

## Fiberfrax® Blanket and Mat Products

### Introduction

The Fiberfrax® blanket and mat product family is a group of lightweight, thermally efficient ceramic fiber insulating materials that combine the advantages of dimensional stability at high temperatures with complete resistance to thermal shock. Featuring a broad range of thermal capabilities and physical characteristics, this product family provides proven and effective solutions to a variety of heat processing applications.

Durablanket® ceramic fiber products are high strength, needed insulating blankets that are made from spun Fiberfrax ceramic fibers. The extra-long spun fibers, cross-locked through a unique forming process, produce a blanket with exceptional handling strength. The Durablanket product family is completely inorganic and available in a variety of temperature grades, densities, and sizes.

Fibermat® Mat, PH blanket, and Moist Pak-D® insulation provide additional options for specific application requirements ranging from high-temperature filtration to hot gas velocity resistance.

Fibermax® Mat is a high-temperature, flexible mat product entirely composed of Fibermax polycrystalline mullite fibers, making it an extremely lightweight, highly resilient insulator that is virtually free of unfiberized (“shot”) particles.

Having excellent chemical stability, Fiberfrax blanket and mat products are unaffected by most chemicals except hydrofluoric and phosphoric acids and concentrated alkalis. If wet by water or steam, thermal and physical properties remain unaffected after drying.

### Durablanket® S

Fiberfrax Durablanket S insulation is a strong, lightweight, flexible needed blanket that is made from spun ceramic fibers. Available in a wide variety of thicknesses, widths and densities, Durablanket S insulation provides an array of proven solutions for a broad spectrum of application problems.



### Durablanket® HP-S

Fiberfrax Durablanket HP-S insulation is a needed blanket made from spun Fiberfrax ceramic fibers. Durablanket HP-S insulation combines all of the physical characteristics offered by Durablanket S insulation in a product with a high-purity chemistry. The chemistry of Durablanket HP-S provides improved performance and service life in applications where fluxing or chemical attack occurs.

### Durablanket® 2600

Fiberfrax Durablanket 2600 insulation extends the high-temperature performance of the Durablanket product line. The product is made from high-purity alumina, zirconia, and silica spun ceramic fibers. This chemical composition, manufactured in a unique fiber-making process, imparts Durablanket 2600 insulation with extremely low shrinkage characteristics at elevated temperatures.

Refer to the product Material Safety Data Sheet (MSDS) for recommended work practices and other product safety information.

### **Duraback®**

Fiberfrax Duraback blanket is a strong, lightweight, flexible needled blanket intended for use as a cost-effective back-up insulation in Fiberwall® furnace linings. It is recommended for use up to 982°C (1800°F).

Duraback blanket can be installed up to four times faster than common block-type back-up insulation.

### **Fibermat® Blanket**

Fiberfrax Fibermat is a lightweight, high-strength needled insulating blanket. The blanket fibers are spun from a ceramic composition having a normal use limit of 760°C (1400°F). Fibermat is completely inorganic and derives its exceptional strength from the needling of long ceramic fibers.

It has excellent thermal and acoustical insulating properties.

### **PH Blanket**

Fiberfrax PH blanket is a unique product that has been specifically designed to provide excellent filtration capabilities in addition to the high chemical stability and low thermal conductivity that is possessed by all Fiberfrax products.

PH blanket is made from Fiberfrax bulk ceramic fibers in a unique wet felting process which removes unfiberized particles. In addition to the strength and resiliency afforded by the interlocking of fibers during the manufacturing process, handling strength is further enhanced by the addition of a small amount of organic binder.

A typical filtration application would involve utilizing PH blanket as a platinum catalyst recovery filter in nitric acid production. In this application, PH blanket offers numerous advantages over glass wool products including longer life, 50-60% improved filter efficiency, reduced chance of blowouts, and better temperature resistance.

### **Moist Pak-D®**

Fiberfrax Moist Pak-D insulation is made from high-strength ceramic fiber blankets impregnated with inorganic bonding agents. This processing results in a flexible insulation that air dries to form a hard, rigid structure. Moist Pak-D is ideal for insulation of complex shapes and for service under conditions of high hot gas velocities.

The material is packaged in a clear polyethylene bag to retain the wet binder during shipment and storage. Since damage will occur, care should be taken to prevent freezing of the product.

Curing of product can be accomplished by air drying for several days or by immediate exposure to temperature in the application. Curing is merely a function of removing the water from the inorganic binder.

### **Fibermax® Mat**

Fibermax Mat is a high-temperature, flexible mat product that is lightweight (1.5 lb/ft<sup>3</sup> density) and highly resilient. It is composed entirely of Fibermax polycrystalline mullite fibers to produce a product that is high-temperature (1650°C/3000°F) resistant and virtually shot-free.

Fibermax Mat contains no organic binders or other additives which cause outgassing fumes or associated problems. In addition to exhibiting excellent resistance to attack from most corrosive agents (exceptions include hydrofluoric acid, phosphoric acid and strong alkalies), Fibermax fiber also resists oxidation and reduction.

## Typical Durablanket Heatflow Calculations

|                     |   | Lining Cross-Section  |   |   |   |
|---------------------|---|---|---|---|---|
|                     |   | 1" Durablanket S, 8PCF<br>1½" Durablanket S, 6PCF<br>1½" Duraback, 4PCF | 2" Durablanket S, 8PCF<br>2" Durablanket S, 6PCF<br>2" Duraback, 4PCF | 2" Durablanket S, 8PCF<br>2" Durablanket S, 6PCF<br>4" Duraback, 4PCF | 2" Durablanket S, 8PCF<br>2" Durablanket S, 6PCF<br>6" Duraback, 4PCF |
| Hot Face<br>°C (°F) | Insulation Thickness – mm (in)<br>Cold Face Temperature – | <b>102 (4)</b><br>°C (°F)   | <b>152 (6)</b><br>°C (°F)   | <b>203 (8)</b><br>°C (°F)   | <b>254 (10)</b><br>°C (°F)  |
| 649 (1200)          |   | 80 (176)  | 65 (149)  | 57 (135)  | 53 (127)  |
| 871 (1600)          |   | 115 (238)   | 91 (196)  | 80 (175)  | 72 (161)  |
| 1093 (2000)         |   | 158 (317)   | 125 (257)   | 109 (228)   | 98 (205)  |

|                     |   | Lining Cross-Section   |  |  |  |
|---------------------|---|--|--|--|--|
|                     |   | 2" Durablanket 2600, 8PCF<br>2" Durablanket S, 6PCF<br>2" Duraback, 4PCF | 2" Durablanket 2600, 8PCF<br>4" Durablanket S, 6PCF<br>2" Duraback, 4PCF | 2" Durablanket 2600, 8PCF<br>4" Durablanket S, 6PCF<br>4" Duraback, 4PCF | 2" Durablanket 2600, 8PCF<br>4" Durablanket S, 6PCF<br>6" Duraback, 4PCF |
| Hot Face<br>°C (°F) | Insulation Thickness – mm (in)<br>Cold Face Temperature – | <b>152 (6)</b><br>°C (°F)  | <b>203 (8)</b><br>°C (°F)  | <b>254 (10)</b><br>°C (°F)   | <b>305 (12)</b><br>°C (°F)   |
| 1149 (2100)         |   | 134 (274)  | 114 (238)  | 103 (218)  | 94 (202)   |
| 1260 (2300)         |   | 154 (310)  | 132 (269)  | 118 (245)  | 109 (228)  |
| 1316 (2400)         |   | 165 (329)  | 141 (285)  | 127 (260)  | 116 (241)  |

All heat flow calculations are based on a surface emissivity factor of .90, an ambient temperature of 27°C (80°F) and zero wind velocity, unless otherwise stated.

All thermal conductivity values for Fiberfrax materials have been measured in accordance with ASTM Test Procedure C-177. When comparing similar data, it is advisable to check the validity of all thermal conductivity values and ensure the resulting heat flow calculations are based on the same condition factors. Variations in any of these factors will result in significant differences in the calculated data.

For additional information about product performance, to identify the recommended product for your application, or for a specific heatflow calculation, please contact the Unifrax Application Engineering Group at 716-278-3888.

Data are average results of tests conducted under standard procedures and are subject to variation. Results should not be used for specification purposes.



## Typical Product Parameters

|                                | Duraback | Durablanket S | Durablanket HP-S | Durablanket 2600 |
|--------------------------------|----------|---------------|------------------|------------------|
| <b>Available Density</b>       |          |               |                  |                  |
| kg/m <sup>3</sup>              | 64       | 64, 96, 128   | 64, 96, 128      | 96, 128          |
| (lb/ft <sup>3</sup> )          | (4)      | (4, 6, 8)     | (4, 6, 8)        | (6, 8)           |
| <b>Chemical Composition</b>    |          |               |                  |                  |
| Al <sub>2</sub> O <sub>3</sub> | 31-35%   | 43-47%        | 43-47%           | 29-31%           |
| SiO <sub>2</sub>               | 50-54%   | 53-57%        | 53-57%           | 53-55%           |
| ZrO <sub>2</sub>               | 5%       | —             | —                | 15-17%           |
| Fe <sub>2</sub> O <sub>3</sub> | 1.3%     | Trace         | —                | —                |
| TiO <sub>2</sub>               | 1.7%     | Trace         | —                | —                |
| MgO                            | *0.5%    | —             | —                | —                |
| CaO                            | ≤7.5%    | —             | —                | —                |
| Na <sub>2</sub> O <sub>3</sub> | —        | <.5%          | <.5%             | —                |
| Alkali                         | —        | 0.05%         | —                | —                |
| Leachable Chlorides            | —        | <10 ppm       | <10 ppm          | <10 ppm          |
| Other Inorganics               | —        | 0.85%         | —                | —                |

\*MgO and other trace inorganics

|                                | PH Blanket | Moist Pak-D*  | Fibermat Blanket   | Fibermax Mat |
|--------------------------------|------------|---------------|--|--------------|
| <b>Available Density</b>       |            | (Typical Dry) |  |              |
| kg/m <sup>3</sup>              | 96         | 190-290       | 88   | 24           |
| (lb/ft <sup>3</sup> )          | (6)        | (12-18)       | (5.5)  | (1.5)        |
| <b>Binder Content</b>          | 3-5%       | —             | —  | —            |
| <b>Chemical Composition</b>    |            |               |  |              |
| Al <sub>2</sub> O <sub>3</sub> | 43-47%     | 23-32%        | 29-47%   | 72%          |
| SiO <sub>2</sub>               | 53-55%     | 68-77%        | 52-57%   | 27%          |
| ZrO <sub>2</sub>               | —          | —             | <18%   | —            |
| Fe <sub>2</sub> O <sub>3</sub> | Trace      | —             | —  | 0.02%        |
| TiO <sub>2</sub>               | Trace      | —             | —  | 0.001%       |
| MgO                            | —          | —             | —  | 0.05%        |
| CaO                            | —          | —             | —  | 0.05%        |
| Na <sub>2</sub> O <sub>3</sub> | <.5%       | <.5%          | <.5%   | 0.10%        |
| Alkali                         | —          | —             | —  | —            |
| Leachable Chlorides            | <10 ppm    | —             | <10 ppm  | 11 ppm       |
| Other Inorganics               | —          | —             | —  | —            |
| <b>Nominal Weight</b>          | —          | —             | ½" thickness = 3.7 oz/ft <sup>2</sup><br>1" thickness = 7.3 oz/ft <sup>2</sup><br>2" thickness = 14.7 oz/ft <sup>2</sup> | —            |

\*Normal shelf life one year in unopened containers.

For additional information about product performance or to identify the recommended product for your application, please contact the Unifrax Application Engineering Group at 716-278-3888.



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## Product Family Characteristics

- Excellent handling strength
- Excellent hot strength
- Low thermal conductivity
- Low heat storage
- Light weight
- Resiliency
- Thermal shock resistance
- High heat reflectance
- Excellent corrosion resistance
- Excellent thermal stability
- Excellent sound absorption
- Excellent fire protection

## Specific Product Characteristics

- Extremely low shrinkage: Fibermax Mat
- Low shrinkage: Durablanket 2600 insulation
- Exceptional handling strength: Durablanket 2600 insulation, Durablanket S insulation, Durablanket HP-S insulation, Fibermat Blanket
- Exceptional hot strength: Durablanket 2600 insulation
- Exceptional velocity resistance: Moist Pak-D insulation
- Excellent conformance to complex shapes: Moist Pak-D insulation
- Low shot content (95% fiber index): Fibermax Mat
- Exceptional sound absorption: Fibermat Blanket, PH blanket
- High resiliency: Fibermax Mat
- Excellent compression recovery: Fibermat Blanket
- Excellent filtration capabilities: PH blanket

## Typical Applications

### Durablanket® S and Durablanket® HP-S

- Furnace, kiln, reformer and boiler linings
- Investment casting mold wrappings
- Removable insulating blankets for stress relieving welds
- Reusable insulation for steam and gas turbines
- Flexible high-temperature pipe insulation
- Pressure and cryogenic vessel fire protection
- High-temperature kiln and furnace insulation
- Furnace door linings and seals
- Soaking pit seals
- Furnace repairs
- Thermal reactor insulation
- Expansion joint seals
- Primary reformer header insulation
- High-temperature gasketing
- Glass furnace crown insulation
- Incineration equipment and stack linings
- Annealing cover seals
- High-temperature filtration
- Nuclear insulation applications
- Atmosphere furnace lining
- Field steam generator lining

### **Durablanket® 2600**

- Ceramic kilns (abrasives, sanitary ware, electrical insulators, etc.)
- Billet/slab reheat furnaces
- Seals, gaskets, batten strips
- Forge furnaces
- Refractory kilns
- BOF door/shields
- Soaking pit seals
- High-temperature kilns and furnaces
- Boiler linings
- Furnace door linings and seals
- Glass furnace crown insulation
- Incineration equipment
- Skid pipe insulation

### **Duraback®**

- Back-up for Fiberwall® lining systems
- Filler for insulating pads
- Expansion joint material

### **Fibermat® Blanket**

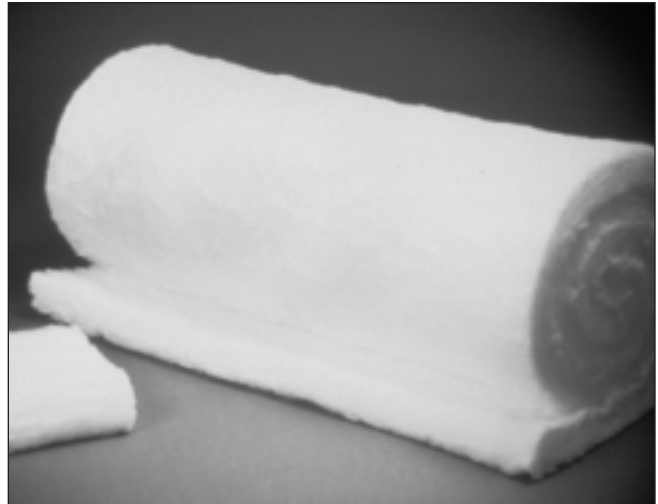
- Acoustical insulation
- Thermal insulation for external applications
- Insulating pads

### **PH Blanket**

- Catalyst recovery filter in nitric acid production
- Diffusion medium for fluidized beds
- Filtration and catalyst carrier medium for radioactive particles and hot exhaust gases

### **Moist Pak-D®**

- Hot face layer for Fiberfrax heater, furnace and kiln linings where hot gas velocities exceed 12.2 m/sec (40 ft/sec)



Fiberfrax blanket

- Hot gas duct, flue and stack linings
- Recuperator linings
- Blow pipe linings
- External and internal pipe insulation
- Reformer header insulation
- Process furnace tube weld protection
- Thermal and corrosion protection of process heater tube supports

### **Fibermax® Mat**

- Expansion joint packing
- Burner wraps
- Batten strips with fiber modules
- Aluminum homogenizing furnace linings

## Typical Product Properties

|  | <b>Duraback</b>               | <b>Durablanket S</b>  | <b>Durablanket HP-S</b>       | <b>Durablanket 2600</b>       |
|--|-------------------------------|---|-------------------------------|-------------------------------|
| Color                                  | White                         | White   | White                         | White                         |
| Temperature Grade*                     | 982°C (1800°F)                | 1260°C (2300°F)   | 1260°C (2300°F)               | 1430°C (2600°F)               |
| Recommended Operating Temperature      | 1800°F                        | 2150°F  | 2150°F                        | 2450°F                        |
| Melting Point                          | 1648°C (3000°F)               | 1760°C (3200°F)   | 1760°C (3200°F)               | 1760°C (3200°F)               |
| Fiber Diameter                         | 2-4 microns (mean)            | 2.5-3.5 microns (mean)  | 2.5-3.5 microns (mean)        | 3.5 microns (average)         |
| Specific Heat @ 1093°C (2000°F)        | 1130 J/kg °C (0.27 Btu/lb °F) | 1130 J/kg °C (0.27 Btu/lb °F)   | 1130 J/kg °C (0.27 Btu/lb °F) | 1130 J/kg °C (0.27 Btu/lb °F) |
| Specific Gravity                       | 2.73 g/cm <sup>3</sup>        | 2.73 g/cm <sup>3</sup>  | 2.73 g/cm <sup>3</sup>        | 2.73 g/cm <sup>3</sup>        |
| Average Tensile Strength (ASTM 686-76) | —                             | 4 lb/in <sup>2</sup> min. @ 4 PCF<br>6 lb/in <sup>2</sup> min. @ 6 PCF<br>7 lb/in <sup>2</sup> min. @ 8 PCF | —                             | —                             |

|   | <b>PH Blanket</b>  | <b>Moist Pak-D</b>   |
|---|--------------------|--|
| Color   | Tan                | White  |
| Temperature Grade*                            | 1260°C (2300°F)    | 1093°C (2000°F)  |
| Recommended Operating Temperature             | 2150°F             | 1850°F   |
| Melting Point                                 | 1790°C (3260°F)    | 1790°C (3260°F)  |
| Fiber Diameter                                | 4-8 microns (mean) | 2-3 microns (mean)   |
| Specific Heat Capacity @ 1093°C (2000°F)      | —                  | 1130 J/kg °C (0.27 Btu/lb °F)  |
| Tensile Strength – 6.4 mm (¼"): (ASTM 686-76) | —                  | Wet = 1.2 x 10 <sup>5</sup> N/m <sup>2</sup> (17 psi)<br>Dry = 3.5 x 10 <sup>5</sup> N/m <sup>2</sup> (50 psi) |
| Hot Gas Erosion Resistance:                   | N/A                | Test procedure based on British Gas Council Research Comm. GC173 = over 30.5 m/sec (100 ft/sec)                |

|  | <b>Fibermat Blanket</b> | <b>Fibermax Mat</b>            |
|--|-------------------------|--------------------------------|
| Color                                      | White                   | White                          |
| Temperature Grade*                         | 760°C (1400°F)          | 1650°C (3000°F)                |
| Recommended Operating Temperature          | 1250°F                  | 2850°F                         |
| Melting Point:                             | —                       | 1870°C (3400°F)                |
| Fiber Diameter                             | 2.5-3.5 microns (mean)  | 2-3.5 microns (mean)           |
| Specific Gravity:                          | 2.73 g/cm <sup>3</sup>  | 3 g/cm <sup>3</sup>            |
| Tensile Strength (ASTM 686-76):            | 7-10 psi (typical)      | —                              |
| Specific Heat Capacity at 1093°C (2000°F): | —                       | 1246 J/kg °C (0.297 Btu/lb °F) |
| Fiber Surface Area:                        | —                       | 7.65 m <sup>2</sup> /g         |

\*The temperature grade of Fiberfrax insulation is determined by irreversible linear change criteria, not product melting point. Test data shown are average results of tests conducted under standard procedures and are subject to variation. Results should not be used for specification purposes.



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Page 8 of 8

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