

## Excelfrax® Microporous Insulation

### Introduction

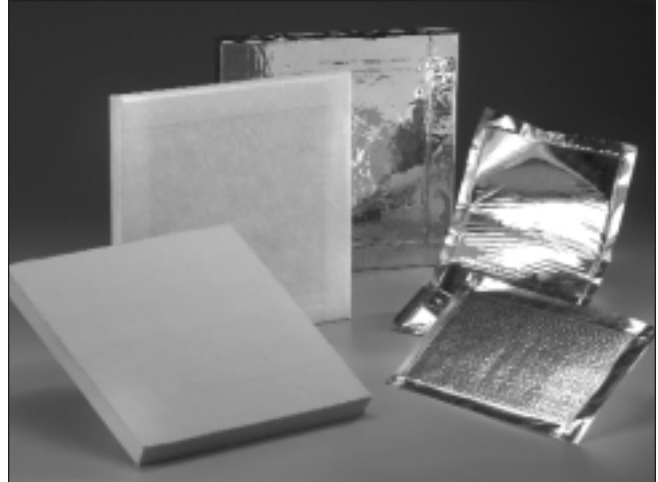
Unifrax Corporation's Excelfrax® product line, based on advanced microporous insulation technology, is a family of products which all exhibit superior insulating characteristics. Excelfrax microporous insulation is composed of inorganic oxides, primarily fumed silica. Silicates and opacifiers are added to improve the material performance.

Microporous materials are very efficient insulation products. These products actually have thermal conductivity values lower than still air. This performance is based on the ability of microporous insulation to block the three modes of heat transfer (i.e., conduction, convection, and radiation).

**Conduction:** Due to the product's low density and the porous structure of Excelfrax on the microscopic level, heat transfer due to conduction is reduced. This microporous structure minimizes the contact points between the molecules, which results in reduced energy transfer from one molecule to another.

**Convection:** Since solid materials have a much higher thermal conductivity than still air, typical insulation materials are designed to trap air in small spaces, reducing heat transfer. Movement of the air, due to convection currents within insulation series, transmits heat through the material. In Excelfrax microporous insulation, the microporous structure of the material results in trapped air pockets smaller than the mean free path of air. Due to this material structure, molecular "collisions" which transfer heat from one surface to another are avoided.

**Radiation:** Excelfrax microporous insulation incorporates opacifiers, which are specifically designed to reduce the heat transfer due to radiation.



### General Characteristics

The Excelfrax product line offers users a number of important advantages:

- Extremely low thermal conductivity saves space, weight and energy.
  - Increases capacity of ladles, kilns, industrial ovens and commercial appliances while maintaining thermal performance.
  - Reduces weight while maintaining thermal performance. This weight reduction can reduce structural requirements for furnaces and other high-temperature vessels.
  - Saves energy and reduces operating costs by reducing heat loss in conventional refractory linings.
- Thermal stability – Excelfrax microporous insulation products are designed to withstand continuous operating temperatures up to 1832°F.
- Consistent operating temperatures – Due to the superior insulating characteristics of Excelfrax, processes may be easier to regulate and control, which often results in a more consistent final product.
- Easy to fabricate – Excelfrax insulation can be fabricated with commonly available tools.

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

## Product Forms

Excelfrax products are available in several product forms to solve a range of thermal insulation problems.

- Excelfrax 1800 Board – A rigid material with comparatively high density, compression resistance and strength. It is available in thicknesses up to 50 mm (2").
- Excelfrax 1800 Flexliner – A thin material with good compression resistance, which is vacuum sealed in a laminated PA/PE film to allow maximum flexibility. It is available in thicknesses up to 10 mm (0.4").

## Typical Product Properties

|  | Excelfrax 1800 Board                | Excelfrax 1800 Flexliner*           |
|--|-------------------------------------|-------------------------------------|
| Color  | Grey                                | Silver                              |
| Recommended Operating Temperature  | Room Temperature to 1000°C (1832°F) | Room Temperature to 1000°C (1832°F) |
| Specific Heat J/Kg°C (BTU/Lb°F) (RT to 800°C (1472°F))                         | 800 (0.19)                          | 800 (0.19)                          |
| Compression at 1 bar   | 2.9%                                | 3.7%                                |
| Shrinkage – Single sided (12 hour, 1000°C (1832°F))                            | 0.5%                                | 0.6%                                |
| Shrinkage – All sides, long term   |                                     |                                     |
| 50°C (122°F)   | —                                   | —                                   |
| 100°C (212°F)  | —                                   | —                                   |
| 800°C (1472°F)   | 1.0%                                | —                                   |
| 950°C (1742°F)   | —                                   | 1.9%                                |
| 1000°C (1832°F)  | 4.8%                                | 4.8%                                |
| Thermal Conductivity (DIN 51046) W/mK (Btu-in/hr ft²°F) At mean temperature of |                                     |                                     |
| 20°C (68°F)  | 0.019 (0.132)                       | 0.021 (0.145)                       |
| 200°C (392°F)  | 0.021 (0.145)                       | 0.023 (0.159)                       |
| 400°C (752°F)  | 0.025 (0.173)                       | 0.028 (0.194)                       |
| 600°C (1112°F)   | 0.030 (0.208)                       | 0.034 (0.236)                       |
| 800°C (1472°F)   | 0.038 (0.263)                       | 0.042 (0.291)                       |
| Cold Crushing Strength (N/mm²) (DIN 51067/DIN 53421)                           | 1.1                                 | 1.3                                 |

\*Data based on core material

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.

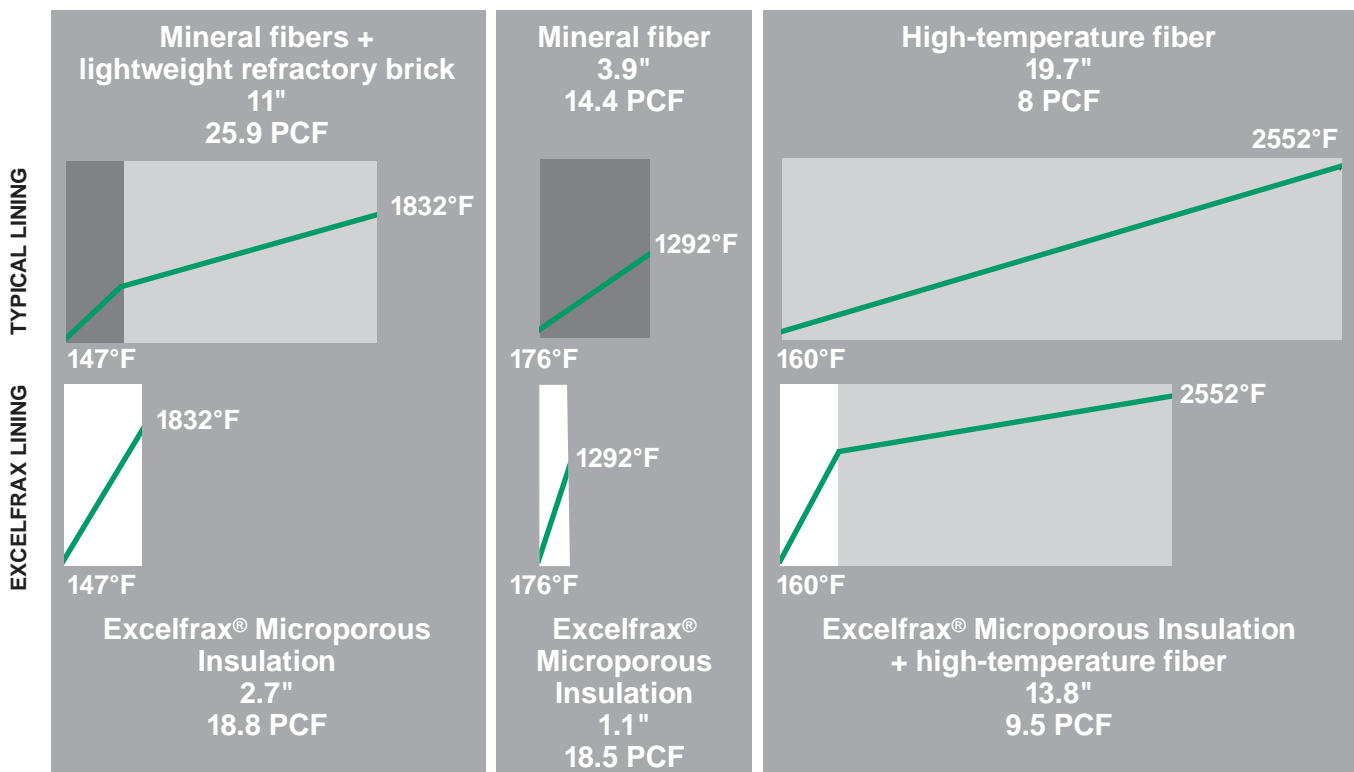


## Typical Product Parameters

|                                 | Excelfrax 1800 Board                    | Excelfrax 1800 Flexliner*  |
|---------------------------------|---|----------------------------|
| Density kg/m <sup>3</sup> (pcf) | 230 (14.4)                              | 365 (22.8)                 |
| Chemical Composition            |   |                            |
| SiO <sub>2</sub>                | 80%                                     | 50%                        |
| SiC                             | 15%                                     | —                          |
| ZrSiO <sub>4</sub>              | —                                       | 45%                        |
| Others                          | 5%                                      | 5%                         |
| Standard Thicknesses            |   |                            |
| mm                              | 12.5, 25, 37.5, 50                      | 3, 7, 10                   |
| in                              | 0.5, 1.0, 1.5, 2.0                      | 0.12, 0.28, 0.39           |
| Standard Panel Sizes            |   |                            |
| mm                              | 650 x 1000<br>1000 x 1320               | 500 x 500<br>500 x 1000    |
| in                              | 25.6 x 39.4<br>39.4 x 52.0              | 19.7 x 19.7<br>19.7 x 39.4 |
| Covering/Edge Protection        | Glass fiber or aluminum foil (optional) | Laminated PA/PE film       |

\*Data based on core material

## Excelfrax Reduces Lining Thickness



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## Other Product Properties

- Resistance to Thermal Shock – Excelfrax is resistant to thermal shock caused by both low and high temperatures.
- Non-Combustibility – Excelfrax is completely non-combustible per German standard DIN 4102 Class A1.
- Wetting – Wetting agents such as water, liquid detergents, oil, petroleum, alcohol, etc. can have an adverse effect on Excelfrax since these liquids can destroy the microporous structure of the product. This can be greatly reduced or eliminated by encapsulating Excelfrax in a barrier material such as polyethylene or aluminum foil.
- Storage – Excelfrax can be stored indefinitely and should be handled and stored in liquid-free conditions. Moist air or steam does not adversely affect the stability of Excelfrax.

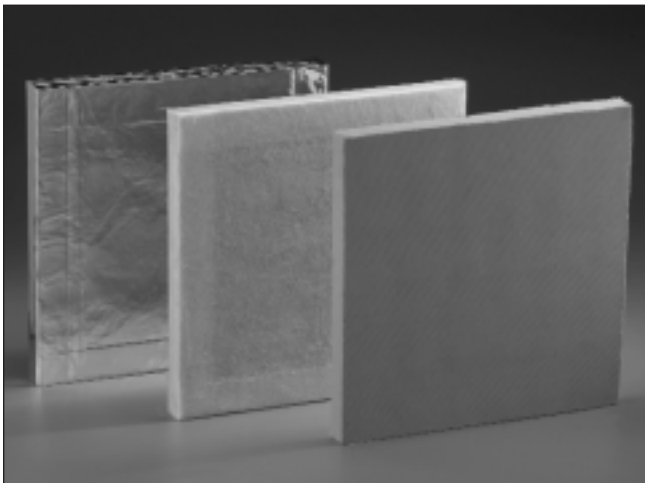
## Excelfrax 1800 Board

Excelfrax 1800 Board is a high-temperature, rigid, microporous material specifically designed for applications where a strong, highly efficient insulating material is required. Excelfrax 1800 Board is available in thicknesses up to 2" and can be field fabricated to meet specific application requirements. In order to protect the material from wetting agents and to aid in handleability, Excelfrax 1800 Board is available with several covering options:

- No covering
- Edge protection with glass scrim
- Full encapsulation with glass scrim or aluminum foil

A partial list of the typical applications for Excelfrax 1800 Board is provided below:

- Back-up insulation in high-temperature furnaces
  - Steel
  - Glass
  - Ceramic
  - Aluminum
- Aluminum launders
- Aluminum transfer ladles



- Electric thermal storage heaters
- Laboratory kilns and heating units
- Fuel cell insulation
- Appliances

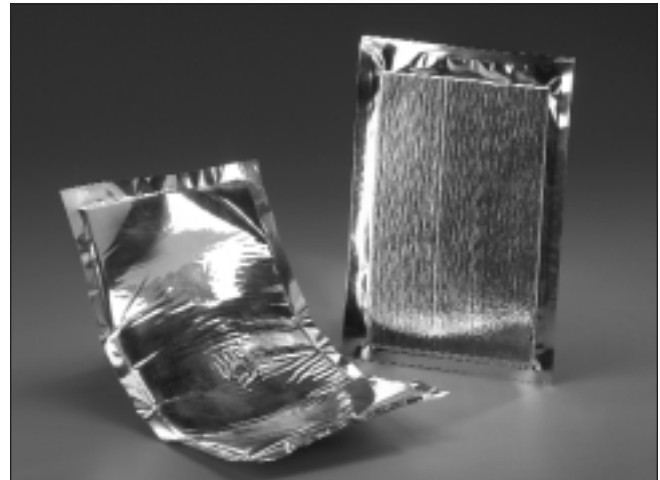
## Excelfrax 1800 Flexliner

Excelfrax 1800 Flexliner is a flexible, thin, microporous insulating panel with superior insulating characteristics. Excelfrax 1800 Flexliner is designed for use between the ladle shell and backup lining. This product can be used to provide maximum thermal efficiency in ladle liner design. By incorporating Excelfrax 1800 Flexliner into a lining design, it is possible to:

- Reduce ladle heat loss without decreasing ladle capacity
- Increase ladle capacity by reducing required thickness of insulating materials
- Minimize the amount of solidified metal in the ladle after the casting process is complete

Typical applications for Excelfrax 1800 Flexliner are listed below:

- Transfer ladles
- Torpedo ladles
- Tundish insulation



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.

