

### ZR-RIG

## Yttria Stabilized Zirconia Rigidizer

The Unrivaled Industry Leader  
of ZrO<sub>2</sub> Insulation

Available in Pints and Quarts

#### ZR-RIG Features

- Manufactured Using Our Own Unique **Zircar** ZYBF Bulk Fiber
- High Temperature Stability up to 2200 °C
- Phase Stabilized with 10 wt% Yttria
- Withstands Water & Steam After Curing
- Usable in Multiple Atmospheres
- Safe to Use - Non-Flammable

#### 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



#### High Purity... Surface Hardening... Water Based...

Yttria stabilized zirconia fibers reinforced with sub-micron zirconia particles.

#### Product Information

**Zircar** Zirconium Oxide Rigidizer Type ZR-RIG is formulated for the surface hardening of all zirconia fiber products and for use in the fabrication of zirconia composites from **Zircar** textiles and other advanced materials. Such composites are comprised of a matrix of zirconia fibers reinforced with sub-micron zirconia particles. ZR-RIG has the same calcined composition as our ZYBF zirconia fibers and forms a fully stabilized zirconia body upon curing.

ZR-RIG contains sub-micron particles of yttria stabilized zirconia suspended in a zirconium acetate aqueous solution. The suspension will settle in transport as shown in the pint sized container in the picture above. The water based rigidizer, when mixed, has the consistency of a low viscosity house paint. Should the rigidizer become too thick during use for complete penetration into the surface of the zirconia fiber product, it can be thinned by small additions of de-ionized or distilled water.

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

## Directions For Use

### Bonding Layers of Zirconia Cloth into a Composite

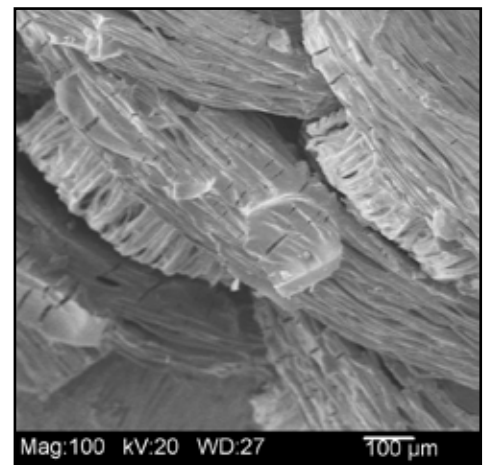
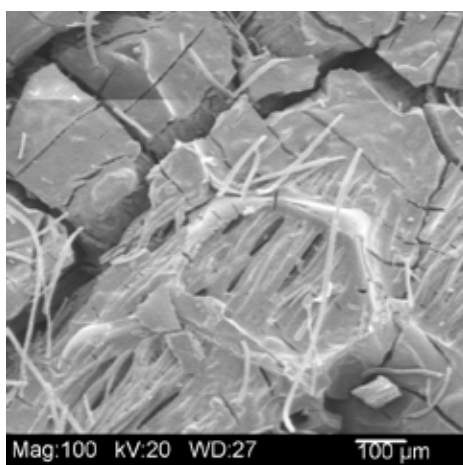
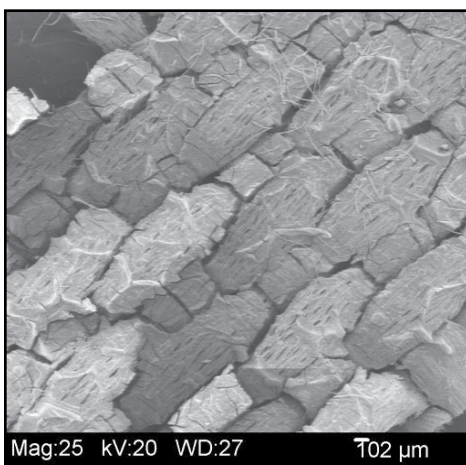
1. Thoroughly mix ZR-RIG before using. It is normal for the sub-micron yttria-stabilized zirconia particles to settle during storage. Using a sponge, brush, spray or simply by pouring on, saturate both sides of the cloth using a liberal amount of ZR-RIG to assure uniform penetration. The rate of application of ZR-RIG for use with **Zircar** cloth ZYW-30A in the production of zirconia composites is about 2.5 fluid ounces per square foot of cloth.
2. Remove excess ZR-RIG from the textile with a rubber squeegee or roller. Partially dry the saturated textile with a stream of dry air or in an oven at low temperature until the ZR-RIG becomes tacky (essentially a "B-staging" operation). A heat gun has been successfully used when the textile is turned several times during heating.
3. Laminate the pieces together or form to shape while the ZR-RIG is tacky. Roll or press the layers together to make good contact.
4. Dry the body slowly, starting at 100-200 °F for several hours, increasing the temperature to 240-300 °F over a period of 3-4 hours. The maximum rate of drying depends on the thickness of the lay-up. Two layers can normally be dried in 1-2 hours at 240 °F. 10 layers or more require 24 hours at 300 °F to dry thoroughly.
5. Cure the rigidizer by heating at 800-1000 °F for 1 hour. Ramping up to these temperatures over a period of several hours is recommended. In some applications, it may be desirable to cure the body above 2000 °F for increased strength.

### Surface Hardening Zirconia Fiber Products

1. Thoroughly mix ZR-RIG before using. Using a sponge, brush, or by dipping, apply several light coats of ZR-RIG to the fiber surface. The rigidizer should soak into the fiber surface completely. When it cakes up on the surface the pores are full.
2. Allow the treated parts to air dry overnight. Curing at 800-1000 °F is then recommended.

### Product Micrographs

Shown below are micrographs of satin weave zirconia cloth, ZYW-30A, rigidized three successive times with zirconia rigidizer, ZR-RIG, and high fired. The resulting composite body still shows the original satin weave structure of the zirconia cloth. The raised ridges which approximate a honeycomb pattern are from contact with open cell urethane foam which was used as the contact surface in a fixture to restrain the rigidized cloth in a flat sheet during drying.

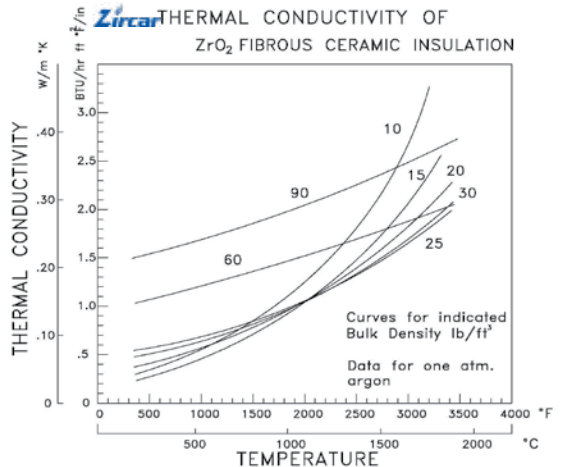


Zircar Zirconia, Inc.  
87 Meadow Road  
P.O. Box 287  
Florida, New York 10921

Phone: (845) 651-3040  
Fax: (845) 651-0074  
Email: sales@zircarzirconia.com  
www.zircarzirconia.com

## Facts About Our Zirconium Oxide

- **Zircar** ZrO<sub>2</sub> 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, HfO<sub>2</sub>, 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 ZrO<sub>2</sub> 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<sub>2</sub> is phase stabilized with 10 wt% Y<sub>2</sub>O<sub>3</sub>.

## Properties & Characteristics

ZR-RIG Properties	
Melting Point, °C (°F)	2590 (4694)
Specific Gravity	1.87
Solids Content, Wt%	50
Cured Chemical Composition (Nominal)	
Oxide	Wt%
ZrO <sub>2</sub> *	90
Y <sub>2</sub> O <sub>3</sub>	10
Trace Inorganics	<0.3

\*1-2% weight hafnia (HfO<sub>2</sub>) occurs naturally with zirconia (ZrO<sub>2</sub>) and does not affect performance.

## Applications

### BONDING AND STRENGTHENING AGENT

ZR-RIG is used for surface hardening and as a strengthening agent for low density zirconia ceramic fiber insulation. It also can be used as a bonding agent in the manufacture of composite structures made from **Zircar** textiles.

## Standard Product Sizes & Ordering

Please contact our Sales Department for pricing and availability.

### To Place an Order

Call: 845-651-3040

email: [sales@zircarzirconia.com](mailto:sales@zircarzirconia.com)

### ZR-RIG

Size	Item Number
1 Pint	BB001
1 Quart	BB002



Zircar Zirconia, Inc.  
87 Meadow Road  
P.O. Box 287  
Florida, New York 10921

Phone: (845) 651-3040  
Fax: (845) 651-0074  
Email: [sales@zircarzirconia.com](mailto:sales@zircarzirconia.com)  
[www.zircarzirconia.com](http://www.zircarzirconia.com)

## Product Samples

### FREE SAMPLES

Call: 845-651-3040

email: sales@zircarzirconia.com

Product Type	Item #
ZR-RIG	SAMPLE-BB

Samples are 1oz



## Other Products & Capabilities

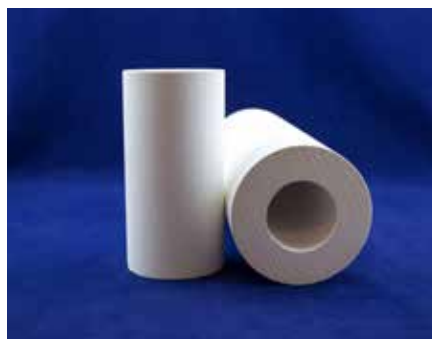
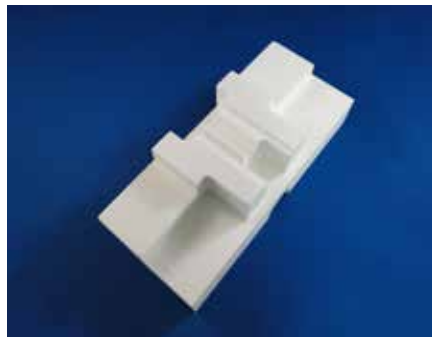
Customers who order ZR-RIG also order:

- ZYF
- ZYC
- FBD
- ZYW
- ZYK

**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.



Zircar Zirconia, Inc.  
87 Meadow Road  
P.O. Box 287  
Florida, New York 10921

Phone: (845) 651-3040  
Fax: (845) 651-0074  
Email: sales@zircarzirconia.com  
www.zircarzirconia.com