

ZYBF

High Temperature Yttria Stabilized Zirconia Fibers

The Unrivaled Industry Leader
of ZrO_2 Insulation

Three Product Types

- ZYBF-1 (7.5 pcf)
- ZYBF-2 (21 pcf)
- ZYBF-5 (16 pcf)

Fiber Available in Pounds and
Kilograms

ZYBF 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 and Reducing Atmospheres
- Extremely Low Silica Content
- Non-RCF, Asbestos Free
- Usable in Multiple Atmospheres

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



Multi Purpose... High Temperature... Low Thermal Conductivity...

Yttria stabilized zirconia staple fibers for vacuum forming insulation shapes, making stronger ceramics and for packing in irregular spaces.

Product Information

Zircar Bulk Fibers Type ZYBF are available in three different forms, all having useful properties up to 2200 °C. These polycrystalline fibers can be vacuum formed into rigid shapes, placed into cavities as loose fill insulation, or added to ceramic bodies and coatings for reinforcement. They are differentiated by fiber length, surface area, crystalline size and porosity. However, they all share the same fiber diameter and calcined chemical composition.

All three ZYBF types are made using the original ZIRCAR Process at our plant in Florida, NY, USA. **Zircar** ZYBF is 6 to 10 microns in diameter, is nearly 100% zirconia phase stabilized with yttria and does not undergo the disruptive phase transition of pure zirconia. ZYBF is general use insulation for severe environments and extremely high temperatures. It is non-reactive to alkali vapors, salts or strong hot solutions and is not wet by most molten metals. ZYBF has low absorption surface area and vapor pressure making it useful in high vacuum.

The picture above shows 5 grams of each type of ZYBF. Due to its lower processing temperature, ZYBF-1 is grey, where the other fibers are processed at higher temperatures resulting in a white color.

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

Properties & Characteristics

ZYBF Properties	ZYBF-1	ZYBF-2	ZYBF-5
Bulk Density, lb/ft ³ (g/cm ³)	7.5 (0.12)	21 (0.34)	16 (0.25)
H ₂ O Wt%	2-3	0.05-0.2	0.05-0.2
Cl Wt%	1.5-2	<0.1	<0.1
Loss on Ignition, 1/2 hour at 950 °C	4-6	0.1-0.4	0.1-0.4
BET Specific Area, m ² /g	75	4	0.4
Pierce Adsorption Mesopore			
Median Pore Diam ¹ Å	75	1300	2600
Standard Deviation ¹ Å	29	94	110
Median Pore Diam ² Å	50	27	23
Standard Deviation ² Å	19	15	12
Pierce Desorption Mesopore			
Median Pore Diam ¹ Å	60	1100	2700
Standard Deviation ¹ Å	23	85	160
Median Pore Diam ² Å	49	28	34
Standard Deviation ² Å	17	15	18

¹Based on Pore Volume

²Based on Surface Area

What Makes Our Zirconia Unique?

The products we manufacture at Zircar Zirconia, Inc. are unique due to the open and closed porosity of our zirconium oxide fibers. This is a one-of-a-kind porosity and is exclusive to **Zircar**. Our products are the best performing ZrO₂ fibrous ceramics in the industry, outperforming all others when challenged with extreme temperatures and severe environments.

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 6-10 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 **Zircar** zirconia fibers. The serration provides additional porosity making our zirconia the lowest thermal conductivity insulation available for service over 1000 °C.

ZYBF-1 are serrated externally and hollow internally resulting in the lowest bulk density and lowest thermal conductivity. ZYBF-2 exhibits the common serrated outer diameter with some internal porosity resulting from additional heat treatment. ZYBF-5 is the most heat treated and therefore the most solid of the fiber types with the added benefit of very little agglomeration.

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 while challenged with extreme temperatures and severe environments.

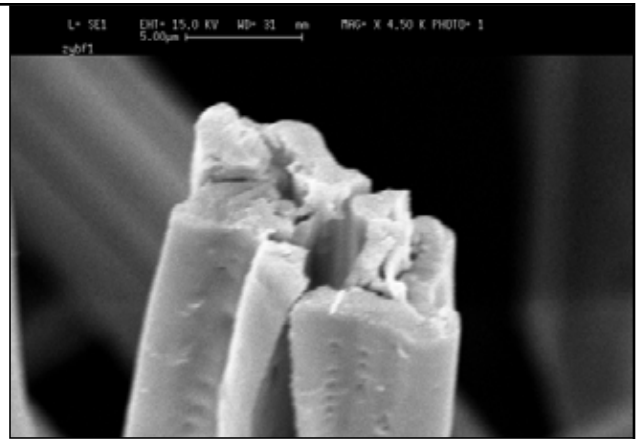
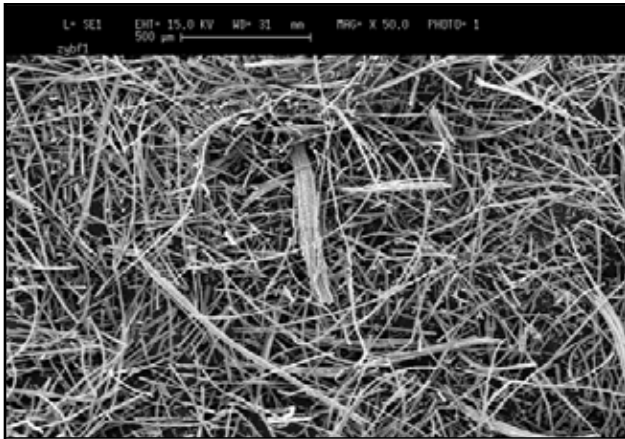
Our unique zirconia fibers are available in many forms in addition to ZYBF.



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Product Micrographs of ZYBF-1



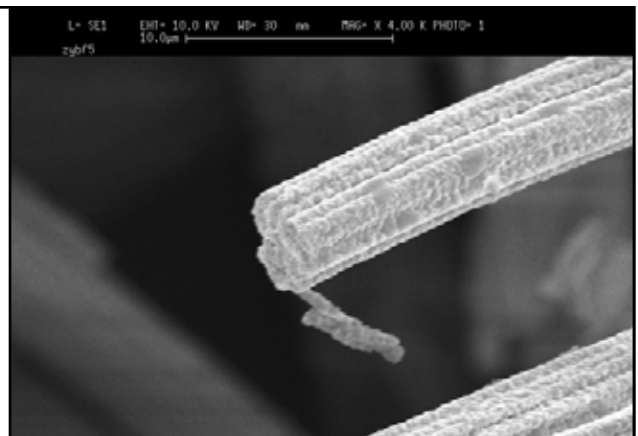
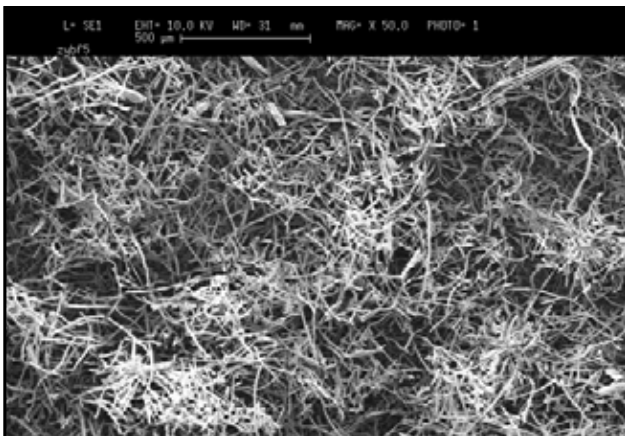
ZYBF-1 is the most reactive and has the highest shrinkage of our fibers. The fibers are generally long and loose as seen in the micrograph on the left. The micrograph on the right shows a fractured fiber with nano-sized crystallized grains that are not visible at that magnification.

Product Micrographs of ZYBF-2



ZYBF-2 fibers are shorter than ZYBF-1 as shown in the micrograph on the left. It also shows significant fiber to fiber binding. The internal porosity and the sub-micron grains can clearly be seen at 5000x magnification in the micrograph on the right.

Product Micrographs of ZYBF-5



ZYBF-5 fibers are generally loose in nature with minimal fiber to fiber binding shown in the micrograph on the left. The micrograph on the right shows characteristically solid fibers with the grain size approaching a micron.

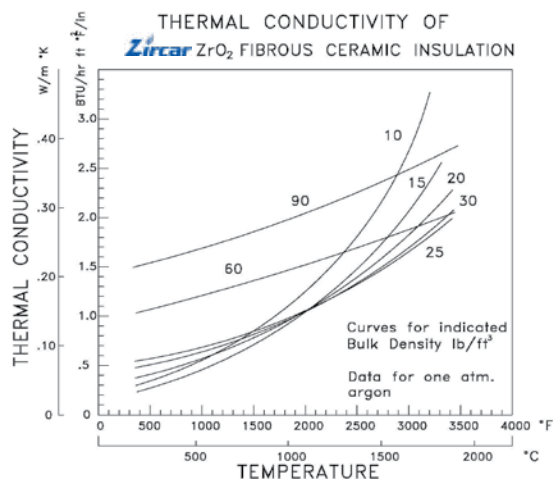


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Facts About Our Zirconium Oxide

- **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

FILLS CAVITIES

Can be placed into cavities as loose fill insulation or used as furnace packing. It can be added to Zirconia Cement Type ZR-CEM and used as a coating or as a filler for holes, bonding of matched surfaces, and repairing cracks and openings in furnace walls composed of zirconia insulation.

THERMAL INSULATION

ZYBF can be used as thermal insulation in many industrial furnace applications. It is ideal for applications where an insulation exhibiting extremely low thermal conductivity is required.

FORMS RIGID SHAPES

ZYBF can be vacuum formed into rigid shapes or as an additive in ceramic fiber vacuum formed products to improve refractoriness. It is stable in vacuum, inert or reducing atmospheres.

All of our Zirconia Bulk Fibers are phase stabilized with 10% yttria (yttrium oxide - Y₂O₃) to maintain a stable tetragonal / cubic structure. The yttria, in a solid solution within the zirconia, stabilizes the tetragonal / cubic structure by preventing the monoclinic to tetragonal crystal transformation that occurs at 1170 °C in pure un-stabilized or insufficiently stabilized zirconia. This undesirable transformation causes an 11% volume change in the crystal unit cell size that can cause micro-cracking and reduced physical strength in the bulk solid.

Yttria stabilized zirconia is an electrical semiconductor at elevated temperatures. This conductivity arises from the different valences of ionic Zr⁴⁺ and Y³⁺. Electricity is conducted at elevated temperatures (700-800 °C) as oxygen ions are induced to flow through the stabilized zirconia structure. This phenomenon forms the basis of zirconia oxygen sensors.

Standard Product Sizes & Ordering

To Place an Order

Call: 845-651-3040

email: sales@zircarzirconia.com

Type ZYBF

Fiber Type	1 Lb	1Kg
ZYBF-1	CF003	CF004
ZYBF-2	CF001	CF002
ZYBF-5	CF009	CF010



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Product Samples

FREE SAMPLES

Call: 845-651-3040

email: sales@zircarzirconia.com

Product Type	Item #
ZYBF-1	SAMPLE-CF-1
ZYBF-2	SAMPLE-CF-2
ZYBF-5	SAMPLE-CF-5

Samples size varies in weight



Custom Design Quotations

Contact Us For A Quotation For Your Custom Part

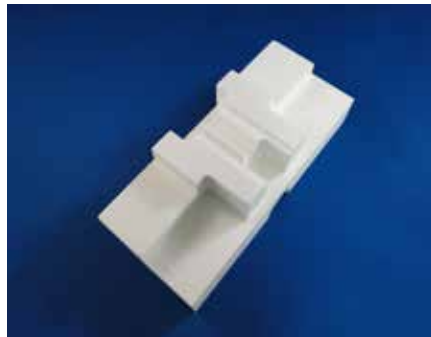
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Zircar can vacuum form ZYBF into ZYFB and machine custom shapes to your design specifications.

Our capabilities include:

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



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



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Other Interesting Products

Zircar ZYP is made from ZYBF. These highly reactive powders have tightly controlled surface areas from 25-60 m²/g.



Zircar FBD is now available in a new larger size, 9" x 18", and up to 3" thick. FBD is the strongest, highest density, highest temperature rated zirconia fiber board on the market.

Zircar ZR-CEM can be used to bond zirconia insulation or mixed with ZYBF to form a patch.



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