

ZYZ

High Temperature Yttria Stabilized Zirconia Insulation

The Unrivaled Industry Leader
of ZrO₂ Insulation

Two Product Types

- ZYZ-3 (30 Pounds per Cubic Foot)
- ZYZ-6 (60 Pounds per Cubic Foot)

Board Sizes up to 12" x 12"

Custom Machining to Tight
Tolerances to Suit Your
Application Requirements

ZYZ Features

- Manufactured Using Our Own Unique **Zircar** ZYBF Bulk Fibers
- Dimensionally Stable up to 1650 °C (3002 °F)
- Good Hot Strength to 1400 °C
- Phase Stabilized with 10 wt% Yttria
- High Purity
- 100% Inorganic, No Off-Gassing or Odors
- Low Thermal Conductivity (K)

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



Low Heat Capacity... High Thermal Shock Resistance...

Silica bonded yttria stabilized zirconium oxide fibrous ceramic insulation rated to 1650 °C.

Product Information

Zircar Zirconium Oxide Boards Type ZYZ are rigid, refractory structures composed of yttria stabilized zirconia fibers that are bonded with silica. This unique composition provides ZYZ insulation with the low thermal conductivity of zirconia fibers combined with the strength and machinability of a silica bonded material. ZYZ is evenly bonded, allowing it to be machined to tight tolerances and intricate shapes. ZYZ has a lower coefficient of thermal expansion than our ZYFB materials. ZYZ is manufactured with our own unique **Zircar** ZYBF Bulk Fibers which are made using the original ZIRCAR Process at our plant in Florida, NY, USA.

ZYZ-3 and ZYZ-6 are silica bonded and fired at a high temperature to impart good dimensional stability up to 1650 °C. ZYZ is ideally suited for thermal insulation and protection applications under conditions of ultra-high temperatures and in a variety of severe environments. ZYZ has good hot strength up to 1400 °C and can be used as a self supporting setter for loads equal to twice its own weight up to this temperature.

ZYZ-3 has lower thermal conductivity at a density of 30 lbs/ft³.

ZYZ-6 has higher strength at a density of 60 lbs/ft³.

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

Properties & Characteristics

Properties (Nominal)	ZYZ-3	ZYZ-6
Bulk Density, lb/ft ³ (g/cm ³)	30 (0.48)	60 (0.96)
Porosity, %	91	85
Melting Point, °C (°F)	2200 (3992)	2200 (3992)
Continuous Maximum Use Temperature, °C (°F) ⁽¹⁾	1650 (3002)	1650 (3002)
Intermittent Maximum Use Temperature, °C (°F) ⁽¹⁾	1700 (3092)	1700 (3092)
Flexural Strength, MPa (psi) Normal to Fiber Plane	0.28 (40)	1.74 (252)
Compressive Strength, MPa (psi) @ 10% Compression Normal to Fiber Plane	0.39 (56)	0.92 (134)
Outgassing in Vacuum	Nil	Nil
Dilatometric Softening Temperature at 10 psi, °C (°F)	1250 (2282)	1275 (2372)
Thermal Expansion Coefficient RT- 1425 °C (2600 °F)	9x10 ⁻⁶ /°C (5x10 ⁻⁶ /°F)	9x10 ⁻⁶ /°C (5x10 ⁻⁶ /°F)
Linear Shrinkage, % (Perpendicular to Thickness)		
1 hour at 1650 °C (3002 °F)	1.7	1.6
24 hours at 1650 °C (1650 °F)	2.3	2.6
Thermal Conductivity, k (Parallel to Thickness)		
W/mk (BTU/hr ft ² °F/inch) at 400 °C (752 °F)	0.08 (0.6)	0.16 (1.2)
W/mk (BTU/hr ft ² °F/inch) at 800 °C (1472 °F)	0.11 (0.8)	0.2 (1.4)
W/mk (BTU/hr ft ² °F/inch) at 1100 °C (2012 °F)	0.14 (1.0)	0.23 (1.6)
W/mk (BTU/hr ft ² °F/inch) at 1400 °C (2552 °F)	0.19 (1.3)	0.25 (1.7)
W/mk (BTU/hr ft ² °F/inch) at 1650 °C (3002 °F)	0.23 (1.6)	0.27 (1.9)
Chemical Composition (Nominal)		
Oxide	Wt%	
ZrO ₂ ⁽²⁾	85	
Y ₂ O ₃	10	
SiO ₂	5	

⁽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?

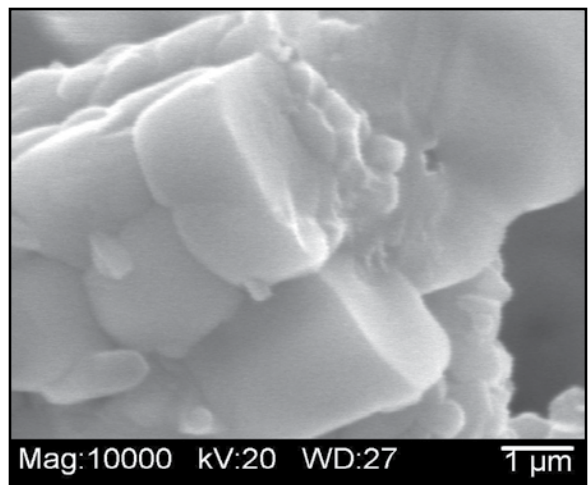
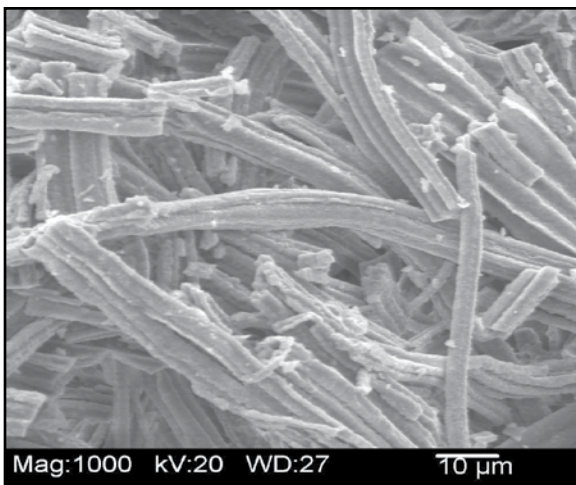
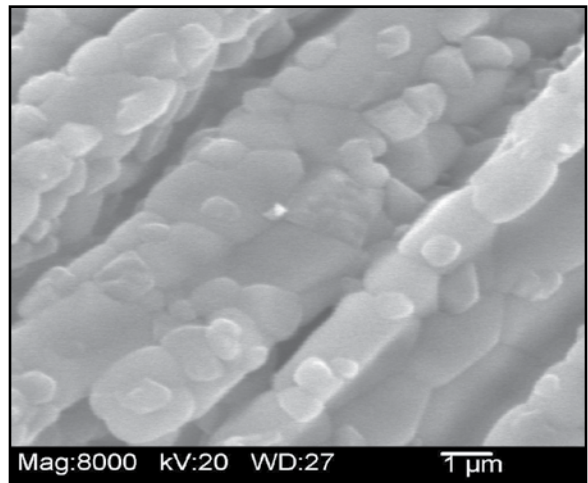
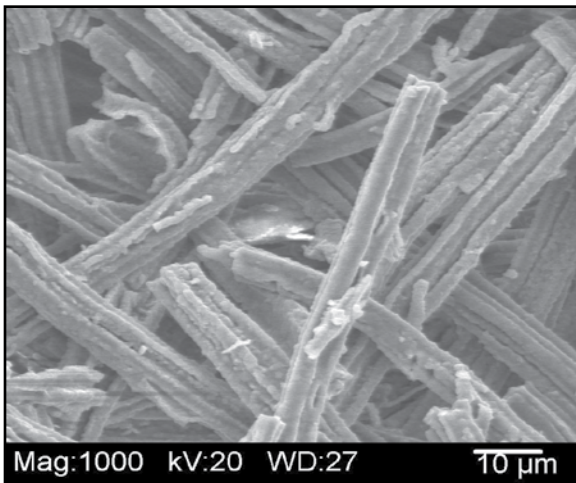
All zirconia has very low specific heat, half as much as alumina. **Zircar** zirconia provides the additional benefit of being highly porous and pure. The 4-6 micron diameter yttria stabilized zirconia fibers require no binders that would add contaminants and diminish purity and functionality. The serrated fiber cross section produced through the ZIRCAR Process is unique to all our zirconia fibers. The serration provides additional porosity making **Zircar** 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.

The fibers are preferentially arranged parallel to the vacuum formed board face creating anisotropic behavior. Vacuum formed ceramic fiber boards exhibit lower compressive strength and thermal conductivity perpendicular to the fiber plane while shrinkage is greater.

Shown below are SEM micrographs of ZYZ-3 (top) and ZYZ-6 (bottom) board surfaces. Both materials are made by vacuum forming zirconia fibers and sintering at a high temperature. The fibers used in ZYZ-6 are generally shorter than those used in ZYZ-3 and are packed tighter resulting in a higher density, lower porosity and higher strength.

Product Micrographs

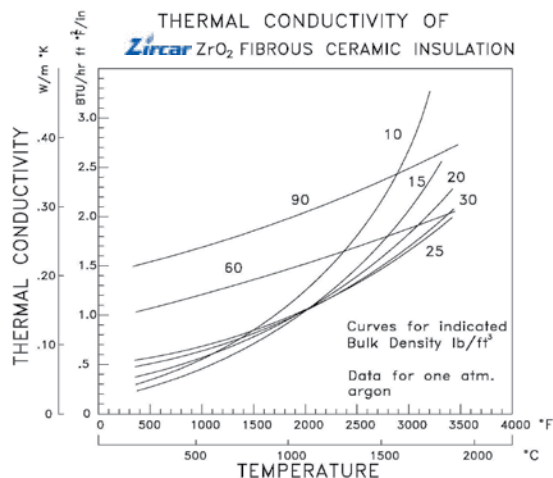


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Facts About Our Zirconium Oxide

- **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

THERMAL INSULATION

ZYZ Boards are used as self-supporting, primary thermal insulation in laboratory and industrial furnaces. ZYZ produces no smoke or odor and undergoes no physically disruptive phase transitions when heated. Zirconia loses a small amount of oxygen at very high temperatures in vacuum and inert or reducing atmospheres. Although this reaction results in a color change from white to gray, other properties remain essentially unchanged and insulation effectiveness is not impaired.

HEAT SHIELDING

The silica bonded board may be used as high temperature heat shielding. It can replace or reduce the number of conventional refractory metal shields needed in many vacuum furnace applications.

SETTER AND FIXTURE MATERIAL

ZYZ Boards are excellent setter and fixturing materials. ZYZ's machinability, dimensional stability and low heat capacity favor its use as a setter in both continuous and batch processes.

ZYZ is not suitable for use in reducing atmospheres because the silica binder is removed in service. For applications where silica is undesirable our zirconia bonded fiber materials ZYFB and/or FBD are recommended.

Cutting & Machining Instructions

For manual cutting, place the part on a smooth clean surface and hold it in place with gentle pressure. Small holes can be drilled in ZYZ by hand with a standard high speed steel twist drill rotated between the fingers. Boards can be cut with a backsaw. If close tolerances are needed, use a drill press and a radial arm saw. Table saws are not recommended without a carrier board since the motion of the material over the saw bed will tend to abrade away the material. For very close tolerances and large amounts of cutting, CNC machining with solid carbide, carbide tipped or diamond tipped tooling is recommended. Slow feeds and high tool rotation rates are best. It should be noted that the material is very abrasive and will cause rapid wear of high speed steel tooling which could result in an out of tolerance condition in a short period of time. Vacuum hold down is best.

Zircar welcomes our customers to take advantage of our machining department's expertise for all your custom machining needs.



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Product Samples

FREE SAMPLES

Call: 845-651-3040

email: sales@zircarzirconia.com

Product Type	Item #
ZYZ-3	SAMPLE-AE
ZYZ-6	SAMPLE-AF

Samples measure 1.8"x 2.8"x 1/2" Tk



Custom Design Quotations

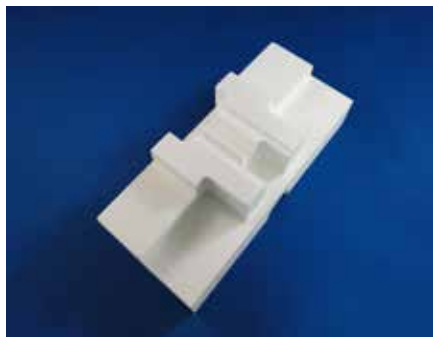
Contact Us For A Quotation For Your Custom Part

Call: 845-651-3040

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Zircar machines custom shapes to your design specifications. Our capabilities include:

- 3D CNC Machining
- Layered Configurations
- Lap Joined Boards and Cylinders
- Diamond Wire Splitting of Cylinders



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Standard Product Sizes & Ordering

ZYZ is available in the standard sizes shown below.
Please contact our Sales Department for pricing and availability.

To Place an Order

Call: 845-651-3040

email: sales@zircarzirconia.com

ZYZ

Size	Item Number	
	ZYZ-3	ZYZ-6
12" x 12" x .5"TK	AE009	AF009
12" x 12" x .75"TK	AE010	AF010
12" x 12" x 1.0"TK	AE011	AF011
12" x 12" x 1.5"TK	AE012	AF012

Other Interesting Products



Zircar Zirconia Bulk Fibers are available in three different types, all having useful properties up to 2200 °C.

Zircar ZR-CEM is formulated specifically for bonding zirconia felts, boards and cylinders to themselves or to back-up thermal insulations such as porous firebrick, alumina fiber and aluminosilicate fiber boards.



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