Innovation Leadership

Yesterday, Today and Tomorrow

For nearly 60 years, the materials science breakthroughs and process technology innovations of Owens Corning have not only built a company... they’ve developed an industry.

From the first commercialization of glass fiber in the 1930s to today's developments for tomorrow’s applications challenges, Owens Corning has led every major industry advance...

1932  Pioneered the steam-blown process to make glass fibers
1935  Invented the continuous fiber forming process
1937  Developed centrifugal spinner technology
1938  Earned the first patents for glass wool
1939  Invented E-glass as the industry standard for over 57 years
1944  Created Superfine flame-attenuated fibers
1945  Introduced continuous strand mat and chopped strand mat
1947  Invented the pre-forming process
1948  Developed the matched metal die-molding process
1952  Introduced glass fiber roving
1968  Developed S-2 Glass® for superior strength and performance
1980  Created the first E-CHR glass (ECRGLAS®) for improved corrosion resistance
1993  Developed the Programmable Powdered Preform Process, P4, for large structural parts
1994  Invented Miraflex® bi-component fiber, the first new glass fiber technology in 60 years
1995  Introduced CRATEC® Chopped Strands, providing global products produced from a common process platform
1996  Developed ZenTron™ reinforcement, the strongest glass fiber ever
1997  Introduced Advantex™ glass fiber, a new industry standard with a new level of environmental performance

Introducing Advantex™
Glass Fiber

- A New Industry Standard
- Enhanced Corrosion Performance
- Higher Heat Resistance
- Improved Environmental Friendliness

Advantex™ glass fiber combines the electrical and mechanical properties of traditional E-glasses with the acid corrosion resistance of E-CHR glass.

A Common Technology System

Advantex glass fiber is an innovative solution to customer demands for a common technology platform... a proprietary product system with across-the-board properties and around-the-globe consistency.

A New Level of Properties

Advantex glass fiber meets the defined standards of E-CHR glass, high resistance to attack in acid environments, at an E-glass cost.

With a higher melting point than traditional E-glass, Advantex glass fiber provides yet another advantage for higher temperature applications.

A Global Product for a Better World

Advantex glass fiber is an advanced approach to environmental stewardship. It's a boron-free formulation. Advantex glass fiber minimizes air pollutants in the manufacturing process which also helps minimize the need for costly control devices. This helps meet increasingly strict environmental regulations. It also will enable Owens Corning to focus more of its future capital resources to meet expanding customer needs.

Leaders Lead

The introduction of the Advantex glass fiber product system marks another industry milestone in Owens Corning's heritage of innovating tomorrow's products today.
Across-the-Board Properties.
Around-the-Globe Consistency.

Advantex glass fiber is a new glass formulation which provides the properties and benefits customers have come to expect from Owens Corning.

An important new advantage of Advantex glass fiber is the common technology platform it provides which enables customers to confidently specify the same product anywhere in the world.

Customers currently using an E-glass product from Owens Corning can expect Advantex glass fiber to provide comparable property and processing characteristics. Advantex glass fiber also meets the defined requirements for an E-CR glass for acid corrosion resistance.

Nomenclature designations for Advantex products are structured in the same industry-recognized formats as traditional Owens Corning E-glass and E-CR glass products.

Longer-term, the common platform will contribute to the improvement of worldwide product availability during times when the limits of industry capacity and supply are challenged.

The Importance of Property Based Specifications

Glass fiber composites are used in more than 40,000 end-use products. In each application, it is the composite's properties in varied operating environments, and against a diverse set of criteria, which have determined its suitability in meeting and exceeding expectations.

Advantex glass fiber combines the electrical, mechanical and other characteristics of E-glass and E-CR glass, yet it is a new glass formulation. Its specification should be based on what it does and not just its composition.

Customers can specify Advantex glass fiber with the confidence they are receiving today's most advanced glass fiber technology.

That's why Owens Corning is leading an industry-wide initiative to convert glass standards from a system that classifies glass by its composition to one that classifies glass by its properties.
Stewardship

Owens Corning maintains an aggressive program of product and environmental stewardship.

Our goal is simple: a common, global standard of excellence.

We view stewardship as a never-ending responsibility for our products from the time they are conceived in the lab, and at every stage of development and usage, throughout their entire life cycle.

Advantex glass fiber is a science-based stewardship solution. It is manufactured without boron and added fluorine, materials which normally require pollution-control devices to control emissions at plants. Therefore, Advantex technology minimizes environmental pollutants at the source rather than after-the-fact.

Advantex glass fiber also offers the same recycling opportunities presently available with E-glass and E-CR glass.

A Commitment to Customer Fitness-for-Use

Owens Corning plans a phased conversion of its product lines to the Advantex glass fiber platform.

Facilities which will produce the new products are being evaluated, qualified and equipped at scheduled intervals. Changeovers will be completed only after customer requirements for properties and processing are met.

For More Information...

In addition to the overview and technical information on Advantex glass fiber presented in this brochure, data sheets are available for converted product lines.

Your Owens Corning sales representative can also answer any other questions you may have and provide any specific details you require.
A New Era in Glass Fibers

The chart below shows a comparison of Advantex glass fiber physical properties with those of traditional E-glass and E-CR glass. Advantex exhibits a higher softening point than either E- or E-CR glass which may be of advantage for some applications.

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Unit</th>
<th>Advantex</th>
<th>E-glass</th>
<th>E-CR glass</th>
<th>S-glass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>ASTM D1505(1)</td>
<td>g/cc</td>
<td>2.62</td>
<td>2.52-2.62</td>
<td>2.66-2.68</td>
<td>2.46-2.49</td>
</tr>
<tr>
<td>Refractive Index</td>
<td>Oil Immersion(1)</td>
<td></td>
<td>1.560-1.562</td>
<td>1.547-1.562</td>
<td>1.576</td>
<td>1.523-1.525</td>
</tr>
<tr>
<td>Thermal Linear</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expansion 0-300°C</td>
<td>ASTM D696(2)</td>
<td>ppm/C</td>
<td>6</td>
<td>5.4</td>
<td>5.9</td>
<td>2.9</td>
</tr>
<tr>
<td>Softening Point</td>
<td>ASTM C338</td>
<td></td>
<td>916</td>
<td>830-860</td>
<td>880</td>
<td>1056</td>
</tr>
<tr>
<td>Annealing Point</td>
<td>Parallel Plate Viscometry(3)</td>
<td>°C</td>
<td>736</td>
<td>640-675</td>
<td>—</td>
<td>816</td>
</tr>
<tr>
<td>Strain Point</td>
<td>Parallel Plate Viscometry(3)</td>
<td>°C</td>
<td>691</td>
<td>600-630</td>
<td>—</td>
<td>766</td>
</tr>
</tbody>
</table>

(1) Fiber
(2) Bulk Annealed Glass
(3) ASTM Method Under Development

Mechanical Property Data

Even though the ultimate properties achieved in the laboratory with single filament measurements are not normally achieved in field applications, they provide a way to compare the properties of glasses prior to field processing. A table comparing the single filament tensile strength and modulus of Advantex glass fiber with E- and E-CR glasses is shown below.

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Unit</th>
<th>Advantex</th>
<th>E-glass</th>
<th>E-CR glass</th>
<th>S-glass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength</td>
<td>ASTM D2101(1,2)</td>
<td>MPa</td>
<td>3100-3800</td>
<td>3100-3800</td>
<td>3100-3800</td>
<td>4500-4830</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kpsi</td>
<td>450-550</td>
<td>450-550</td>
<td>450-550</td>
<td>665-700</td>
</tr>
<tr>
<td>Elastic Modulus</td>
<td>Sonic Method(3)</td>
<td>GPa</td>
<td>80-81</td>
<td>76-78</td>
<td>80-81</td>
<td>88-91</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mpsi</td>
<td>11.6-11.8</td>
<td>11.0-11.3</td>
<td>11.6-11.8</td>
<td>12.8-13.2</td>
</tr>
<tr>
<td>Elongation at the</td>
<td>ASTM D2101(1,2)</td>
<td>%</td>
<td>4.6</td>
<td>4.5-4.9</td>
<td>4.5-4.9</td>
<td>5.4-5.8</td>
</tr>
<tr>
<td>Breaking Load</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) Pristine, unsized, laboratory-produced single fiber
(2) 2 inch, gauge length
(3) Fiber
Key Property Tests

In addition to its validation as a replacement for E-glass and E-CR glass, Advantex glass fiber technology continues to undergo extensive testing and further validation to define the full extent of its capabilities.

Tensile Strength

The following chart shows a comparison of Advantex glass fibers with E- and E-CR glasses for typical composites containing Type 30° rovings.

**Type 30° Tensile Strength in Epoxy Resin**

![Tensile Strength Chart]

Water Durability

One of the key features of E- and E-CR glasses is their durability in water. The chart below demonstrates that Advantex glass fiber maintains the high standards of these types of glasses.

**Water Durability**

[Graph showing Flexural Strength Retention in Water for different temperature conditions]

Mechanical Property Data

Spray Gun Roving Strength Properties

**Spray Gun Roving Flexural Modulus**

[Graph showing Flexural Modulus for different temperature conditions]

Results shown are from a single test series.
Acid Resistance

Advantex glass fiber has excellent resistance to acids. Comparisons with E-CR glass in both bulk glass and laminate data in acid environments are shown in the following charts.

Electrical Properties

Although Advantex glass fiber does not contain boron as do traditional E-glasses, it exhibits comparable electrical properties. The data below shows how the critical electrical properties of volume resistivity and dielectric breakdown strength compare with currently available E-glass products.

Volume resistivity is a measure of the insulating properties of the glass.

Breakdown strength is a measure of the voltage which can be withstood before arcing through the material occurs.

Summary

The preceding charts indicate that Advantex glass fiber exhibits properties which compare well with E-glass in mechanical and electrical properties. They also show comparable properties to E-CR glass in acid corrosion resistance in studies to date. As a result of this combination of E- and E-CR glass properties, Advantex glass fiber spans a much broader band of applications than either E- or E-CR glass could do alone.