

ZYF

High Temperature Yttria Stabilized Zirconia Felt

ZYF is the Flagship Product of
Zircar Zirconia, Inc.

Three Nominal Thicknesses

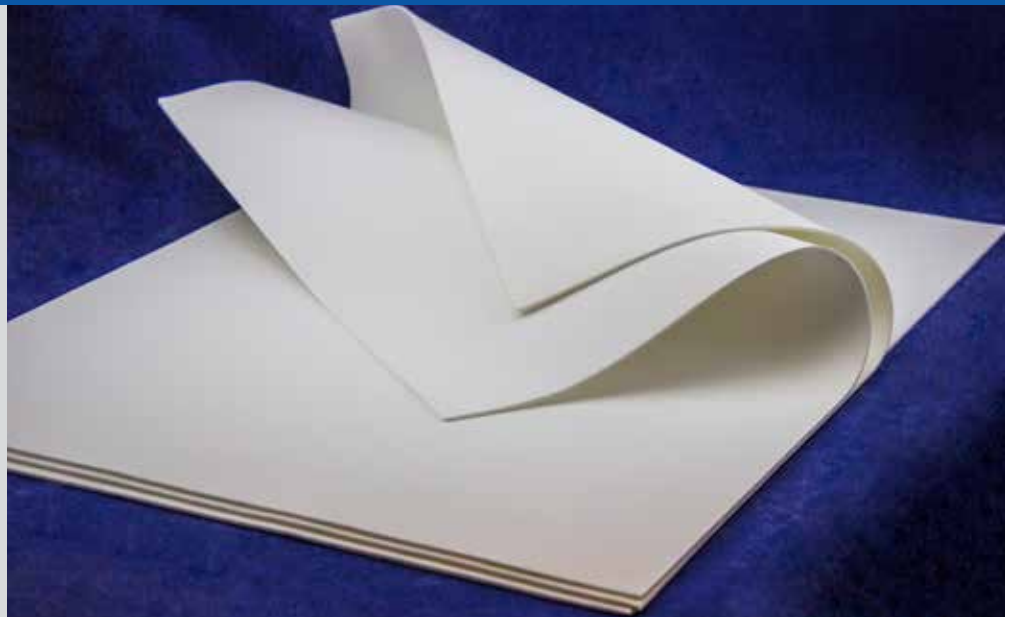
- **ZYF-50 (50 mils)**
- **ZYF-100 (100 mils)**
- **ZYF-150 (150 mils)**

ZYF Features

- Temperature Rating to as High as 2000 °C
- Phase Stabilized with 10 wt% Yttria
- High Purity
- Low Thermal Conductivity (K)
- 100% Inorganic, No Off-Gassing or Odors
- Excellent in Corrosive, Oxidizing & Reducing Atmospheres
- Flexible to 1350 °C
- High Porosity
- Very Light Weight
- Wrappable
- Easy to Cut
- Machinable
- Can be Die Cut
- Can be Cemented or Rigidized with ZR-CEM or ZR-RIG

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



Thin... Flexible... Foldable... Wrappable...

Fibrous ZrO_2 ceramic felt insulation that can withstand temperatures in excess of 2000 °C.

Product Information

Zircar Felt Type ZYF is an excellent all-purpose high temperature insulation that can be used as a separator, wrapper, fixture, gasket, cushion, pillow, pad, barrier, cover, layering or packing material in high temperature applications. More specific applications for ZYF are in the Czochralski method of crystal growing as iridium and platinum crucible insulation, and precious metal condensate reclamation material. ZYF is a ceramic textile made using the original ZIRCAR Process at our plant in Florida, NY, USA. ZYF is a flexible, light weight, porous, needled felt comprised of 4 to 6 micron diameter fibers and is nearly 100% zirconia phase stabilized with yttria. The fibers are mechanically interlocked and retain their flexible nature up to 1350 °C. ZYF is a general use insulation with properties that excel at extremely high temperatures and in severe environments such as corrosive, oxidizing and reducing atmospheres.

We use the highest purity materials in our products. The products contain only minimal trace oxides and no organics that off-gas when heated. Because **Zircar** zirconia fibers are yttria stabilized, they do not undergo the disruptive phase transition of pure zirconia. ZYF is non-reactive to alkali vapors, salts or strong hot solutions and is not wet by most molten metals. ZYF has low adsorption surface area and vapor pressure, making it useful in high vacuum.

ZYF-50 is 50 mil thick*
ZYF-100 is 100 mil thick*
ZYF-150 is 150 mil thick*

*nominal

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

Thickness

The notable difference between ZYF-50, ZYF-100, and ZYF-150 is the thickness. The three types of **Zircar** zirconia felt are ZYF-50, nominally 0.05 inches, ZYF-100, nominally 0.1 inches, and ZYF-150, nominally 0.15 inches thick. The thickness affects how bendable the material is and has to be considered when choosing the product if you plan to wrap, bend, or fold the material in any way.



The dime for scale shows the wrappability of ZYF-50 and thickness of ZYF products.



ZYF-50, ZYF-100, and ZYF-150 stacked on top of one another showing the difference in thickness of the three felts. ZYF-50 is on top with ZYF-150 on the bottom.

Properties & Characteristics

Properties (Nominal)	ZYF-50	ZYF-100	ZYF-150
Thickness, inch	0.05	0.1	0.15
Bulk Porosity, %	96	96	96
Bulk Density, lb/ft ³ (g/cm ³)	15 (0.24)	15 (0.24)	15 (0.24)
Tensile Strength, lb/in width	0.6	1.6	2.0
Melting Point, °C (°F)	2593 (4700)	2593 (4700)	2593 (4700)
Maximum Use Temperature, °C (°F) ⁽¹⁾	2000 (3632)	2000 (3632)	2000 (3632)
Minimum Wrapping Diameter Before Breaking, inch	0.25	0.75	3
Vapor Pressure @ 2500 °F, Torr	8 x 10 ⁻¹²	8 x 10 ⁻¹²	8 x 10 ⁻¹²
Linear Shrinkage, 1 hr. @ 1650 °C Isothermal Soak, %	5	4	4
Specific Heat BTU / lb - °F			
@200 °F	.13	.13	.13
@4300 °F	.18	.18	.18
Chemical Composition (Nominal)			
Oxide	Wt%		
ZrO ₂ ⁽²⁾	89+	89+	89+
Y ₂ O ₃	10	10	10
Al ₂ O ₃	<0.01	<0.01	<0.01
SiO ₂	<0.02	<0.02	<0.02

⁽¹⁾ Maximum use temperature is dependent on variables such as chemical environment and stresses; both thermal and mechanical.

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



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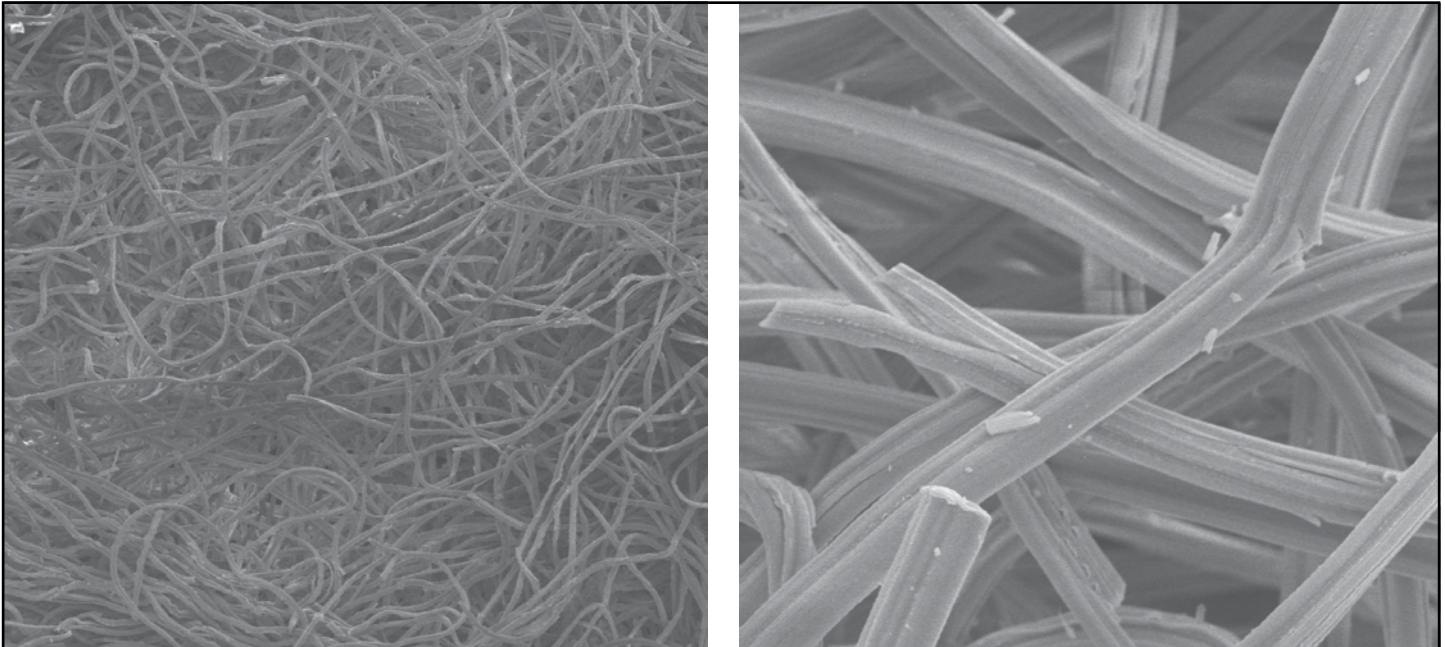
What Makes Our Zirconia Unique?

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 are mechanically interlocked requiring 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.

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.

Our unique zirconia fiber products are available in many forms in addition to felt.

Product Micrographs



Micrographs showing the serrated structure and mechanical interlock of ZYF fibers. The micrograph on the left is magnified by 100x while the micrograph on the right is magnified by 1000x.

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.



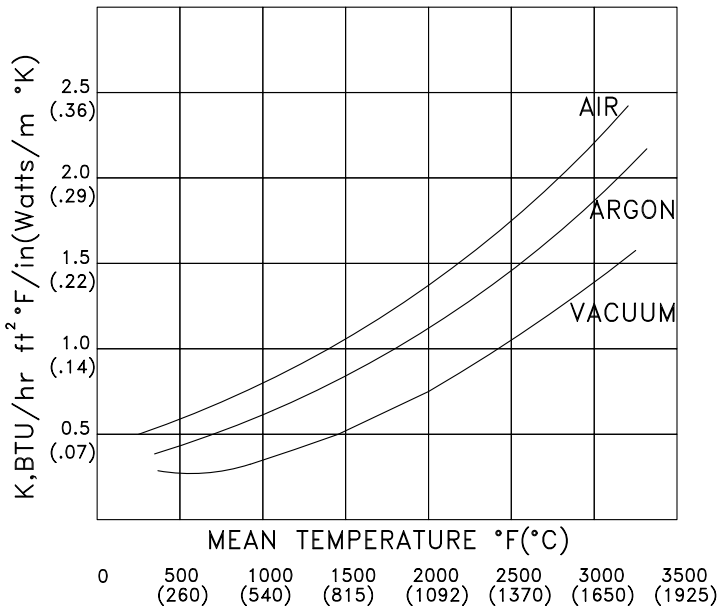
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Facts About Our Zirconium Oxide (cont.)

- Zirconia has the lowest thermal conductivity of any commercial refractory and is one of the most studied ceramic materials in the world.

Thermal Conductivity of
Zircar Type ZYF
in Various Atmospheres



- Upon heating unstabilized zirconia undergoes disruptive phase changes. At room temperature unstabilized ZrO_2 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** ZrO_2 is phase stabilized with 10 wt% Y_2O_3 .

Applications

ALL-PURPOSE

ZYF is an excellent all-purpose high temperature insulation that can be used as a separator, wrapper, fixture, gasket, cushion, pillow, pad, barrier, cover, layering or packing material.

HIGH TEMPERATURE SETTER

ZYF is used in powder metal sintering in vacuum and hydrogen atmospheres, quartz glass melting and hot working operations.

HIGH TEMPERATURE SHIELD/COVER

Molybdenum elements in rapid cycle furnaces will shed aggressive silica glass during high temperature heat treatment. Routine use of ZYF will protect your silica susceptible ware from the damage molybdenum elements cause.

HIGH TEMPERATURE INSULATION

Used between layers of refractory metal heat shields to improve insulation performance in vacuum furnaces and hot isostatic presses.

CRYSTAL GROWTH

ZYF acts as thermal insulation and a cushioning barrier as well as a platform for iridium recovery in the Czochralski method of oxide crystal growing. In this method an iridium crucible is often used to contain the melt. Iridium, a precious metal in the platinum group vaporizes at high temperature. A layer of ZYF wrapped around the iridium crucible creates a physical barrier between the fragile crucible and the backup insulation. The steep thermal gradient across the ZYF causes condensation of the iridium into the felt from which it can then be easily segregated and recovered.

ELECTROLYTIC CELL GASKET

ZYF is unaffected by long term exposure to KOH and is used as a separator/gasket in batteries and fuel cells using alkali electrolytes.

Cutting & Machining Instructions

For manual cutting, place the part on a smooth clean surface and hold it in place with gentle pressure. Felt can be cut with a utility knife or die cut. For very close tolerances and large amounts of cutting, CNC machining with very small diameter, down cutting spiral, solid carbide, carbide tipped or diamond tipped tooling is recommended. Slow feeds and high tool rotation rates are best. 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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Standard Product Sizes & Ordering

Zircar Felt Type ZYF is available in standard sized sheets which are listed below. ZYF can not manufactured as a continuous roll.
Please contact our Sales Department for pricing and availability.

To Place an Order

Call: 845-651-3040

email: sales@zircarzirconia.com

Type ZYF

Size	Item Number		
	ZYF-50	ZYF-100	ZYF-150
12"x 18"			CBA01
18"x 24"	CA001	CB001	CBA03
18"x 27"		CB047	

ZYF Custom Capabilities

ZYF can be customized for your application. Contact our Sales Department to discuss your unique requirements.

- Custom Sheet Sizes
- Die Cut Parts
- Rigidized with Zirconia or Alumina
- Layered/Sintered/Laminated Configurations
- Powder Loaded
 - Silica ZYF-S
 - Zirconia ZYF-Z
 - Alumina ZYF-A
 - Lanthanum Strontium Manganite ZYF-LSM
 - Custom Powder



Layered and Laminated into a Custom Curve



Die Cut into Custom Shapes and Sizes



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Product Samples

FREE SAMPLES

Call: 845-651-3040

email: sales@zircarzirconia.com

Product Type	Item #
ZYF-50	SAMPLE-CA
ZYF-100	SAMPLE-CB
ZYF-150	SAMPLE-CBA

Samples measure 1.8" x 2.8"



Other Products & Capabilities

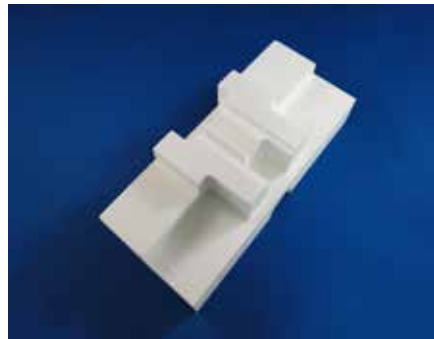
Customers who order ZYF also order:

- ZR-RIG
- ZR-CEM
- ZYFB and FBD
- Rare Earth Oxide Felts, Cloth and Fiber Boards

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



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



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