



Zircar Zirconia, Inc.
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ZIRCONIA BOARDS & DISCS TYPE ZYZ



ZYZ Boards & Discs are Available in Four Standard Thicknesses.

FEATURES

- Rigid and Machinable
- Silica Bond for Thermal Shock Resistance
- Available in Two Densities; 30 & 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 **ZYZ Boards and Discs** are rigid, refractory structures composed of yttria-stabilized zirconia fibers that are bonded with silica. This unique composition provides Type **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 Type ZYFB materials.

Type **ZYZ** is ideally suited for thermal insulation and protection applications under conditions of ultra-high temperatures and in a variety of severe environments. **ZYZ** is fired at a high temperature to impart good dimensional stability up to 1650°C. **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** produces no smoke or odor and undergoes no physically disruptive phase transitions when heated. **ZYZ** is available in two forms. **ZYZ-3** has a bulk density of 30 pcf and possesses extremely low thermal conductivity. **ZYZ-6** has a bulk density of 60 pcf and is stronger than **ZYZ-3**.

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.

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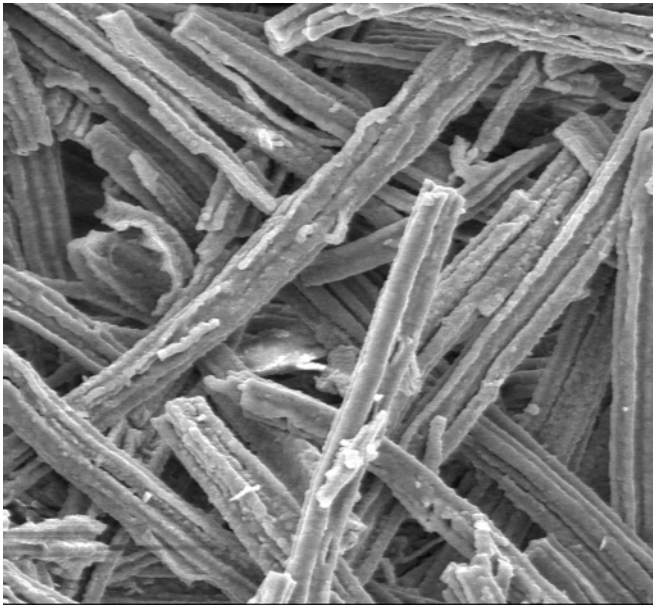
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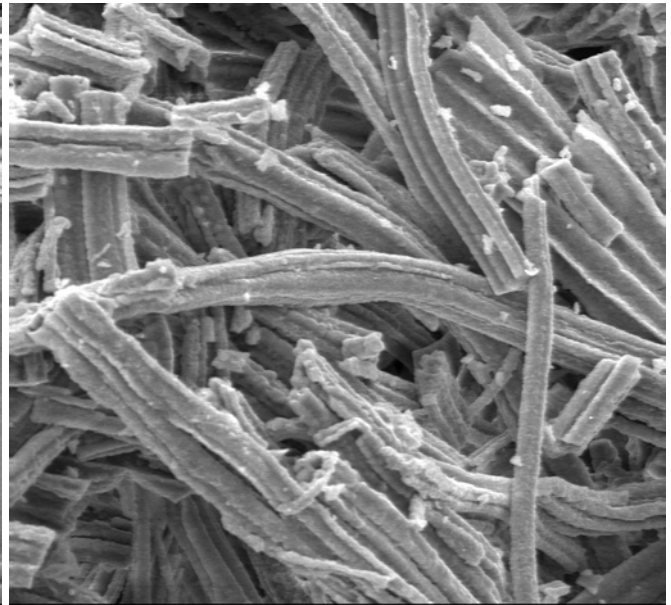
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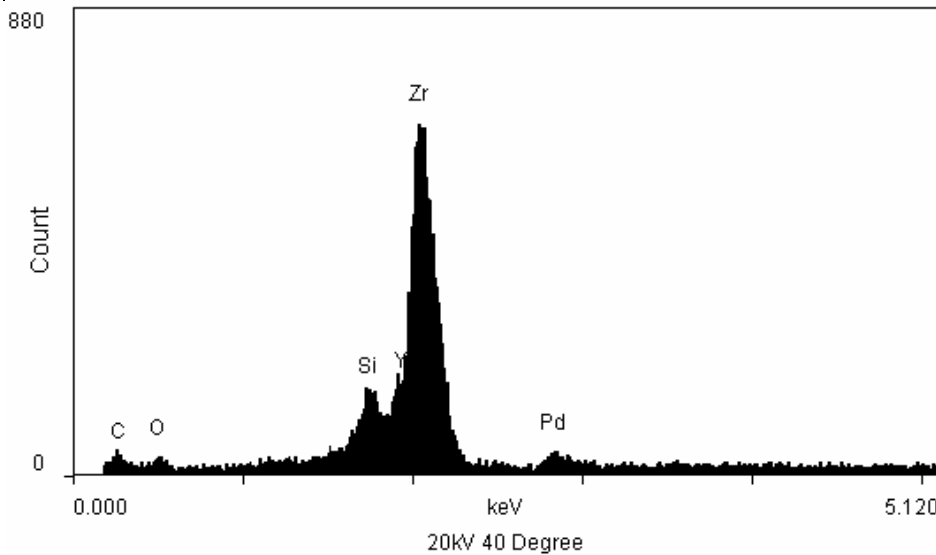
Shown below are SEM micrographs of **ZYZ-3** (left) and **ZYZ-6** board surfaces. Both materials are made by vacuum forming zirconia fibers and sintering at a high temperature. The fibers used in **ZYZ-6** are generally shorter than those used in **ZYZ-3** and are packed tighter resulting in a higher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



Mag:1000 kV:20 WD:27 10 μm



Mag:1000 kV:20 WD:27 10 μm



Shown on the left is an energy dispersive spectroscopy (EDS) graph of the intersection of two fibers on the surface of ZYZ-3. The silica peak is from the silica binder.

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CHEMICAL COMPOSITION

Zircar Zirconia's Type **ZYZ** is nominally 85 wt% $ZrO_2 + HfO_2$ and 10 wt% Y_2O_3 . 1 to 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 **ZYZ** minimizing trace oxides.

Trace Oxide	Typical Wt%
SiO_2 (binder)	5
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 **ZYZ** has the consistency of soft chalk and can be cut or machined with a very wide range of tooling. For manual cutting place the **ZYZ** 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 **ZYZ** is very abrasive and will cause rapid wear of high speed steel tooling which over time could result in an out of tolerance condition. **ZYZ** boards can be held in place for CNC machining with a vacuum hold down set up. Hot glue can also be used to fixture **ZYZ** 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 **ZYZ**.

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PROPERTIES & CHARACTERISTICS

	ZYZ-3	ZYZ-6
Bulk Density, g/cc (pcf)	0.48 (30)	0.96 (60)
Porosity, %	91	85
Melting Point, °C (°F)	2200 (3992)	2200 (3992)
Continuous Maximum Use Temperature, °C (°F)	1650(3002)	1650(3002)
Intermittent Maximum Use Temperature, °C (°F)	1700(3092)	1700(3092)
Flexural Strength, (Parallel to Thickness) MPa (psi)	0.28 (40)	1.74 (252)
Compressive Strength, (Parallel to Thickness) MPa (psi) @ 10% Compression	0.39 (56)	0.92 (134)
Outgassing in Vacuum	Nil	Nil
Dilatometric Softening Temperature, °C (°F) at 10psi	1250 (2282)	1275 (2372)
Thermal Expansion Coefficient RT - 1250°C (2282°F) (Perpendicular to Thickness)	$9 \times 10^{-6}/^{\circ}\text{C}$ ($5 \times 10^{-6}/^{\circ}\text{F}$)	$9 \times 10^{-6}/^{\circ}\text{C}$ ($5 \times 10^{-6}/^{\circ}\text{F}$)
Linear Shrinkage (Perpendicular to Thickness), %		
1 hour at 1650°C (3002°F)	1.7	1.6
24 hours at 1650°C (3002°F)	2.3	2.6
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)	0.20 (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)

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APPLICATION INFORMATION

- **ZYZ** Boards are used as self-supporting, primary thermal insulation in laboratory and industrial furnaces.
- **ZYZ** Boards and Discs 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 and is not restricted to non-oxidizing conditions.
- **ZYZ** Boards and Discs 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.
- Complex assemblies and fixtures can be fabricated by bonding **ZYZ** boards and shapes together using Zircar Zirconia Cement Type ZR-CEM. The cemented **ZYZ** assembly can be easily machined into the custom shape require for your application. **ZYZ** surfaces can also be hardened with Zirconia Rigidizer Type ZR-RIG.
- **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-3**, **ZYFB-6** and/or **FBD** are recommended.

ORDERING INFORMATION

Zircar Zirconia Insulation Type **ZYZ** is available in Standard sized Boards and Discs. which are listed on page 6 along with their ordering item number. Please contact our Sales Department for Pricing ad 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, ZYZ-3, Item # AE011, 12" x 12" x 1.00" TK

- Our forming process and machining capabilities allow a wide variety of **custom sized** parts to be made (such as: **boards, discs 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	ZYZ-3 Item No.	ZYZ-6 Item No.
Board, 8" x 8" x 0.50" TK	AE001	AF001
Board, 8" x 8" x 0.75" TK	AE002	AF002
Board, 8" x 8" x 1.00" TK	AE003	AF003
Board, 8" x 8" x 1.50" TK	AE004	AF004
Board, 10" x 10" x 0.50" TK	AE005	AF005
Board, 10" x 10" x 0.75" TK	AE006	AF006
Board, 10" x 10" x 1.00" TK	AE007	AF007
Board, 10" x 10" x 1.50" TK	AE008	AF008
Board, 12" x 12" x 0.50" TK	AE009	AF009
Board, 12" x 12" x 0.75" TK	AE010	AF010
Board, 12" x 12" x 1.00" TK	AE011	AF011
Board, 12" x 12" x 1.50" TK	AE012	AF012
Disc, 8" DIA x 0.50" TK	AE301	AF301
Disc, 8" DIA x 0.75" TK	AE302	AF302
Disc, 8" DIA x 1.00" TK	AE303	AF303
Disc, 8" DIA x 1.50" TK	AE304	AF304
Disc, 10" DIA x 0.50" TK	AE305	AF305
Disc, 10" DIA x 0.75" TK	AE306	AF306
Disc, 10" DIA x 1.00" TK	AE307	AF307
Disc, 10" DIA x 1.50" TK	AE308	AF308
Disc, 12" DIA x 0.50" TK	AE309	AF309
Disc, 12" DIA x 0.75" TK	AE310	AF310
Disc, 12" DIA x 1.00" TK	AE311	AF311
Disc, 12" DIA x 1.50" TK	AE312	AF312

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