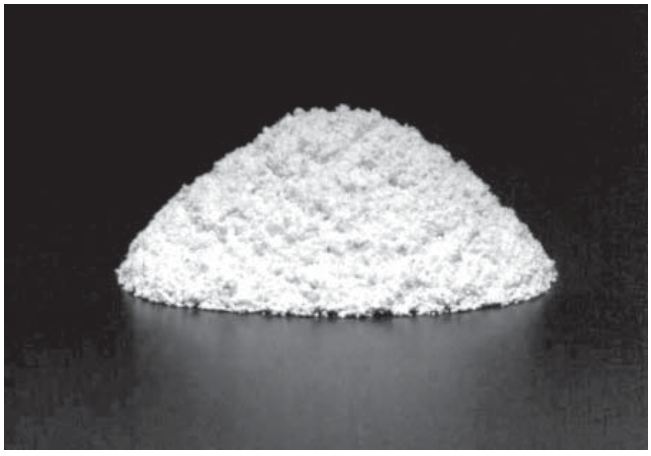
Fiberfrax® Ceramic Fiber



Introduction

Fiberfrax® ceramic fibers are a family of high-temperature fibers designed to be used in a variety of industrial and commercial applications. Manufactured from alumina-silica materials, Fiberfrax® fibers are chemically inert.

Some of the unique properties these fibers offer are:

- High-temperature stability
- Low thermal conductivity
- Low heat storage
- Excellent thermal shock resistance
- Lightweight

Fiberfrax® fibers are available in a variety of chemistries and diameters which can service a wide variety of applications. In addition, these fibers can be further modified by chopping or by removal of the unfiberized particles (called shot). Lubricants can also be added to the fiber to enhance fiber properties.

Fiberfrax® fibers exhibit excellent chemical stability and resistance to attack from most corrosive agents. Exceptions include hydrofluoric acid, phosphoric acid and strong alkalis. Fiberfrax® fibers also effectively resist oxidation and reduction. If wet by water or steam, thermal and physical properties are restored upon drying. Fiberfrax® fibers contain no water of hydration.

Fiberfrax Bulk Fibers

Fiberfrax® Bulk Fibers are manufactured to be used as feedstock in manufacturing processes or other applications where product consistency is critical. Manufactured on large, computer-controlled furnaces, these products provide customers with consistent material properties. Fiberfrax® Bulk Fibers are typically used in the manufacture of other ceramic fiber based product forms such as:

- High-temperature boards, felts, and papers
- Combustion chambers for commercial and residential boilers
- Riser sleeves for molten metal casting
- Fireplace logs and panels for gas fireplaces
- Tap out cones for molten metal applications
- Specialized vacuum-formed shapes

These bulk fibers can also be directly used as high temperature fill and packing material in a variety of high temperature applications, such as:

- Expansion joints
- Furnace base seals
- Tube seals
- Burner tile packing
- Chimney insulation

Fiberfrax® 6000 Series

Fiberfrax® 6000 Series fibers are manufactured from high-purity kaolin clay for use in applications up to 1260°C. Manufactured on large, computer-controlled furnaces, these products have consistent material properties to provide

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

customers with a fiber ideally suited for their application. Fiberfrax® 6000 Series fibers can also be chopped into several grades (coarse, medium, and fine) to provide an effective solution in many vacuum-forming and related applications.

Fiberfrax® 7000 Series Fiber

Fiberfrax® 7000 Series fibers are manufactured from high purity alumina-silica materials for use in applications up to 1260°C. These products are manufactured on computer-controlled, state-of-the-art furnaces to provide customers with consistent fiber properties. Fiberfrax® 7000 Series fibers can also be chopped into several grades (coarse, medium, and fine) to provide customers with a fiber ideally suited for their application. Benefits of Fiberfrax® 7000 Series fibers include:

- Low thermal shrinkage at high temperatures
- Consistent fiber properties
- Several chopped grades

Fiberfrax® 8000 Series Fiber

Fiberfrax® 8000 Series fibers are special insulation fiber manufactured from high purity alumina, zircon sand and silica materials for use in applications up to 1430°C.

Product Name	6000 Series	7000 Series	8000 Series	Insulfrax® Fiber
Color	White	White	White	White/Light Green
Melting Point	1760℃(3200°F)	1760℃(3200°F)	1760℃(3200°F)	> 1310℃(2390°F)
Temperature Grade	1260℃(2300°F)	1260℃(2300°F)	1430℃(2600°F)	1260℃(2300°F)
Recommended Operation Temperature(1)	1100℃(2012°F)	1176℃(2150°F)	1343℃(2450°F)	1100℃(2012°F)
Special Gravity	2.73g/cm^3	2.73g/cm^3	2.73g/cm^3	2.67g/cm^3

(1) The recommended operating temperature of Fiberfrax® Products is determined by irreversible linear change criteria, not melting point.

	6000 Series	7000 Series	8000 Series	Insulfrax® Fiber
Al_2O_3	43-52%	43-52%	29-31%	
SiO_2	46-57%	48-57%	53-55%	61-67%
ZrO_2			15-17%	
Fe_2O_3	<0.5%			
K_2O+Na_2O	<0.2%			
CaO				27-33%
MgO				2-7%

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

Computer-controlled furnacing technology at Unifrax allows for control of various product parameters. These parameters, such as diameter, settle volume(2) and fiber index(3), are critical to proper fiber selection. The following table details the product parameters for Fiberfrax® Bulk Fibers:

Typical Product Parameters

Fiber Class	Products	Chemistry	Chopping	Average Fiber Diameter	Fiber Index	Settle Volume
6000Series	6000-S1	Kaolin	N/A	2.5 to 3.5 microns	45-55%	N/A
	6000-S2	Kaolin	N/A	2.5 to 3.5 microns	45-55%	N/A
	6001-C-5	Kaolin	Coarse	1.5 to 2.5 microns	45-55%	500
	6001-M-5	Kaolin	Medium	1.5 to 2.5 microns	45-55%	300
	6001-F-5	Kaolin	Fine	1.5 to 2.5 microns	45-55%	150
	6000-B2	Kaolin	N/A	1.5 to 2.5 microns	45-55%	N/A
7000Series	7000-S1	High Purity	N/A	2 to 3.5 microns	45-55%	N/A
	7000-S2	High Purity	N/A	2 to 3.5 microns	45-55%	N/A
	7001-C-5	High Purity	Coarse	1.5 to 2.5 microns	45-55%	500
	7001-M-5	High Purity	Medium	1.5 to 2.5 microns	45-55%	300
	7001-F-5	High Purity	Fine	1.5 to 2.5 microns	45-55%	150
	7000-B2	High Purity	N/A	1.5 to 2.5 microns	45-55%	N/A
8000Series	8000-S2	AZS	N/A	2 to 3.5 microns	45-55%	N/A
	8000-B1	AZS2	N/A	1.5 to 2.5 microns	45-55%	N/A

(2) Settle Volume is a measurement used to indicate the physical dimensions (i.e., diameter, length) of a fiber. A larger number indicates the fiber has larger physical dimensions, such as diameter and/or length.

(3) Fiber Index is the percentage of fiberized material by weight in a fiber. Unfiberized material is called shot. (i.e., higher fiber index indicates a "cleaner" fiber). Fiber index is measured using the conical elutriation method. For questions regarding this testing, please contact Unifrax at 716-278-3800(U.S.A) or 86-21-5046-4566(Shanghai, China).

(4) B1 is blown fiber without lubricants. B2 is blown fiber with lubricants. S1 is spun fiber without lubricants. S2 is spun fiber with lubricants 6000, 7000 Series are not chopped, 6001,7001 series are chopped filer

Fiberfrax® Specialty Fibers

In addition to Fiberfrax® Bulk Fibers, Unifrax Corporation has the ability to produce many different specialty fibers that provide a variety of desirable performance properties for certain applications. These fibers can be classified into the following general categories:

- High-Index Fibers
- Large-Diameter Fibers
- Milled Fibers

High-Index Fibers

Fiber index is a measurement which determines the amount of fiberized material in the actual fiber. During fiber manufacturing, shot or unfiberized material is produced as a natural product of the fiberization process. Unifrax Corporation has the ability to reduce the amount of shot in a fiber by controlling the furnacing process or by washing out the unfiberized material. Unifrax offers several high index fibers ranging in fiber index from 68% up 95+%.

Fiberfrax® High-Index Fibers have proven to be a good reinforcement material for use in automotive brake lining and other friction materials. These high-index fibers provide a variety of desirable properties such as:

- Frictional stability
- High-temperature frictional performance
- Fade resistance
- Flexural reinforcement

Fiberfrax® High-Index fibers can also be used as a mechanical thixotrope in coatings applications offering reinforcement and fire resistance as additional benefits. These fibers offer the following unique properties:

- Excellent high-temperature stability
- Good strength and high modulus
- Low coefficient of thermal expansion
- Superior chemical resistance
- Very low moisture absorption

The thixotropic properties of Fiberfrax® High-Index Fibers in conjunction with the mechanical and physical properties they have to offer make them an excellent candidate for use in:

- Mastics
- Adhesives
- Thick Film Coatings
- Fire Protective Materials
- Caulks, Putties, and Sealants

Fiberfrax® Large-Diameter Fibers

Unifrax has the ability to control the average fiber diameter of fibers through a unique spinning operation. It is this spinning operation that is used to produce both the Fiberfrax® Spun Fiber and Long Staple Fibers. Average fiber diameters for these fibers range from 3 to 12 microns as detailed on the table below. These larger-diameter fibers provide certain desirable properties, such as:

- Excellent resistance to mechanical stress and vibration
- Reduced processing time in vacuum-forming operations
- Ability to produce lower-density vacuum-formed products

Fiberfrax® Milled Fibers

Fiberfrax® Milled Fibers are ball milled from Regular Fiberfrax® Fibers to reduce fiber length, thus increasing the flow ability and facilitating its dispersion in a matrix, such as resins or refractory cement compositions. Fiberfrax® Milled Fibers can also be used as a compact filler insulation. These milled fibers can be used as a functional additive in a variety of coatings and composites to provide the following benefits:

- Superior wear resistance
- Improved corrosion resistance
- Provides reinforcement and excellent compressive strength

Specialty Fibers Typical Product Parameters

Fiber Class	Products	Chemistry	Chopping	Average Fiber Diameter	Fiber Index
High-Index Fibers	Washed 657	High Purity	N/A	1 to 2.5 microns	70
	Washed 707	High Purity	N/A	1 to 2.5 microns	75
	Washed 757	High Purity	N/A	1 to 2.5 microns	80
	HS70	High Purity	N/A	1 to 2 microns	68
	HS70C	High Purity	Fine	1 to 2 microns	68
	HS95	High Purity	N/A	1 to 2.5 microns	95
	HS95C	High Purity		1 to 2.5 microns	95
	HAS-HP	High Purity	N/A	0.75 to 1.5 microns	95+
	HAS-K	Kaolin	N/A	0.75 to 1.5 microns	95+
Large-Diameter Fibers	Long Staple Fine	AZS	N/A	4 to 8 microns	N/A
	Long Staple Medium	AZS	N/A	8 to 12 microns	N/A
	Spun	High Purity	N/A	3 to 5 microns	50
Milled Fibers	8000-S2	AZS	N/A	1 to 2 microns	50

For additional information about product performance or any suggestion for product application, please contact the Unifrax Application Engineering Group at 716-278-3888 or 86-21-50464566.