

SikaFiber® PRODUCT TECHNOLOGY

FIBER TYPE

The first step to choosing the right fiber is to understand the type of fiber required for your application. The main standards for fiber reinforced concrete are ASTM C 1116 and EN14889. ASTM C 1116, Standard Specification for Fiber Reinforced Concrete, outlines four (4) classifications of fiber reinforced concrete;

- Type I – Steel fiber-reinforced concrete or shotcrete (ASTM A820)
- Type II – Glass fiber-reinforced concrete or shotcrete (ASTM C1666)
- Type III – Synthetic fiber-reinforced concrete or shotcrete (Polypropylene ASTM D7508)
- Type IV – Natural Fiber-reinforced concrete or shotcrete (ASTM D7357)

FIBER REINFORCED CONCRETE

Micro fibers have a diameter that is less than 0.3 mm. Micro fibers are either monofilament or fibrillated. Micro fibers should be used for plastic shrinkage control (cracking that can occur in the first 24 hours of concrete cure), impact protection, and reduction of explosive

spalling during a fire. The fibrillated micro fibers are often used in replacement of the lightest welded wire fiber (6x6 W1.4/W1.4) for temperature and shrinkage characteristics.

Structural macro fibers have a diameter greater than 0.3 mm. Macro fibers are used as a replacement for temperature and shrinkage reinforcement (WWF) or as structural reinforcement in concrete or shotcrete. Macro fibers are used where an increase in residual (post-cracking) flexural strength is required (ASTM C1609 or EN14845).

FIBER PERFORMANCE

Macro fiber performance is influenced by three characteristics; tensile strength, aspect ratio (calculated as the length/diameter) and anchorage (hooked, crimp, emboss, fibrillation, etc.). One characteristic does not outweigh another; all three items have to work together for optimal performance. Fiber reinforced concrete is a composite material and therefore, all fibers are tested in the concrete to prove their performance.

Steel fibers may be collated (glued) together in a clip. The collation of the fibers does not improve performance of the fiber reinforced concrete. Collated fibers improve the ease of mixing of high aspect ratio fibers. Collated fibers are added to the concrete mix, the bundles are spread throughout the concrete. Continued mixing action breaks apart the clips to let the individual fibers separate quickly throughout the mix. In the same vein, synthetic macro fibers can be in a wrapped bundle or puck. The fiber wrapping is degradable and will disperse during mixing.

Fibers begin to function in a structural supportive manner when the concrete matrix starts to crack, just like traditional reinforcement. The crack has to occur for the load to switch from the concrete to the reinforcement. The fibers then provide ductility and support by bridging cracks and thus providing post crack strength to the concrete.



BEST USE OF THE DIFFERENT TYPES OF FIBERS

| State of concrete or mortar | Effect / property improvement | Recommended fiber type |
|-----------------------------|---|---------------------------|
| Fresh | Reduce Rebound of Shotcrete | Micro-PP fibers |
| Fresh | Homogeneity improvement | Micro-PP fibers |
| Up to 24 Hours | Early-age cracking reduction | Micro and Macro-PP fibers |
| 28 days hardening or more | Improvement of explosive spalling | Micro-PP fibers |
| 1-2 days | Reduction of cracks induced by restraint or temperature | Micro & Macro-PP fibers |
| 28 days hardening or more | Transmission of external forces | Macro-PP & Steel fibers |

PP = Polypropylene Synthetic Fibers

SIKA FULL RANGE SOLUTIONS FOR CONSTRUCTION:



WATERPROOFING



CONCRETE



REFURBISHMENT



SEALING AND BONDING



FLOORING



ROOFING

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The sale of all Sika products are subject to the following Limited Warranty:

LIMITED MATERIAL WARRANTY

SIKA warrants this product for one year from date of installation to be free from manufacturing defects and to meet the technical properties on the current Product Data Sheet if used as directed within shelf life. User determines suitability of product for intended use and assumes all risks. Buyer's sole remedy shall be limited to the purchase price or replacement of product exclusive of labor or cost of labor.

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Our most current General Sales Conditions shall apply.
Please consult the Product Data Sheets prior to any use and processing.

FOR ASSISTANCE WITH FIBERS: 1.833.236.1255 | sikafibers@us.sika.com

CONTACT SIKA: 1.800.933.7452 | usa.sika.com

SIKA CORPORATION
4019 Industry Drive
Chattanooga, TN 37416

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CONCRETE SikaFiber® PRODUCT GUIDE



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SikaFiber® PRODUCT TECHNOLOGY



Fibers are an ideal ingredient for use in concrete and mortars as a method for improving these materials where they may otherwise have weaknesses. Micro concrete fibers can reduce plastic shrinkage cracking, settlement cracking, and improve explosive fire spalling resistance. Macro concrete fibers reduce shrinkage crack formation and crack widths whilst also increasing performance in energy absorption and toughness. Additional benefits such as reduction or elimination of reinforcing steel and increased durability can also be seen. In addition, the use of fiber reinforced concrete, over rebar and wire mesh, leads to faster and safer concrete installations.

Fiber Reinforced Concrete (FRC) is not a new concept. Since biblical times fibers were used in cementitious construction materials in the form

of straw and horse hair. Today, there is a large variety of fiber options for reinforcing concrete, such as micro and macro synthetic fibers, steel fibers and fiber blends. With so many options it can be difficult to determine exactly what fiber is required for a given application. Examples of common applications utilizing FRC include ground-supported slabs, composite metal decks, mat slabs, pavements, bridge decks, tunnel segments, shotcrete and various precast applications.

In 2018, Sika® acquired the global Concrete Fibers business from Propex Holding, LLC, which included a US plant manufacturing synthetic fibers for use in concrete reinforcement, sales operations across Sika's geographical regions, and Fibermesh®, a strong brand in FRC. The acquired business was the perfect addition to

Sika's concrete admixture product lines making Sika® a true single source supplier for all ready mix and precast concrete applications. With the addition of Fibermesh®, Novomesh®, Novocon®, and Enduro® to Sika's product portfolio, Sika® can better supply the needs of concrete customers, engineers, general contractors, owners, and architects.

KEY FRC BENEFITS

- Reduced incidence of early age plastic shrinkage cracking
- Improved load capacity and ductility
- Protection against freeze-thaw cycles
- Better cohesion in the fresh concrete
- Increased abrasion resistance
- Higher flexural and shear strengths
- Reinforcement replacement
- Joint Extension

CHARACTERISTICS, BENEFITS & APPLICATION GUIDES

SikaFiber® CHARACTERISTICS GUIDE

| Type | Products | Length, " | Dosage, lbs/cu.yd | Standards | Description |
|----------------|-----------------------------|---------------|-------------------|------------------------------|---|
| ACRYLIC | Sika Fibermesh® AC 100 | Graded | 0.5 - 1 | ASTM C1116 - Type III | Micro Monofilament Acrylic Fiber, Degradable Bags |
| NYLON | Sika Fibermesh® FN | 0.5", 0.75" | 1 | ASTM C1116 - Type III | Micro Monofilament Nylon Fiber, Degradable Bags |
| MICRO | Sika Fibermesh® 500 | Graded | 1.5 | ASTM D7508 | Polypropylene Monofilament or Fibrillated Degradable Bags |
| | Sika Fibermesh® HP | Graded | 0.5 | ASTM D7508 | Polypropylene Monofilament, Fine Denier, Degradable Bags |
| | Sika Fibermesh® 150 | Graded | 1 | ASTM D7508 | Polypropylene Monofilament, Degradable Bags |
| | Sika Fibermesh® 300e3 | Graded | 1.5 | ASTM D7508 | Polypropylene Fibrillated, Degradable Bags |
| MACRO | Sika Fibermesh® 150F | 0.25" or 0.5" | 1 - 3.4 | ASTM D7508 | Polypropylene Monofilament, Degradable Bags |
| | Sika Fibermesh® 650 | Graded | 3 - 7 | ASTM D7508 | Structural, Polypropylene, In Pucks |
| | SikaFiber® 800 Stealth | 1.5" | 3 - 7 | ASTM D7508 | Structural, Crimped, Polypropylene, In Pucks |
| | SikaFiber® Enduro® Prime | 2.2", 2.4" | 3 - 7 | ASTM D7508 | Structural, Crimped, Polypropylene, In Pucks |
| | SikaFiber® 54 Force | 2" | 3 - 11 | ASTM D7508 | Structural Embossed Polypropylene, In Pucks |
| | Sika Fibermesh® 650S | Graded | 5 - 8.5 | ASTM D7508 | Structural, Polypropylene, In Pucks |
| STEEL | Sika Fibermesh® 665 | 2.6" | 5 - 9 | ASTM D7508 | Structural, Polypropylene, In Pucks |
| | SikaFiber® Novocon® XR | 1.5", 2" | 25 - 66 | ASTM A820 - Type V | Steel, Crimped, 25 lb Repulpable Bags |
| | SikaFiber® Novocon® CS 1000 | 1" | 20 - 75 | ASTM A820 - Type II | Steel Fiber, 55 lbs Boxes |
| | SikaFiber® Novocon® HE4550 | 2" | 25 - 67 | ASTM A820 - Type I | Steel, Hooked End, 44 lb Paper Bags |
| | SikaFiber® Novocon® CHE6560 | 2.4" | 24 - 67 | ASTM A820 - Type I | Steel, Collated Hooked End, 44 lb Paper Bags |
| | SikaFiber® Novocon® CHE8060 | 2.4" | 25 - 67 | ASTM A820 - Type I | Steel, Collated Hooked End, 44 lb Paper Bags |
| BLEND | SikaFiber® Novocon® CHE6535 | 1.4" | 35 - 80 | ASTM A820 - Type I | Steel, Collated Hooked End, 44 lb Paper Bags |
| | SikaFiber® Novomesh® 850 | 1.5" | 24-48 | A820 Type V & C1116 Type III | Steel-Synthetic Blend, 24 lb Degradable Bags |
| | SikaFiber® Novomesh® 950 | 1.9" | 5 - 10 | ASTM D7508 | Macro-Micro Synthetic Blend, 5 lb Bags |

SikaFiber® APPLICATION GUIDE

Concrete fibers have an innumerable amount of applications in concrete construction. Not only will benefits in fresh and hardened properties be seen, secondary benefits will be made as well. By reducing or replacing traditional meshes and steel reinforcement, labor costs will be reduced and construction schedules can be accelerated. Safety is increased by reducing the chances of tripping or impalement by traditional steel reinforcement. With concrete fiber being integral (well mixed) throughout the concrete, there is no opportunity for reinforcement to end up in the bottom of your slab.

KEY APPLICATION BENEFITS:

- Integral Reinforcement
- Increased safety
- Less opportunities for callbacks
- Long term durability increase
- Reduction in labor for placement of reinforcement

SikaFiber® PERFORMANCE BENEFITS GUIDE

| Type | Products | Early Age Benefits | | | Long Term Benefits | | | | | | | | | | |
|----------------|-----------------------------|------------------------------------|-------------------------------------|-------------------|--|---|--------------------------------------|---|----------------------------------|-----------------------|----------------------------|-------------------|---------------------------|--|---|
| | | Reduces Plastic Shrinkage Cracking | Reduces Plastic Settlement Cracking | Improves Cohesion | Reduces Explosive Spalling During Fire | Provides Post First Crack Reinforcement | Provides Shatter & Impact Resistance | Provides Restrained Shrinkage Crack Control | Flexural Toughness for Shotcrete | Extends Joint Spacing | Greater Fatigue Resistance | Greater Ductility | Reduces Water Penetration | | |
| ACRYLIC | Sika Fibermesh® AC 100 | • | • | • | | | • | | | | | | | | • |
| NYLON | Sika Fibermesh® FN | • | • | • | | | • | | | | | | | | • |
| MICRO | Sika Fibermesh® HP | • | • | • | | | • | | | | | | | | • |
| | Sika Fibermesh® 150 | • | • | • | | | • | | | | | | | | • |
| | Sika Fibermesh® 300e3 | • | • | • | | • | • | | | | | | | | • |
| MACRO | Sika Fibermesh® 150F | • | • | • | • | | • | | | | | | | | • |
| | Sika Fibermesh® 650 | • | • | • | | • | • | • | | | | | | | • |
| | SikaFiber® 800 Stealth | • | • | • | | • | • | • | | | | | | | • |
| | SikaFiber® Enduro® Prime | • | • | • | | • | • | • | | | | | | | • |
| | SikaFiber® 54 Force | • | • | • | | • | • | • | • | | | | | | • |
| | Sika Fibermesh® 650S | • | • | • | | • | • | • | • | | | | | | • |
| STEEL | Sika Fibermesh® 665 | • | • | • | | • | • | • | | | | | | | • |
| | SikaFiber® Novocon® XR | | | | | • | • | • | • | | | | | | • |
| | SikaFiber® Novocon® CS 1000 | | | | | • | • | • | • | | | | | | • |
| | SikaFiber® Novocon® HE4550 | | | | | • | • | • | • | | | | | | • |
| | SikaFiber® Novocon® CHE6560 | | | | | • | • | • | • | | | | | | • |
| | SikaFiber® Novocon® CHE8060 | | | | | • | • | • | • | | | | | | • |
| BLEND | SikaFiber® Novocon® CHE6535 | | | | | • | • | • | • | | | | | | • |
| | SikaFiber® Novomesh® 850 | • | • | • | | • | • | • | • | | | | | | • |
| | SikaFiber® Novomesh® 950 | • | • | • | | • | • | • | • | | | | | | • |

| | | Slabs | | | | | | Pavements | | | Composite Metal Deck | Precast | | | | Shotcrete & Underground | |
|----------------|-----------------------------|------------------------------|------------|------------|------------------|----------------|----------|--------------------------|----------|----------|----------------------|-----------------|---------------------------|------|----------------|-------------------------|---------------------|
| | | Residential/Light Commercial | Commercial | Industrial | Heavy Industrial | Extended Joint | Overlays | Parking Areas & Roadways | Overlays | Sidewalk | | Tunnel Segments | Vaults Tanks & Containers | Pipe | Wall & Tilt-Up | Tunneling & Mining | Slope Stabilization |
| ACRYLIC | Sika Fibermesh® AC 100 | • | • | • | • | | • | | | | | | | | | | |
| NYLON | Sika Fibermesh® FN | • | | • | • | | | | | | | | | | | | |
| MICRO | Sika Fibercast® 500 | | | • | • | | | | | | | | | • | | • | |
| | Sika Fibermesh® HP | • | • | • | • | | | | | | | | | • | • | • | |
| | Sika Fibermesh® 150 | • | • | • | • | | | | | | | | | • | • | • | |
| | Sika Fibermesh® 300e3 | • | | | | | | | | | | | | • | | | |
| MACRO | Sika Fibermesh® 150F | | | | | | | | | | | | | • | | | |
| | Sika Fibermesh® 650 | • | • | | | | | | | | | | | • | | | |
| | SikaFiber® 800 Stealth | • | • | | | | | | | | | | | • | | | |
| | SikaFiber® Enduro® Prime | | | • | • | | | | | | | | | • | • | • | |
| | SikaFiber® 54 Force | | | | | | | | | | | | | • | | | |
| | Sika Fibermesh® 650S | | | | | | | | | | | | | • | | | |
| STEEL | Sika Fibermesh® 665 | | | | | | | | | | | | | • | | | |
| | SikaFiber® Novocon® XR | | • | | | | | | | | • | | | | | | • |
| | SikaFiber® Novocon® CS 1000 | | • | • | | • | • | | | | | | | • | | | |
| | SikaFiber® Novocon® HE4550 | | | • | | | | | | | | | | • | | | |
| | SikaFiber® Novocon® CHE6560 | | | • | • | | | | | | | | | • | | | |
| | SikaFiber® Novocon® CHE8060 | | | | • | | | | | | | | | • | | | |
| BLEND | SikaFiber® Novocon® CHE6535 | | | | | | | | | | | | | • | • | • | • |
| | SikaFiber® Novomesh® 850 | • | • | • | | | | | | | | | | • | • | • | • |
| | SikaFiber® Novomesh® 950 | • | • | • | | | | | | | | | | • | • | • | • |

