

Nicalon™

NICALON™ ceramic fiber is a multi-filament silicon carbide-type fiber manufactured by NGS Advanced Fibers Co., Ltd. (Japan). The fiber is homogeneously composed of ultra-fine beta-SiC crystallites and an amorphous mixture of silicon, carbon, and oxygen. The fiber has excellent strength and modulus properties for ceramic fibers, and retains its properties at high temperatures. **NICALON™** is highly resistant to oxidation and chemical attack.

NICALON™ is available in a wide variety of electrical grades, product forms, and surface treatment options, depending on the intended use. Properties are shown in Table 1.

USES

NICALON™ ceramic fiber can be used as a reinforcement for plastic, ceramic, and metal matrix composites to produce high performance composite materials. Surface treatments are normally recommended to facilitate processing and maximize composite properties.

NICALON™ can be used to form fibrous products such as high temperature insulation, filters, etc. Its resistance to chemical attack allows it to be used in harsh environments.

GRADES

NICALON™ ceramic fiber is available in two primary grades, differentiated by electrical properties. Other electrical grades, such as low volume resistivity are also available. Contact COI Ceramics to discuss specific needs.

Ceramic Grade (CG) NICALON™

The standard grade of the **NICALON™** product line; offers the optimum mechanical properties and high-temp performance for most applications.

HVR Grade NICALON™

A low dielectric (high volume resistivity) fiber that is designed to offer optimum balance of mechanical and electrical properties in dielectric structures.

PRODUCT FORMS

NICALON™ ceramic fiber is available in several physical forms and with various surface treatment options, to offer maximum application flexibility.

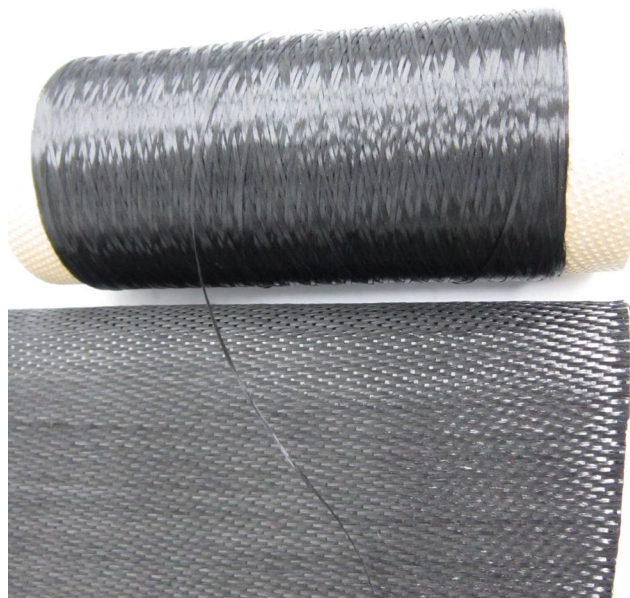
Continuous Fiber

Supplied as multi-filament spooled tow.

Woven Cloth Available in three weave styles as shown in Table 2. Woven cloth is typically supplied as 1-meter-wide continuous rolls of specific lengths. Other weave or braid styles can be made available. Contact COI Ceramics to discuss specific needs.

Other

Nicalon™ can also be configured into chopped fiber, twill, woven tapes, braids, etc. A network of providers exist to respond to your exact needs. Contact COI Ceramics to discuss specifics and receive further information.



COI Ceramics, Inc., offers a variety of advanced ceramic products that are engineered to meet the demanding requirements of high-temperature applications. See the COI Ceramics website for a complete review of the materials solutions available for your applications.
www.coiceramics.com

APPLICATIONS

Polymer Matrix Composites

NICALON™ family of products is suitable for incorporation into standard resin prepreg, using conventional prepreg techniques. Unidirectional or oriented prepreg can be produced using continuous fiber, or woven cloth, respectively. Special fiber surface treatments (see Table 3) are normally recommended to maximize fiber property translation into the composite and to afford superior retention of composite properties under hot-wet conditions. Resin systems can include the entire line of thermosets and thermoplastics.

Ceramic Matrix Composites

NICALON™ can be incorporated as the reinforcing phase for a variety of ceramic composites. Standard CMC processing techniques, such as sol-gel, chemical vapor infiltration, melt infiltration or polymer infiltration can be used. Candidate matrix materials include silicon carbide, silicon nitride, alumina, glasses, etc. Fiber surface treatments are generally removed before making CMC's (see Table 4). Fiber interface coatings, such as BN, are recommended to achieve optimum CMC properties.

Metal Matrix Composites

Chopped, woven, or continuous **NICALON™** ceramic fiber can serve as a reinforcing phase in MMC's.

Weaving, Braiding, and Coating

As a textile grade yarn, **NICALON™** can be readily incorporated into a large variety of woven tapes, braids, etc. Specialty interface coatings such as BN (often required for optimum CMC mechanical properties) may be applied to the tow or cloth. A number of US providers can respond to customer needs. Contact COIC to discuss specific needs and receive further information.

AVAILABILITY & ORDERING

NICALON™ ceramic fiber is available exclusively in North America from COIC. For more information, contact the COIC Fiber Sales Office (801-251-8111).

LIMITED WARRANTY

COI Ceramics believes that the information contained herein is an accurate description of the typical properties and uses of the product. It is the customers responsibility to test the material to determine fiber performance and safety for the intended application.

COIC's sole warranty is that the product meets current NGS production specification limits. Specification writers should contact COIC for sales specifications. COIC specifically disclaims any other express or implied warranty.

TABLE 1: TYPICAL PROPERTIES

	Ceramic Grade	HVR Grade	LVR Grade
Tex g/km	200-220		
Tensile Strength, Gpa	≥2.6	≥2.40	≥2.44
Tensile Modulus, Gpa	≥188	≥174	≥180
Oxygen Content, wt%	10.5-13.5		
Density, g/cc	2.50-2.65	2.25-2.40	2.40-2.55
Tow Denier (nominal)	1800		
Sizing Amount, wt%	0.5-2.0		
Volume Resistivity, W·cm	1x10 ³ -1x10 ⁴	1x10 ⁶ -1x10 ⁷	Report

Table 4: Surface Treatment Removal

Surface Treatment	Recommended	Alternate
M-Sizing	600°C, 30 min, air	350°C, 4 hours, air
PVA-Sizing	Wash warm water	600°C, 30 min, air
P-Sizing	Wash methyl ethyl ketone	600°C, 30 min, air
DCC-2	Integral to fiber; removal not recommended	

Table 2: Standard Weave Sizes

Weave Style	Yarn Count (end/inch) (warp x fill)	Aerial Weight (CG) - g/m ² (nominal)
PW	16 x 16	255-305
5HS	16 x 16	255-305
8HS	22 x 22	350-410

Table 3: Surface Treatment Options

Designation	Type	Intended Use*
M-Sizing	Polyvinyl Acetate	CMC & MMC
PVA-Sizing	Polyvinyl Alcohol	CMC & MMC
P-Sizing	Modified Epoxy	PMC
DCC-2 Sizing	Proprietary	PMC, TS & TP

*PMC = polymer matrix composite
 CMC = ceramic matrix composite
 MMC = metal matrix composite
 TS = thermoset & TP = thermoplastic