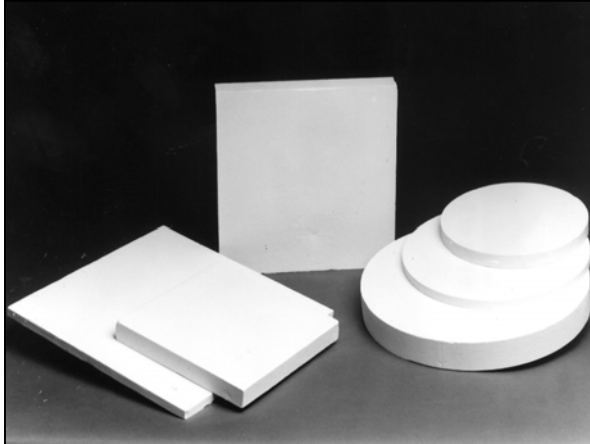




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ZIRCONIA BOARDS, DISCS & CYLINDERS TYPE ZYFB



ZYFB Boards & Discs are Available in Four Standard Thicknesses.

FEATURES

- Rigid and Machinable
- High Purity Zirconia Bonded
- Two Densities Available 30 pcf & 60 pcf
- Extreme High Temperature Stability
- Fibers Stabilized with ~10 wt% Yttria
- Low Thermal Conductivity
- Can be Cemented with Zircar Zirconia Cement Type ZR-CEM
- Can be Surface Hardened with Zircar Zirconia Rigidizer Type ZR-RIG
- Pre-fired and Organic Free

Type **ZYFB Boards, Discs and Cylinders** are rigid, refractory structures composed of yttria-stabilized zirconia fibers that do not undergo the usual phase transitions associated with pure zirconia. Type **ZYFB** is ideally suited for thermal insulation applications under conditions of ultra-high temperatures and in a variety of severe environments. **ZYFB** is fired at a high temperature to impart good dimensional stability up to 1650°C and can be used at higher temperatures where some additional sintering can be tolerated. It 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.

ZYFB is available in two densities. **ZYFB-3** has a bulk density of 30 pcf and possesses extremely low thermal conductivity. **ZYFB-6** has a bulk density of 60 pcf and is stronger than **ZYFB-3**. Both are zirconia bonded and have exceptional resistance to oxidizing and reducing atmospheres at high temperatures. Zirconia does, however, lose a small amount of oxygen at very high temperatures in vacuum and inert or reducing atmospheres. This reaction results in a color change from white to gray while most other properties remain essentially unchanged and insulation effectiveness is not impaired.

ZYFB has exceptional resistance to most corrosive environments. It undergoes little attack by molten alkali metal chlorides and carbonates at temperatures up to 700°C and withstands aqueous solutions of alkali metal hydroxides at temperatures as high as 230°C. **ZYFB** will also tolerate exposure to inorganic acids at their boiling point for short lengths of time.

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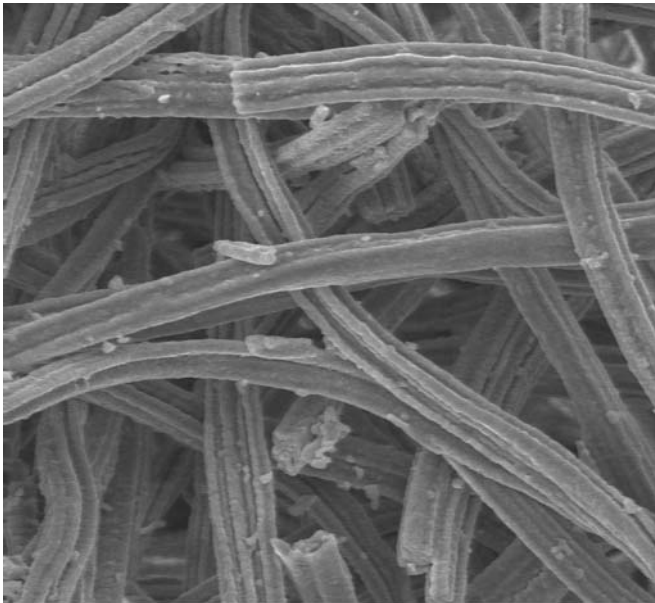
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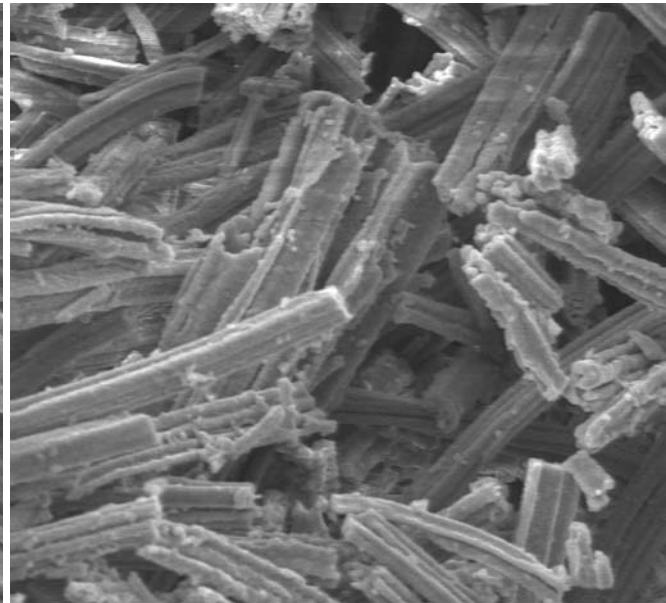
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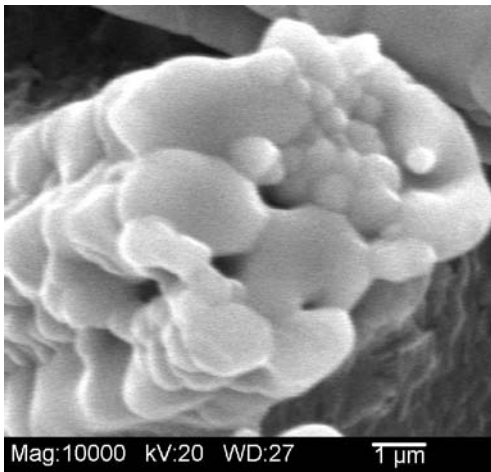
Shown below are SEM micrographs of **ZYFB-3** (left) and **ZYFB-6** board surfaces. Both materials are made by vacuum forming zirconia fibers and sintering at a high temperature. The fibers used in **ZYFB-6** are shorter than those used in **ZYFB-3** resulting in a higher density, lower porosity and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



Mag:1000 kV:20 WD:27 10 μ m



Mag:1000 kV:20 WD:27 10 μ m



Mag:10000 kV:20 WD:27 1 μ m

Shown on the left is an SEM micrograph of the end of a fiber on the surface of a **ZYFB-6** board. This micrograph has been reduced to 75% of its original size. Grains ranging in size from about 0.5 to about 3 microns make up the fiber which is about 6.5 microns across. The serrated structure which is characteristic of all Zircar zirconia fibers can be seen both in the lower magnification images shown above and in the close up view on the left. The very porous nature of Type **ZYFB** can also be clearly seen in the micrographs.

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ZIRCONIA BOARDS, DISCS & CYLINDERS TYPE ZYFB

CHEMICAL COMPOSITION

Zircar Zirconia's type **ZYFB** is nominally 90 wt% $\text{ZrO}_2 + \text{HfO}_2$ and 10 wt% Y_2O_3 . 1 - 2 wt% hafnia, HfO_2 , occurs naturally with zirconia, ZrO_2 , and does not affect performance. Only the highest purity starting materials are used to make type **ZYFB** minimizing trace oxides.

Trace Oxide	Typical Wt%
SiO_2	0.12
TiO_2	0.14
CaO	0.09
MgO	0.03
Fe_2O_3	0.04

Trace Oxide	Typical Wt%
Al_2O_3	0.01
Na_2O	0.01
SnO_2	0.001
Cr_2O_3	0.0005
Ag_2O	0.0005

MACHINING INFORMATION

Zirconia Type **ZYFB** has the consistency of soft chalk and can be cut or machined with a very wide range of tooling. For manual cutting, place the **ZYFB** part on a smooth clean surface and hold it in place with gentle finger pressure. When close tolerances are not required and the amount of cutting is limited, small holes can be drilled by hand with a standard high speed steel twist drill rotated between the fingers and boards can be cut with a back saw. If closer tolerances are needed, holes can be drilled using a drill press and boards can be cut with 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 or carbide tipped tooling is recommended. While quite soft, Type **ZYFB** is very abrasive and will cause rapid wear of high speed steel tooling which over time could result in an out of tolerance condition. **ZYFB** boards can be held in place for CNC machining with a vacuum hold down set up. Hot glue can also be used to fixture **ZYFB** but will generally form a very strong bond that will pull away material from the machined part. Crystal Bond™ which burns away cleanly when heated has also been used to fixture **ZYFB**.

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ZIRCONIA BOARDS, DISCS & CYLINDERS TYPE ZYFB

PROPERTIES & CHARACTERISTICS

	ZYFB-3	ZYFB-6
Bulk Density, g/cc (pcf)	0.48 (30)	0.96 (60)
Porosity, %	92	84
Melting Point, °C (°F)	2590 (4694)	2590 (4694)
Flexural Strength, (Parallel to thickness) MPa (psi)	0.60 (85)	2.10 (300)
Compressive Strength, (Parallel to thickness) @ 10% Compression MPa (psi)	0.29 (42)	1.59 (230)
Outgassing in Vacuum	Nil	Nil
Dilatometric Softening Temperature, °C (°F) at 10 psi	1180 (2156)	1240 (2264)
Thermal Expansion Coefficient (Perpendicular to Thickness) Room Temperature to 1180°C (2156°F)	$10.7 \times 10^{-6}/^{\circ}\text{C}$ ($6 \times 10^{-6}/^{\circ}\text{F}$)	$10.7 \times 10^{-6}/^{\circ}\text{C}$ ($6 \times 10^{-6}/^{\circ}\text{F}$)
Linear Shrinkage (Perpendicular to Thickness) , %		
1 hour at 1650°C (3002°F)	1.2	1.0
24 hours. at 1650°C (3002°F)	2.8	1.7
Thermal Conductivity, (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)	0.19 (1.3)
W/mK (BTU/hr ft ² °F/inch) at 1100°C (2012°F)	0.14 (1.0)	0.22 (1.5)
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)	0.24 (1.7)	0.27 (1.9)

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APPLICATION INFORMATION

- **ZYFB** is used as a high temperature, machinable hot face insulation in glass melting furnaces.
- **ZYFB** is used as high temperature heat shielding. It can replace or reduce the number of conventional refractory metal shields needed in many vacuum furnace applications and is not restricted to non-oxidizing conditions.
- **ZYFB** is used as insulation in directional solidification furnaces for jet turbine blades.
- **ZYFB** Boards and Discs are excellent setter and fixturing materials. **ZYFB's** ready machinability, dimensional stability and low heat capacity favor its use as a setter in both continuous and batch processes.
- Zircar Zirconia Cement Type **ZR-CEM** can be used to bond **ZYFB** boards and shapes together to build up complex fixtures. Custom shapes for your particular application may be easily machined out of these products.
- **ZYFB** can be treated with surface coatings to meet your needs. Please inquire.

ORDERING INFORMATION

Zircar Zirconia Insulation Type **ZYFB** is available in standard sized Boards and Discs which are listed on page 6 with their ordering item number. Please contact our Sales Department for Pricing and Availability.

- To order one of our standard sized Boards or Discs specify the Quantity you wish to order, Product Type, Item #, and Size. For example: 12 each, ZYFB-6, Item # AB312, 12" DIA. x 1.50" TK
- Our forming process and machining capabilities allow a wide variety of **custom sized** parts to be made (such as: **boards, discs, cylinders and other shapes**). Please contact us with your special requirements and we'll be happy to provide you with a quotation.

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Standard Sizes	ZYFB-3 Item No.	ZYFB-6 Item No.
Board, 8" x 8" x 0.50" TK	AA001	AB001
Board, 8" x 8" x 0.75" TK	AA002	AB002
Board, 8" x 8" x 1.00" TK	AA003	AB003
Board, 8" x 8" x 1.50" TK	AA004	AB004
Board, 10" x 10" x 0.50" TK	AA005	AB005
Board, 10" x 10" x 0.75" TK	AA006	AB006
Board, 10" x 10" x 1.00" TK	AA007	AB007
Board, 10" x 10" x 1.50" TK	AA008	AB008
Board, 12" x 12" x 0.50" TK	AA009	AB009
Board, 12" x 12" x 0.75" TK	AA010	AB010
Board, 12" x 12" x 1.00" TK	AA011	AB011
Board, 12" x 12" x 1.50" TK	AA012	AB012
Disc, 8" DIA x 0.50" TK	AA301	AB301
Disc, 8" DIA x 0.75" TK	AA302	AB302
Disc, 8" DIA x 1.00" TK	AA303	AB303
Disc, 8" DIA x 1.50" TK	AA304	AB304
Disc, 10" DIA x 0.50" TK	AA305	AB305
Disc, 10" DIA x 0.75" TK	AA306	AB306
Disc, 10" DIA x 1.00" TK	AA307	AB307
Disc, 10" DIA x 1.50" TK	AA308	AB308
Disc, 12" DIA x 0.50" TK	AA309	AB309
Disc, 12" DIA x 0.75" TK	AA310	AB310
Disc, 12" DIA x 1.00" TK	AA311	AB311
Disc, 12" DIA x 1.50" TK	AA312	AB312

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