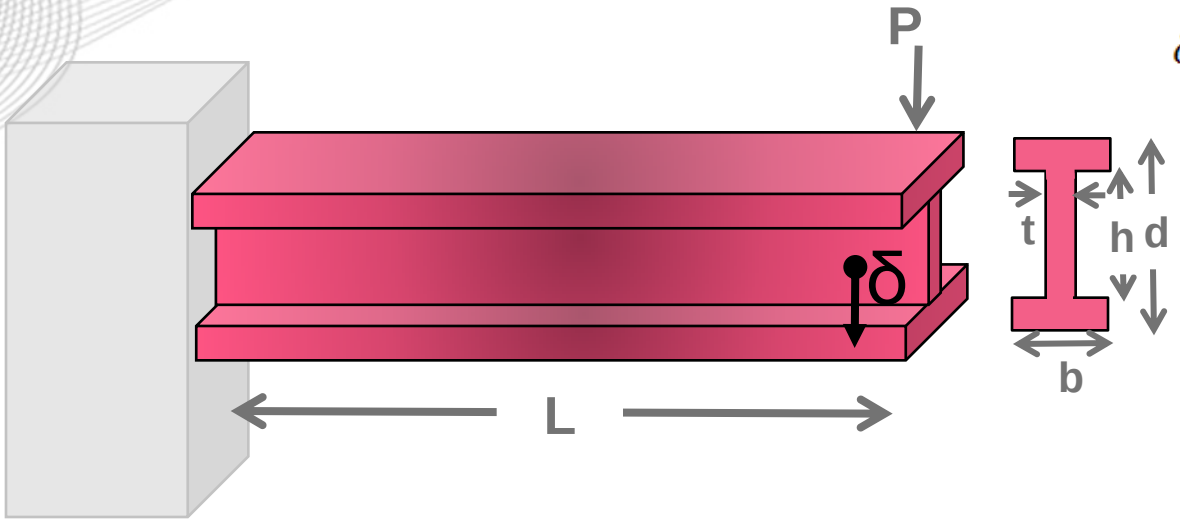




XStrand® H glass vs. E-glass:

- Up to 20% stronger and 15% stiffer
- Significantly improved acid corrosion resistance
- Save up to 20% in weight

XStrand® H Glass Superior Properties



$$\delta_{max} = \frac{PL^3}{3EI}$$

$$I = \frac{bd^3 - h^3(b-t)}{12}$$

Material cost index

E-glass : 100

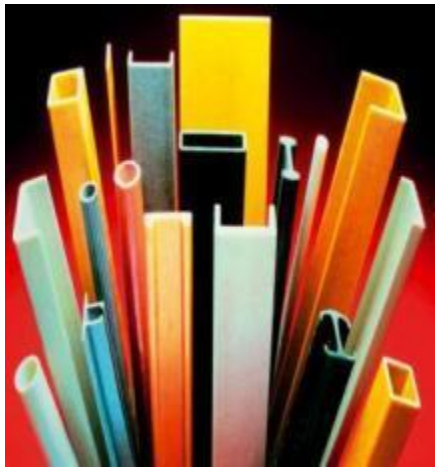
XStrand H : 140

VE resin : 360

XStrand® H Property Improvement vs. E-Glass*		
Improvement	Scenario 1	Scenario 2
Stiffness	**+17%**	**1%**
Cost Ratio	**1.20**	**1.05**
Weight	**+1%**	**-13%**

*75% glass content by weight with vinyl ester matrix

XStrand® H Reinforcement Value Study

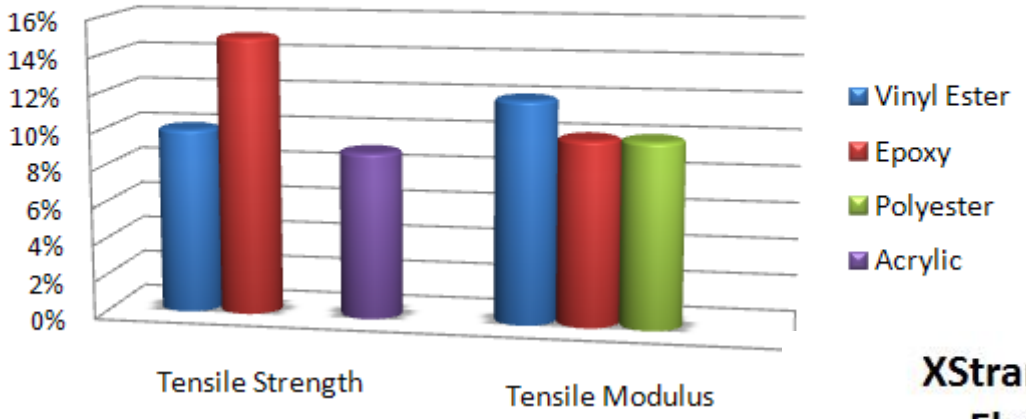


Value discovery study done with some of our current customers already using Advantex® glass for its benefits over E-glass:

- XStrand® H rovings and Advantex® rovings sent to customers
- Independently pultruded according to customers' methods and resins
- Pultruded products mechanically tested
- Results sent back to Owens Corning

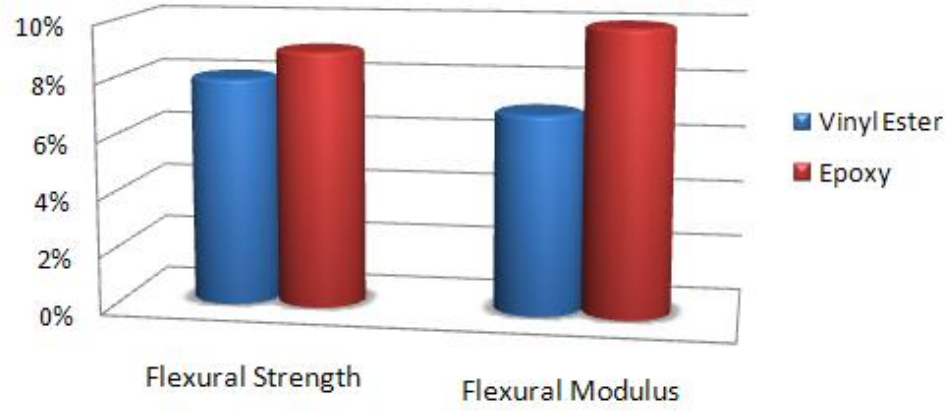
XStrand® H Reinforcement Study Results

XStrand® H Glass vs. Advantex® Glass Tensile Properties (ASTM D3916)



Performance Increase with XStrand® H glass:
Tensile Strength: +8% to +15%
Tensile Modulus: +10% to +12%

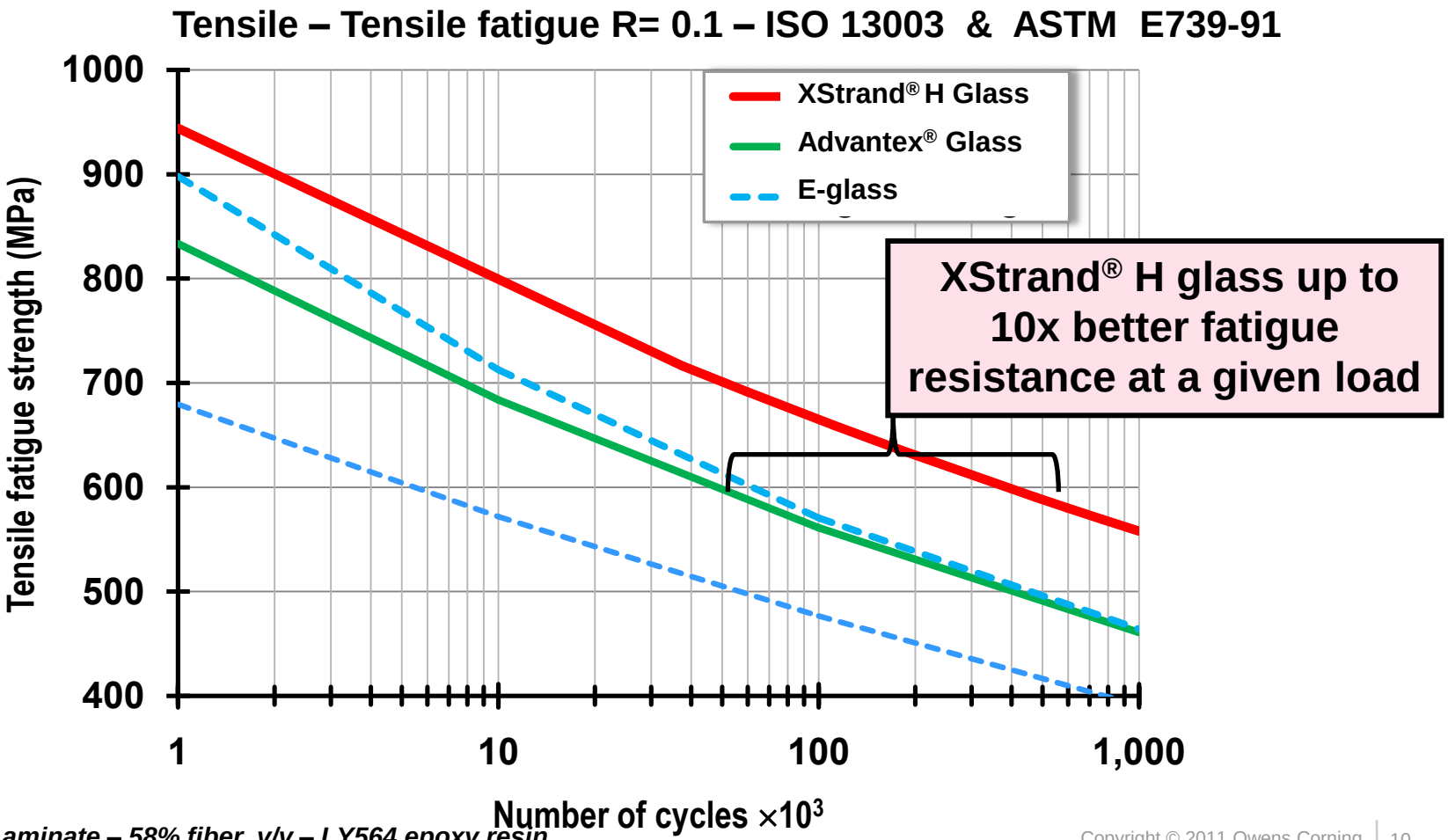
XStrand® H Glass vs. Advantex® Glass Flexural Properties (ASTM D790)



Performance Increase with XStrand® H glass:
Flexural Strength: +8% to +9%
Flexural Modulus: +7% to +10%

XStrand® H Glass Cyclic Fatigue

XStrand® H glass enables longer composite lifetime under fatigue loading



Unidirectional Laminate – 58% fiber v/v – LY564 epoxy resin

XStrand® H MCX24 High-Performance Roving for Long Span Pultrusion

- Multi-compatible sizing
  - Vinyl ester
  - Polyester
  - Epoxy
  - Polyurethane
  - Acrylic
- 17 to 24µ filaments
- 2400 to 4800 tex

PRODUCT DESCRIPTION

XStrand™ H roving is part of a new generation of High-Performance Reinforcements enabling significantly stronger, stiffer and lighter composite parts than traditional E-glass reinforcements.
Owens Corning High-Performance Reinforcements *XStrand™ H* are made from a boron-free glass formulation that meets R-Glass standards ISO 2078, ASTM C162 & DIN B1259-1. The glass formulation is designed for excellent mechanical properties (tensile strength and modulus) and offers significantly better thermal and corrosion resistance properties than E-glass.

USAGE AND PERFORMANCE

XStrand™ H roving consists of continuous high-performance glass filaments gathered in a single-end roving without mechanical twist and treated with specifically developed sizings. These rovings are charaterized by a low level of catenary, excellent processing and handling characteristics: low fuzz, low static, complete run-out and fast wet-out.

PRODUCT APPLICATION

XStrand™ H MCX24 roving has been specifically developed for composite in demanding industrial applications requiring high modulus and long life. They are particularly suitable for the production of long span composite products by pultrusion process as ladder rails, bars, rods, grating systems and miscellaneous pultruded structural shapes in polyester, vinylester and epoxy resin systems. *XStrand™ H MCX24* can also be used in acrylic and polyurethane resin systems. *XStrand™ H MCX24* is also suitable for the production of poles and other composite elements by filament winding process.

FEATURES AND PRODUCT BENEFITS

• Up to 15% Stiffer and to 35% Stronger glass versus conventional E-Glass	• Provides lower deformation for a given load. • Allows weight and cost savings (reduced amount of reinforcement and resin).
• Longer resistance to corrosion and cyclic loadings	• Improves sustainability for long life structures. • Improved reliability and lower maintenance cost.
• Multi-process and multi-resin compatible	• For use with pultrusion process and also suitable for filament winding process. • Excellent adhesion with polyester, vinylester and epoxy resin systems. Also compatible with acrylic and polyurethane resin system.

XStrand® H Reinforcements: Enabling Pultrusion Technology

Features and Benefits:

- Higher part stiffness:
  - Lower deformation for a given load
  - Weight and material savings
- Longer resistance to corrosion and fatigue:
  - Improves sustainability for long-life structures

Potential Applications:

- Long span (ladder rail, telescopic poles, decking)
- Structural beams, grating
- Lighting poles
- Door and window frames
- Rebar (infrastructure and bridge decks)
- Earthquake protection/retrofit
- Building repair



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Thank you

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