# BASALT FIBER INTRODUCTION

### 1.1 Basalt Fiber Overview

A new type of environmental protection fiber in the 21st century - filtration, adsorption and purification of harmful media and gases in the field of environmental protection, especially in the field of high temperature filtration, the long-term use temperature of basalt fiber is 650 ° C, which is far superior to traditional filter materials. , filter material, the preferred material for high temperature resistance.

In addition, basalt fiber is a low-cost substitute for carbon fiber and has a series of excellent properties. Most importantly, because it is derived from natural ore without any additives, it is the only green and healthy glass fiber product that is non-environmentally polluting and non-carcinogenic. Therefore, the application of basalt fiber in the field of reinforcement of composite materials has attracted extensive attention and will develop rapidly.

### 1.2.1 The Main Performance Index of Basalt Fiber

| Performance | | Valve |
|---|---|---|
| Thermophysical Properties | | |
| Operating Temperature ℃ | | -269~650℃ |
| Bonding Temperature ℃ | | 1050℃ |
| Thermal Conductivity w/m.°K | | 0.03~0.038 |
| Physical Properties | | |
| Monofilament Diameter **(μm)** | | 7~15 |
| Density (g/cm³) | | 2.63~2.65 |
| E-Modulus (GPa) | | 91~110 |
| Tensile Strength (MPa) | | 3000~4800 |
| Tensile Strength under Heat Treatment % | 20℃ | 100 |
| | 200℃ | 95 |
| | 400℃ | 82 |
| Chemical Stability (weight loss at 3 hours boiling) | | |
| 2N HCL | | 2.2 |
| 2N NaOH | | 2.75 |
| $H_2O$ | | 0.2 |
| Electrical Properties | | |
| Specific Capacity Resistance Ω.M | | 1*1012 |
| Dielectric Loss Tangent (at frequency 1M Gs) | | 0.005 |
| Permittivity (at frequency 1M Gs) | | 2.2 |
| Acoustic Performance | | |
| Sound Absorption Coefficient | | 0.9~0.99 |

### 1.2.2 Basalt Fiber's Excellent Mechanical Properties

a. The tensile strength of basalt fiber is 2800~3800MPa;
b. The tensile strength of basalt fiber is 2~2.5 times that of metal;
c. Basalt fiber can increase the tensile strength by 30% at 100~250°C, while glass fiber can decrease by 23%;
d. Basalt fiber can also maintain high strength under the action of hot water. For example, under the action of hot water at 70°C, glass fiber will lose its strength in less than 200 hours, while the strength of basalt fiber can be maintained for 1200 hours.

**Comparative Properties of Basalt Fibers and Other Fibers**

| Performance | Basalt Fiber | E-Glass Glass Fiber | S-Glass Glass Fiber | Carbon Fiber | Aramid Fiber |
|---|---|---|---|---|---|
| Density (g/cm³) | 2.63~2.65 | 2.54~2.57 | 2.54 | 1.78 | 1.45 |
| Tensile Strength(MPa) | 3000~4800 | 3100~3800 | 4020~4650 | 3500~6000 | 2900~3400 |
| E-Modulus (GPa) | 91~110 | 72.5~75.5 | 83~86 | 230~600 | 70~140 |
| Elongation at Break (%) | 1.5~3.2 | 4.7 | 5.3 | 1.5~2.0 | 2.8~3.6 |
| Working Temperature(℃) | 650 | 380 | 300 | 500 | 250 |

### 1.2.3 Basalt Fiber's Outstanding Thermal Performance

a. The operating temperature range of basalt fiber is -269~650℃;
b. Working at 400°C, the breaking strength can maintain 85%; working at 600°C, the breaking strength can keep 80%;
c. Pre-treated at 780~820°C, the fiber will not shrink when working at 860°C, and even mineral wool with excellent temperature resistance can only maintain 50%~60% of its strength at this time, and glass wool is completely destroyed .

**Basalt Fiber Thermal Stability Data**

| Temperature Retention% / Test Strength (kg/mm²) | 300℃ | 400℃ | 500℃ | 600℃ | 700℃ |
|---|---|---|---|---|---|
| 234 | 98.7 | 88.7 | 58.9 | 38.4 | 25 |
| 240 | 99 | 89 | 61 | 39 | 27 |
| 250 | 100 | 90 | 65 | 38.8 | 28.9 |

### 1.2.4 Basalt Fiber's Stable Chemical Properties

a. Basalt fiber has high corrosion resistance and high chemical stability in corrosive media (acid, alkali, salt solution);
b. Basalt fibers can maintain higher alkali corrosion resistance in saturated alkaline solutions and alkaline media such as cement;
c. Basalt fiber is compatible with inorganic binders;
d. The temperature absorption of basalt fiber is less than 1. Compared with glass fiber, the temperature absorption rate of basalt fiber is 6~8 times lower, and its absorption capacity does not change with time, which ensures its material stability during use , long life and environmental compatibility.

**Table1: Chemical Compositionof Basalt Fiber**

| Chemical Composition | Mass Percentage |
|---|---|
| $SiO_2$ | 52~58 |
| $Al_2O_3$ | 14~19 |
| CaO | 5~9 |
| MgO | 3~6 |
| $Na_2O+K_2O$ | 3~6 |
| $TiO_2$ | 0.5~2.5 |
| $Fe_2O_3+FeO$ | 9.0~14.0 |
| Others | 0.09~0.13 |

Note: Fibers made of different chemical componets have different strengths and physical and chemical properties.

**Table2: Comparison of Fiber Mass Fraction Loss between Basalt Fiber and E-GLASS Fiber after Boiling for 3 hours**

| Fiber Properties | Heat Absorption Rate% | Mass Loss after Boiling in Medium for 3 hours | | |
|---|---|---|---|---|
| | | $H_2O$ | 2N NaOH | 2N HCL |
| Basalt Fiber | ＜1 | 0.2 | 2.75 | 2.2 |
| E-GLASS Fiber | 10~20 | 0.7 | 6 | 38.9 |

## 1.3 Basalt Fiber's Physical Properties

Basalt fiber has a series of superior properties.

(1) The naturalness of raw materials.
Since the raw material for the production of basalt chopped red dimension is taken from natural volcanic extrusive rocks, besides its inherent high chemical stability and thermal stability, there are no ingredients harmful to human health.

(2) Comprehensive performance.
Basalt fiber is a veritable "multifunctional" fiber. For example, it is resistant to acid and alkali, low temperature and high temperature (-269~650°C), thermal insulation and sound insulation, its tensile strength exceeds that of large tow carbon fiber, and its elongation at break is better than that of small tow carbon fiber: The surface polarity of basalt chopped fibers has excellent interfacial wettability when compounded with resin, and basalt chopped fibers have three-dimensional molecular dimensions, which are higher than linear polymer fibers with one-dimensional molecular dimensions. Excellent comprehensive properties such as compressive strength, shear strength, adaptability to use in harsh environments, and aging resistance.

(3) Low cost.
The price of basalt fiber used in cement mud is not high, and it is a very competitive substitute product for polypropylene fiber and polypropylene fiber.

(4) Natural compatibility.
Basalt fiber is a typical silicate fiber. It is easy to disperse when mixed with cement concrete and mortar. The freshly mixed basalt fiber mud concrete has stable volume, good workability and durability, and has excellent durability. Temperature resistance, anti-seepage crack resistance and impact resistance.