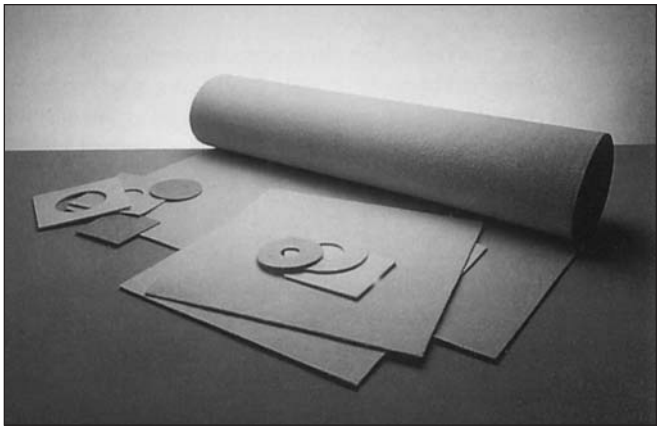
Fiberfrax® Ceramic Fiber Paper



Introduction

The Fiberfrax® ceramic fiber paper product line is a unique family of products which is manufactured by forming alumino-silicate fibers in a nonwoven matrix. The ceramic fibers are randomly orientated during manufacture, then held in place with a latex binder system. A specialized paper-making process is statistically controlled to form uniform, lightweight, flexible sheets.

Unifrax Corporation has been producing Fiberfrax papers for over 25 years and is the largest ceramic fiber producer worldwide with in-house paper-making capabilities.

By blending different fibers, binders, and additives while varying the manufacturing process, Unifrax Corporation now produces a variety of Fiberfrax paper products for a wide range of applications.

Fiberfrax papers exhibit excellent chemical stability, resisting attack from most corrosive agents. Exceptions are hydrofluoric, phosphoric acids and concentrated alkalies. If Fiberfrax papers are wet by water or steam, all thermal and physical properties are completely restored upon drying. No water of hydration is present in most Fiberfrax paper grades. Fiberfrax papers have good dielectric strengths.

Fiberfrax papers, with the exception of the inorganic series, will generate small amounts of smoke and trace element outgassing during the initial exposure to temperatures above 450°F.

Product Line Advantages

Fiberfrax ceramic fiber papers offer our customers many unique problem-solving advantages which include:

- High-temperature stability
- Low thermal conductivity
- Low heat storage
- Weight reduction
- Resiliency
- Thermal shock resistance
- High heat reflectance
- Good dielectric strength
- Excellent corrosion resistance
- Easy to wrap, shape, or cut
- Ease of fabrication

General Uses of Fiberfrax Papers

Fiberfrax papers are used to solve a wide variety of heat-related problems, and are used as:

- Highly efficient refractory backup
- Dependable fire protection
- Thermal insulation
- Hot gas filtration media
- Molten metal splash and spark protection
- High-temperature gasket, separator, or parting agent

Typical Markets/Applications

Based on the uses listed in the preceding text, Fiberfrax papers solve a range of application problems in the industries listed below:

Aerospace

- Heat shields
- Nose cone ablative shields
- Igniter line protection
- Oxygen generators

Appliance

- Self-cleaning ovens
- Woodburning stoves
- Electrical heaters
- Mobile home appliance insulation

Ceramic and Glass

- Ware separator
- Metal clad brick gaskets
- Glass tank refractory backup

Petrochemical

- Transfer line protection
- Welding
- Brazing protection

Automotive

- Muffler insulation
- Heat shielding

Steel and Nonferrous

- Investment casting mold wrapping
- Ladle refractory backup
- Thermocouple tube protection
- Heat treating parting agent
- Foundry gasketing
- Ladle shroud wrap

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

Product Range

Product Segmentation

Fiberfrax ceramic fiber papers are differentiated by thickness, density, fiber index, and chemistry. They are often segmented into three groups:

- Utility grades, which include 440 and Rollboard paper, are the most cost-effective products in applications where performance characteristics are less critical.
- Standard grades: 550, 970, 880, and 110 paper are used where reliability and consistency are important.
- Premium grades: 882-H, 972-H, and HSA paper are used either when organic outgassing cannot be tolerated or when thermal performance is critical.

Utility Grade

440 Paper

440 paper is a low-cost, high-strength composite paper made from a combination of ceramic fiber, inert fillers, and reinforcing fiberglass. The fiberglass gives added strength to the 440 paper at operating temperatures between 450 and 1300°F. This product is formulated with a fire retardant smoke suppressant reducing the effects of the organic binder burnout.

Rollboard

The lower density, binder chemistry, and bulk ceramic fiber grade used to manufacture Fiberfrax Rollboard paper result in a product with lower cost, higher flexibility, and reduced smoke and odor during burnout. Rollboard paper is best suited for wrapping intricate shapes or molds and as a standard grade single use product in disposable applications.

Standard Grade

110 Paper

110 paper is a clay-filled, sheeted ceramic fiber paper which is denser and more rigid than other standard grade products. The rigidity is maintained even after burnout of the organic bonding agents. The good dielectric strength, compression resistance, and die cutting characteristics of 110 paper are advantageous in many high-temperature gasketing applications.

550 Paper

550 paper is made from unwashed high-purity ceramic fiber. Its higher density and binders give performance properties ideal for most refractory applications.

970 Paper

970 paper is made from high-purity Fiberfrax washed fiber. During the manufacture of this product, a large portion of the unfiberized particles in the bulk fiber are removed prior to paper lay-up. The washing of the fiber gives great uniformity to the paper's structure while reducing weight and improving the thermal performance; in addition, this product is preferred in automatic die stamping operations where unfiberized particles in the paper can lead to excessive die wear.

Premium Grade

880 Paper

880 paper is made from a higher alumina content, shorter, smaller diameter fiber and laid up at higher densities. These product parameters lead to reduced shrinkage, higher strength, an increased operating temperature range and better chemical resistivity. This product is used in applications where the service life of standard ceramic fiber papers is reduced.

HSA Paper

HSA paper is made from high surface area (HSA) fibers that contain a low percentage of unfiberized material. Use of this fiber results in a paper with lighter weight and extremely low thermal conductivity, making it the choice of the aerospace industry. It is also used when uniform pore structure and a low content of unfiberized material are required in applications such as glass contact or gas filtration.

Inorganic Papers

Fiberfrax papers are available without the organic binder system. These products are completely free of organics and used when higher fired strength is required or in processes and applications where even small amounts of organic burnout is unacceptable. Two temperature grades and several thicknesses and widths are available.

- **972-H** is heat treated during the manufacturing process to remove organic binders. As manufactured, 972-H paper remains soft and flexible allowing it to conform to most shapes or contours.
- **882-H** has higher temperature stability and higher density than 972-H Paper. The fiber geometry and product density lead to the maximum burn strength of an unbindered paper.

Certifications/Approvals

Fiberfrax papers have been independently tested for conformance to a wide variety of industry standards. For example, several Fiberfrax papers are listed as "Recognized Components" with Underwriters Laboratories, Inc.; conform to U.S. Coast Guard requirements for incombustible materials; and are tested in accordance with ASTM methods. For details of existing approvals and test procedures, contact the Unifrax Application Engineering Group at 716-278-3888.

Additional Capabilities

Unifrax has several manufacturing capabilities which can enhance the performance of Fiberfrax papers in a wide variety of applications. Utilizing precision high-speed slitters, Unifrax can slit paper materials down to one-inch (1") widths for installation speed and convenience. Material can be laminated, foil faced or adhesive backed to tailor the material form to specific application requirements.

Fiberfrax Ceramic Fiber Papers
Typical Product Properties

Paper Grade		440*	Roll Board	110	550	970	880	HSA	972-H	882-H	HSA** (OF)
Physical Properties											
Color		Gray	Off-White	Tan	White	White	White	White	White	White	White
Temperature Grade	°F	1600	2300	2300	2300	2300	2600	2300	2300	2600	2300
	°C	870	1260	1260	1260	1260	1427	1260	1260	1427	1260
Recommended Operating Temp.	°F	1300	2000	1900	2000	2000	2100	2000	2000	2100	2000
	°C	704	1100	1040	1100	1100	1150	1100	1100	1150	1100
Melting Point	°F	1800	3200	2800	3260	3260	3500	3100	3260	3500	3100
	°C	982	1760	1538	1793	1793	1927	1704	1793	1927	1704
Compression (PSI % Deformation)											
10%		5	1	4	1	1.3	3	—	—	—	—
25%		34	5	26	6	5.8	16	—	—	—	—
50%		489	32	167	35	22	44	—	—	—	—
Strength											
Tensile (PSI) (as manufactured)		86	58	147	102	94	136	55	—	—	—
Burst (PSI) (as manufactured)		45	22	248	19	25	37	—	—	—	—

Notes About Chart

*The 440 paper contains a fire retardant smoke suppressant.

**The HSA "OF" designation signifies materials made without the use of organic binders.

- "H" designation references the heat treating process used to remove organics.
- The recommended operating temperature of Fiberfrax insulation is determined by a maximum irreversible linear change criteria, not product melting point.

The 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.

Fiberfrax Ceramic Fiber Papers
Typical Product Parameters

Paper Grade	440*	Roll Board	110	550	970	880	HSA	972-H	882-H	HSA** (OF)
Physical Properties										
Density (pcf)	13	10	18	12	10	18	10	12	16	7
Fiber Index (% Wt)	n/a	40	n/a	50	70	45	100	70	45	100
LOI (incl. binder)	9.5	3.0	8.5	6.5	7.0	8.0	3.0	0.1	0.1	0.1
Chemistry (% Wt)										
Al_2O_3	32-35	47-52	45-50	47-52	47-52	58-60	47-52	47-52	58-60	47-52
SiO_2	42-46	48-53	40-44	48-53	48-53	40-42	47-52	48-53	40-42	47-52
Na_2O_3	<2	<0.5	<1.5	<0.5	<0.5	<0.3	<0.5	<0.5	<0.3	<0.5
Fe_2O_3	<2	<0.5	<1.1	<0.5	<0.5	<0.1	<0.05	<0.5	<0.1	<0.05
Thickness inches* (mm)**										
A = 1/32 (0.8)					X			X		
F = 1/16 (1.6)	X		X	X	X	X	X	X	X	
J = 1/8 (3.2)	X	X	X	X	X	X		X	X	X
K = 1/4 (6.35)				X						
Roll Sizes (std)	25#, Mill	Mill	Sheet	25#, Mill	10#, 25#, Mill	25#, Mill	Sheets	25#	10#, 25#	500sf
Width (std, inches)	24, 48	18, 24	42x48	24, 48	12, 24, 48	12, 24, 48	42x48	12, 24	12, 24	51

Availability
Nonstandard widths available upon request.

Notes About Chart
*The 440 paper contains a fire retardant smoke suppressant.

**The HSA "OF" designation signifies materials made without the use of organic binders.

***Measured under 4 PSF.

"H" designation references the heat-treating process used to remove organics.

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.

Data 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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