

ZYK-15

High Temperature Yttria Stabilized Zirconia Cloth

The Preferred Battery Separator for Top NiH Battery Manufacturers

Sizes

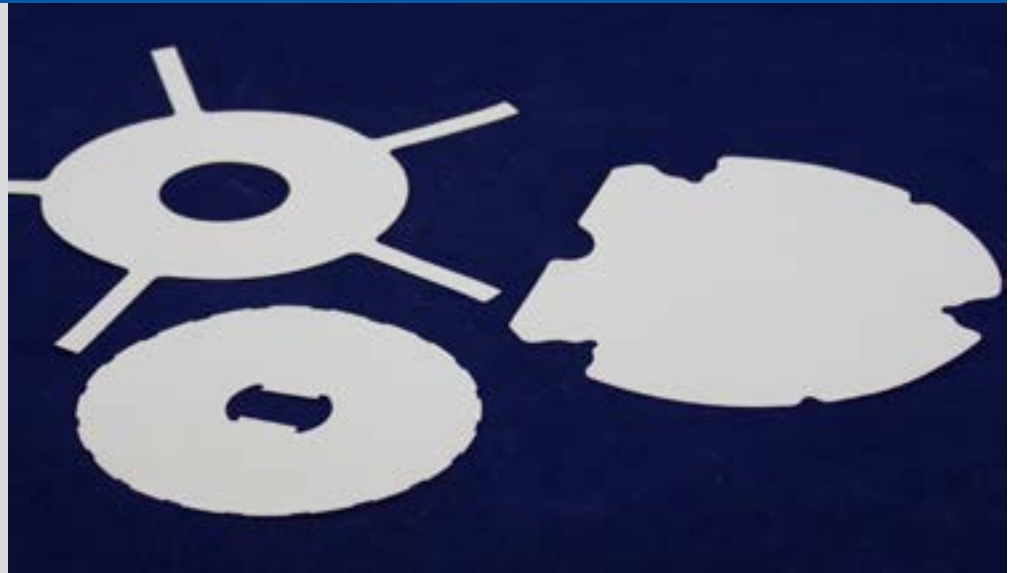
- **Sheets up to 18" x 24"**
- **Custom Sizes Available**

ZYK-15 Features

- Temperature Rating to as High as 2200 °C
- Phase Stabilized with 10 wt% Yttria
- High Purity
- Low Thermal Conductivity (K)
- 100% Inorganic, No Off-Gassing or Odors
- Excellent in Corrosive, Oxidizing & Reducing Atmospheres
- Flexible to 1350 °C
- High Porosity
- Very Light Weight
- Wrappable
- Can be Die Cut
- Can be Cemented or Rigidized With ZR-CEM or ZR-RIG

The **Zircar** Fibrous Ceramics Advantage

Low Mass,
Low Heat Storage &
Low Thermoconductivity
means
High Thermal Shock Resistance,
High Insulation Performance,
Higher System Efficiency &
Lower Energy Costs



Thin... Flexible... Foldable... Wrappable... Die Cuttable...

Fibrous ZrO₂ ceramic knit is a superior electrochemical separator and insulator that can withstand molten alkali chlorides, molten metals and extreme temperatures in excess of 2000 °C.

Product Information

Zircar Zirconia Cloth ZYK-15 is a tricot knit cloth nominally 0.012" thick. This material offers extreme temperature and chemical resistance in a flexible form and provides the lowest thermal conductivity of any commercially available refractory fiber material. ZYK is made using the original ZIRCAR Process at our plant in Florida, NY, USA, and is comprised of continuous individual filaments fabricated in a tricot knit form that is nearly 100% zirconia phase stabilized with yttria. It is suitable for applications such as high energy battery separators, thermal insulation in crystal growing furnaces, and for the filtration of hot gasses. ZYK-15 has exceptional resistance to molten alkali metal chlorides and carbonates at temperatures as high as 700 °C, to aqueous solutions of alkali metal hydroxides at temperatures as high as 220 °C and to attack by hot caustic solutions, such as KOH.

ZYK-15 is a true textile. It requires neither binders nor supporting wires in its construction and will comply somewhat to both tensile and compressive forces due to the mechanical interlocking of fibers. Elongation of 4 to 8% before breaking allows ZYK-15 to conform to irregular sizes. ZYK-15 can be compressed up to two-thirds of its normal thickness and still recover a major fraction of its original dimension with little fiber damage.

For more information,
phone: (845) 651-3040
email: sales@zircarzirconia.com
website: www.zircarzirconia.com

ZYK-15 Chemical Resistance

Zircar Zirconia Cloth Type ZYK-15 has exceptional resistance to molten alkali metal chlorides and carbonates at temperatures as high as 700 °C and to aqueous solutions of alkali metal hydroxides at temperatures as high as 220 °C. These materials will tolerate exposure to a mineral acid at its boiling point for short lengths of time. Extensive contact with hot phosphoric acid, however, causes embrittlement and stiffening due to the formation of zirconium phosphate.

Molten metals such as copper, aluminum, iron steel, etc., do not wet and therefore cause little change in either the chemical or the physical nature of these products in spite of many hours of exposure.

The fine capillary and pore structure of ZYK-15, in combination with the hydrophilic nature of zirconia and the serrated surface of the individual fibers in the knit threads, impart excellent wetting solution retention and wicking characteristics to this material.



Properties & Characteristics

| Properties (Nominal) | ZYK-15 |
|---|-----------------------|
| Thickness, mils | 12 |
| Bulk Porosity, % | 85 |
| Bulk Density, lb/ft ³ (g/cm ³) | 42.5 (0.68) |
| Tensile Strength, lb/in width (g/cm width) | 0.93 (166) |
| Weight / Area, g/m ² (oz/yd ²) | 207 (6.1) |
| Melting Point, °C (°F) | 2590 (4694) |
| Continuous Maximum Use Temperature, °C (°F) ⁽¹⁾ | 2200 (3992) |
| Specific Heat, J / kgK (BTU / lb-°F) @ 93 °C (200 °F) | 544 (0.13) |
| Specific Heat, J / kgK (BTU / lb-°F) @ 2370 °C (4298 °F) | 754 (0.18) |
| Vapor Pressure @ 1370 °C (2498 °F), Torr | 8 x 10 ⁻¹² |
| Linear Shrinkage, % 1hr.@ 1650 °C (3002 °F) Isothermal Soak | 4.3 |
| Composition Wt% (Nominal) | |
| ZrO ₂ ⁽²⁾ | 90 |
| Y ₂ O ₃ | 10 |
| Trace Impurities | <0.25 |

⁽¹⁾ Maximum use temperature is dependent on variables such as the chemical environment and stresses; both thermal and mechanical.

⁽²⁾ 1-2% weight hafnia (HfO₂) occurs naturally with zirconia (ZrO₂) and does not affect performance.



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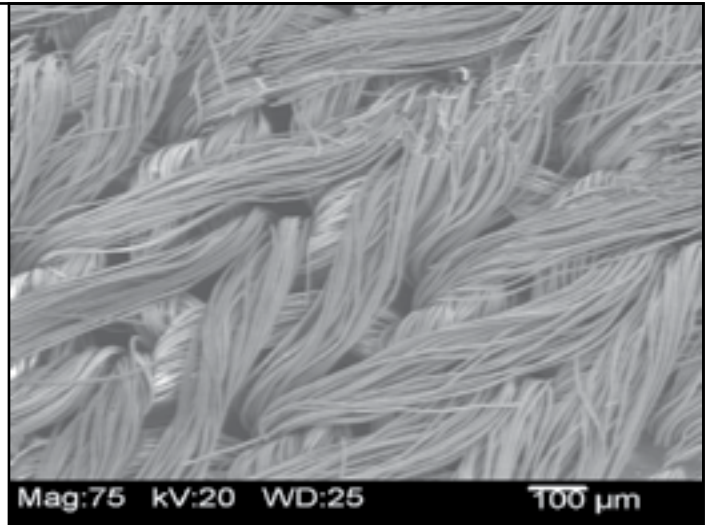
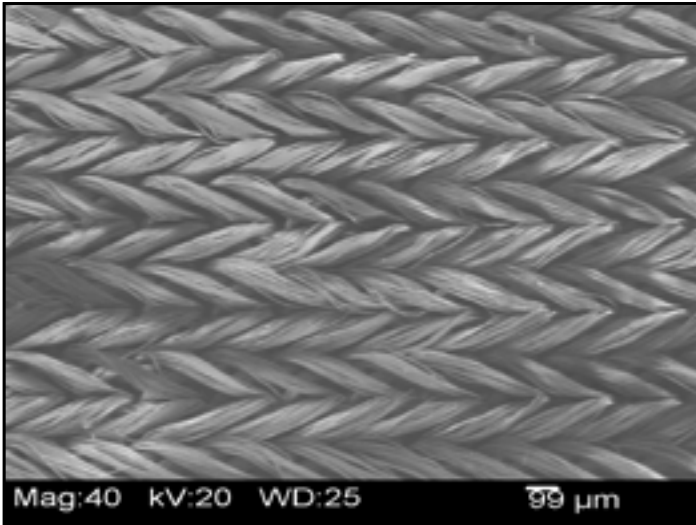
What Makes Our Zirconia Unique?

All zirconia has very low specific heat, half as much as alumina. **Zircar** zirconia provides the additional benefit of being highly porous and pure. The yttria stabilized zirconia fibers are bundled in filament threads which are mechanically knit requiring no binders that would add contaminants and diminish purity and functionality. The serrated fiber cross section produced through the ZIRCAR process is unique to all **Zircar** zirconia fibers. The serration provides additional porosity making our zirconia the lowest thermal conductivity insulation available, for service over 1000 °C.

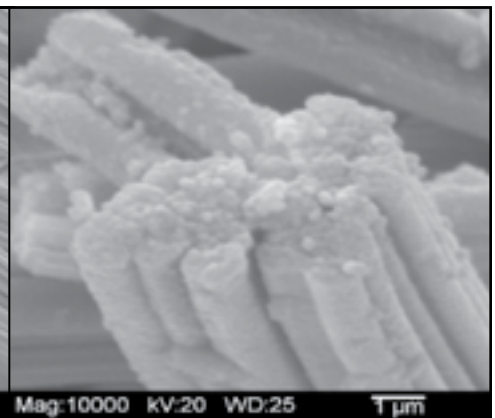
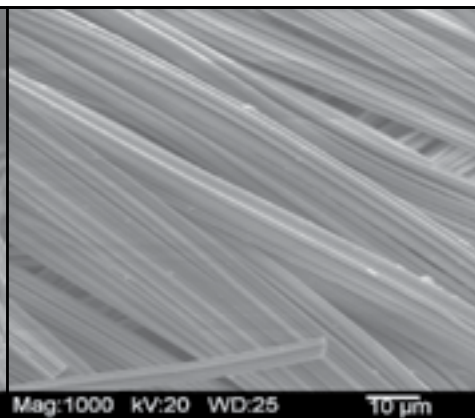
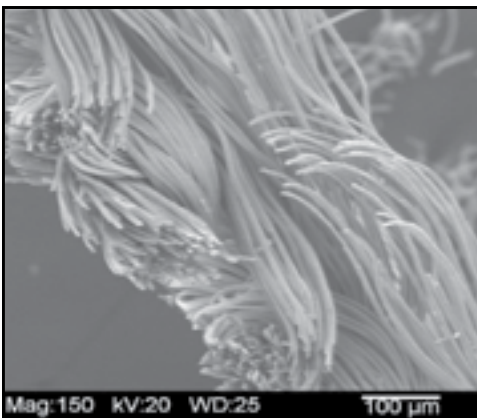
At high temperatures, heat transfer by radiation dominates over conduction and convection. **Zircar** zirconia fibers are the best in the industry at reflecting and radiating heat while not storing it. They facilitate steep temperature gradients and outperform all others when challenged with extreme temperatures and severe environments.

Our unique zirconia fibers are available in many forms in addition to ZYK.

Product Micrographs



Zirconia Cloth Type ZYK has the unique advantage of being a knit structure. This structure is tied together and irregular shapes can be cut that do not unravel.



The micrograph on the left shows the cut edge of Type ZYK and the individual filaments of the tied together threads.

The micrograph in the middle shows individual fibers arranged mostly parallel to each other in a thread. These filaments show the serrated nature of all **Zircar** zirconia fibers.

The end of an individual Type ZYK fiber is shown in the micrograph on the right. The individual submicron crystallites which make up the near theoretical density fiber can be seen clearly.

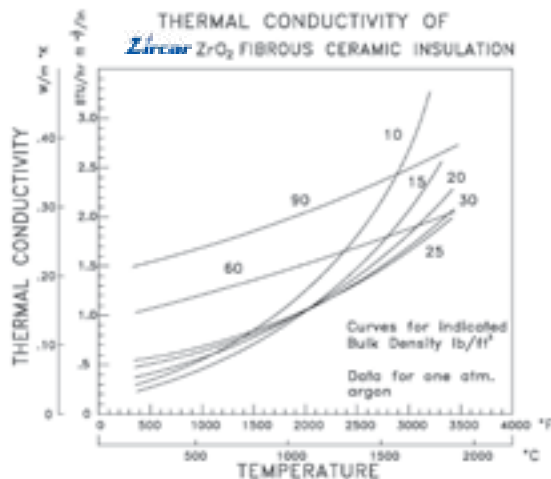


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Facts About Our Zirconium Oxide

- **Zircar** ZrO₂ fibrous ceramics are manufactured using the original ZIRCAR Process which was developed by Bernie H. Hamling (BHH) while at Union Carbide Corp. in Sterling Forest, NY. In 1974 BHH purchased the patents for the process and began ZIRCAR Products, Inc. Over the years the name ZIRCAR became synonymous with high quality advanced fibrous ceramics. In July 2000 Zircar Zirconia, Inc. purchased Bernie's zirconia business and to this day still uses his original process. Although Bernie is no longer with us, we think of him often and are grateful for the opportunity to continue his legacy in the ceramics industry. Thank you BHH.
- At very high temperatures in vacuum and inert or reducing atmospheres, zirconia loses a small amount of oxygen. The reaction results in a color change from white to gray but most other properties remain essentially unchanged and insulation effectiveness is not impaired.
- 1 to 2% hafnium oxide, HfO₂, occurs naturally with zirconium oxide. Hafnia is sometimes referred to as zirconia's twin because of structural similarities.
- Zirconia has the lowest thermal conductivity of any commercial refractory and is one of the most studied ceramic materials in the world.



- Upon heating unstabilized zirconia undergoes disruptive phase changes. At room temperature unstabilized ZrO₂ adopts a monoclinic crystal structure and transitions to tetragonal and cubic at higher temperatures. The volume expansion caused by the cubic to tetragonal to monoclinic transformation induces large stresses which cause cracking on cooling. The addition of yttria eliminates the phase transitions by stabilizing the tetragonal and cubic phases. **Zircar** ZrO₂ is phase stabilized with 10 wt% Y₂O₃.

Applications

SEPARATORS

ZYK-15 is used as separators in nickel-hydrogen batteries. These battery separators are die cut from sheets of ZYK-15 and then 100% visually inspected on a light box. Each lot is chemically analyzed and parts from each sheet are measured and weighed to assure that the parts supplied meet the requirements of the satellite builders. It can also be used as an effective separator for high temperature fuel cells.

INSULATION

ZYK-15 is an effective high temperature insulation for applications where space is at a premium. Its high strength allows for repeated flexing at temperatures below 1350 °C.

HEAT SHIELDING

ZYK-15 has found use as a high temperature heat shielding material. Its use can significantly reduce the number of conventional refractory metal shields needed in many applications and is not restricted to vacuum and inert or reducing environments.

REINFORCEMENT

ZYK-15 is an effective reinforcement for ablative materials used in nozzles, nose tips and heat shields.

Other applications for ZYK-15 include filter media for hot gasses, catalyst supports, corrosion resistant wrapping, and flexible setter cloths at elevated temperatures. ZYK-15 can be coated with ZR-RIG to create thin walled, rigid fibrous zirconia tubes, and other shapes.

Standard Product Size & Ordering

To Place an Order

Call: 845-651-3040

email: sales@zircarzirconia.com

Please contact our Sales Department to discuss FREE SAMPLES, pricing and availability.

Type ZYK-15

| Size | Item |
|--------------------|-----------|
| ZYK-15 1.8" x 2.8" | SAMPLE-CC |
| ZYK-15 18" x 24" | CC001 |



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