



Zircar Zirconia, Inc.
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ZIRCONIA BULK FIBERS TYPE ZYBF



Zirconia Bulk Fiber Type ZYBF-2

FEATURES

- Available in Five Different Forms
- Low Thermal Conductivity
- Highly Refractory
- Low Heat Storage
- Extreme High Temperature Stability
- Fibers Stabilized with ~10 wt% Yttria
- Lightweight
- Available "Off the Shelf"

Zirconia Bulk Fibers Type **ZYBF** are yttria stabilized zirconia fibers available in five 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, crystallite size and porosity. However, they all share the same fiber diameter and calcined chemical composition. All five forms of **ZYBF** are made using the "Zircar Process" which replicates the gross physical structure of an organic precursor fiber with a ceramic. Typically these fibers are 6 to 10 microns in diameter and have a serrated outside surface.

All of our Zirconia Bulk Fibers are phase stabilized with ~10% yttria (yttrium oxide - Y_2O_3) 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 Zr^{+4} and Y^{+3} . 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.

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PROPERTIES & CHARACTERISTICS

	ZYBF-1	ZYBF-2	ZYBF-3	ZYBF-4	ZYBF-5
Nominal Composition, Wt% Calcined 1/2 hour at 950°C					
ZrO ₂ *	90	90	90	90	90
Y ₂ O ₃	10	10	10	10	10
Trace Elements	<1	<1	<1	<1	<1
Bulk Density, g/cc (pcf)	0.12 (7.5)	0.34 (21)	0.42 (26)	0.27 (17)	0.25 (16)
Weight% H ₂ O	2 - 3	0.05 - 0.2	0.05 - 0.2	0.05 - 0.2	0.05 - 0.2
Weight% Cl ⁻	1.5 - 2.0	<0.1	<0.1	<0.1	<0.1
Loss On Ignition, 1/2 hour at 950°C	4 - 6	0.1 - 0.4	0.1 - 0.4	0.1 - 0.4	0.1 - 0.4
BET Specific Area, m ² /g	75	4	0.4	1.5	0.4
Pierce Adsorption Mesopore					
Median Pore Diam ¹ Å	75	1300	1700	790	2600
Standard Deviation ¹ Å	29	94	80	101	110
Median Pore Diam ² Å	50	27	43	40	23
Standard Deviation ² Å	19	15	18	20	12
Pierce Desorption Mesopore					
Median Pore Diam ¹ Å	60	1100	280	760	2700
Standard Deviation ¹ Å	23	85	45	182	160
Median Pore Diam ² Å	49	28	36	700	34
Standard Deviation ² Å	17	15	15	38	18

* 1 - 2 wt% hafnia occurs naturally with zirconia and does not affect performance.

¹ Based on Pore Volume

² Based on Surface Area

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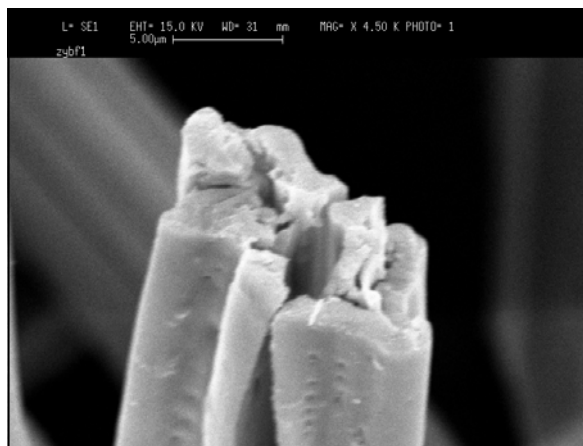
ZIRCONIA BULK FIBERS TYPE ZYBF

PICTOMICROGRAPHS

Type ZYBF-1 is a grayish colored, low-fired, very fine grained, hollow fiber which has some apparent fiber to fiber binding as supplied. **ZYBF-1** has a very high BET surface area (75 m²/g) and may be dispersed with grinding media to a submicron particle size. **ZYBF-1** is the longest of the five ZYBF fiber types with lengths in excess of 1 cm.

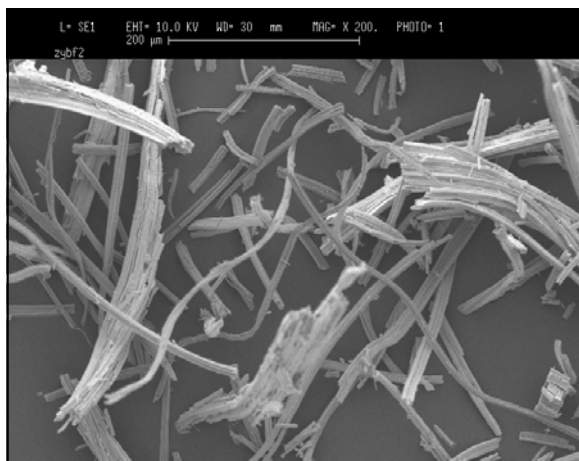


Photomicrograph of Type ZYBF-1 Fibers originally at 50X magnification. ZYBF-1 is the longest of our zirconia fibers

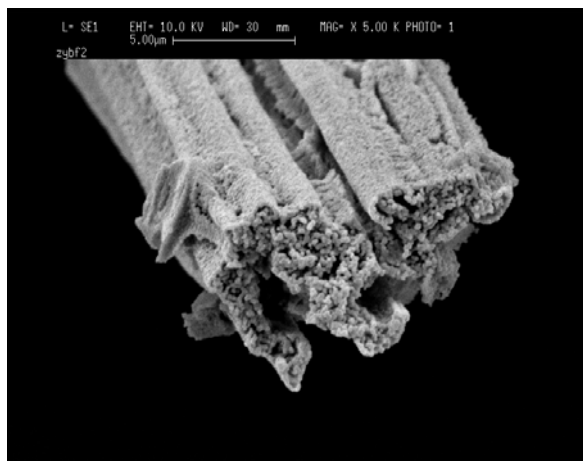


Photomicrograph of Type ZYBF-1 Fiber originally at 4500X magnification. Note the hollow nature of the fiber

Type ZYBF-2 is a high-fired, fine grained, hollow fiber which has some significant fiber to fiber binding as shown in the photo below left.



Photomicrograph of Type ZYBF-2 originally at 200X magnification.



Photomicrograph of Type ZYBF-2 originally at 5000X magnification

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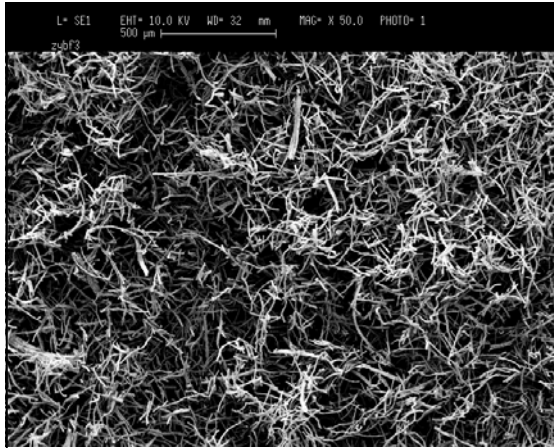


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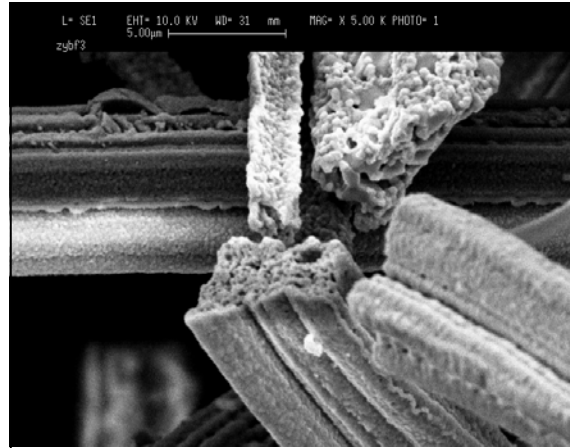
ZIRCONIA BULK FIBERS TYPE ZYBF

MORE PICTOMICROGRAPHS

Type ZYBF-3 is a high-fired, medium grained, porous fiber which has minimal fiber to fiber binding as shown in the photo on the right. ZYBF-3 fibers are shorter fibers on the order of a few hundred microns long.

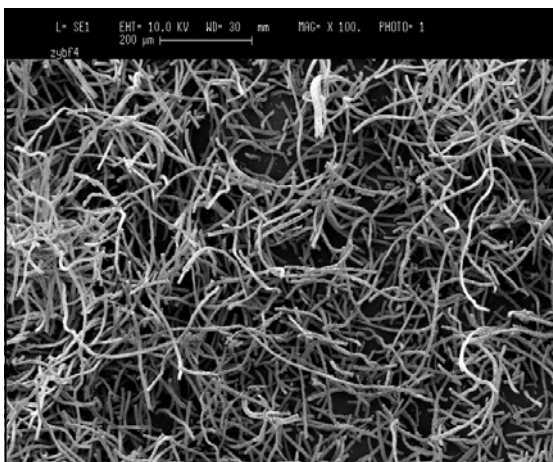


ZYBF-3 Photomicrographs originally at
50X magnification

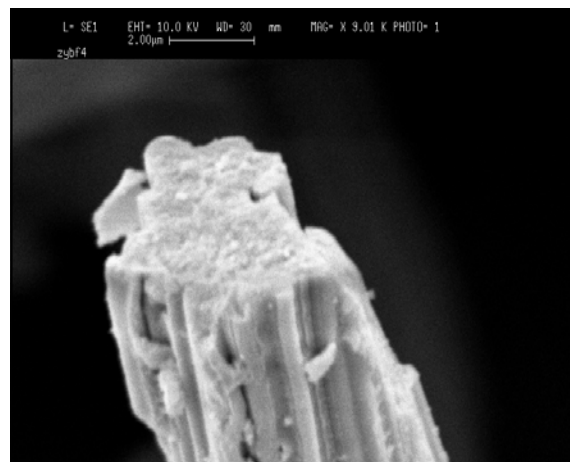


ZYBF-3 Photomicrographs originally at
5,000X magnification

Type ZYBF-4 is a medium-fired, medium-grained, mostly solid fiber which has minimal fiber to fiber binding.



ZYBF-4 Photomicrographs originally at
100X magnification



ZYBF-4 Photomicrographs originally at
9,010X magnification

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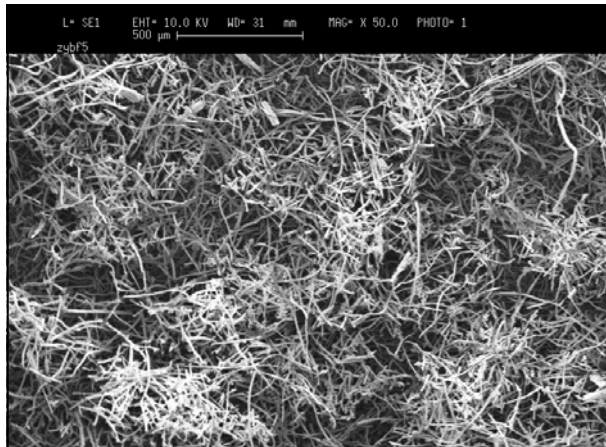


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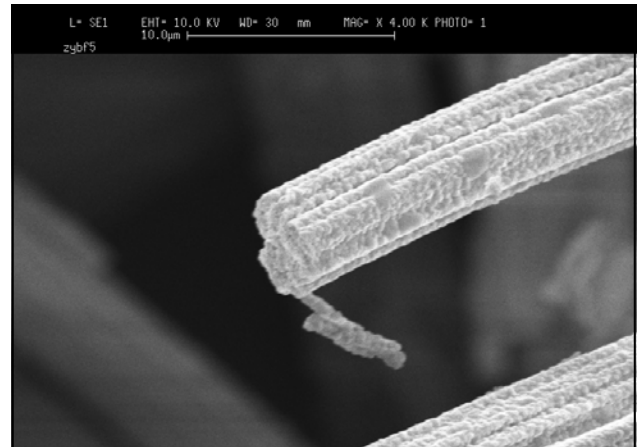
ZIRCONIA BULK FIBERS TYPE ZYBF

MORE PICTOMICROGRAPHS

Type **ZYBF-5** is a high-fired, large-grained, mostly solid fiber which has minimal fiber to fiber binding.



ZYBF-5 Photomicrographs originally at
50X magnification



ZYBF-5 Photomicrographs originally at
4,000X magnification

APPLICATION INFORMATION

- ZYBF can be vacuum formed into rigid shapes.
- Type ZYBF is used as an additive in ceramic fiber vacuum formed products to improve refractoriness.
- Type ZYBF can be added to our Zirconia Cement Type ZR-CEM and used as a coating or as a filler for holes, bonding of mis-matched surfaces, and repairing cracks and openings in furnace walls composed of zirconia insulation.
- Type ZYBF can be placed into cavities as loose fill insulation or used as furnace packing.
- Type ZYBF is used as thermal insulation in many industrial furnace applications. It is ideal for applications where an insulation exhibiting extremely low thermal conductivity is required.
- Type ZYBF is used in aggressive chemical environments due to its high purity stability and stability. It is stable in vacuum, inert or reducing atmospheres.

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ZIRCONIA BULK FIBERS TYPE ZYBF

ORDERING INFORMATION

Zirconia Bulk Fiber Type ZYBF is available both one pound and one kilogram standard bags. Please contact our Sales Department for Pricing and Availability.

- To order specify the Quantity required, Fiber Type, Package Size and the Item Number as listed in the table below.
For example: 10 each, ZYBF-2, 1 lb , Item # CF001

Fiber Type	1 Pound Package Item Number	Fiber Type	1 Kilogram Package Item Number
ZYBF-1	CF003	ZYBF-1	CF004
ZYBF-2	CF001	ZYBF-2	CF002
ZYBF-3	CF005	ZYBF-3	CF006
ZYBF-4	CF007	ZYBF-4	CF008
ZYBF-5	CF009	ZYBF-5	CF010

- Larger package quantities are available on a quoted basis. Please contact our Sales Department with your requirements and we'll be happy to provide you with a quotation.

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