



The Protectors

Our oxidized PAN fibers

PANOX®



Carbon Fibers



PANOX[®] oxidized PAN fibers **Effective flame proofing.** **Easy processing.**

PANOX fibers from SGL Carbon are inherently flame-resistant. They do not melt, drip or burn. The limiting Oxygen Index (LOI) of >45%, (depending on the fiber density), means that an oxygen content of at least 45% is required before the fibers will burn. As the normal oxygen content of air is only 21%, this means that, under normal circumstances, PANOX will not burn at all. With their excellent handling and processing properties, PANOX fibers are an ideal choice for heat-resistant and flame-proof woven and non-woven fabrics. Smart solutions from SGL Carbon – real protectors.

450%

Our oxidized PAN fibers

Our oxidized, thermally stabilized polyacrylonitrile (PAN) fibers are known throughout the world under the PANOX brand name, and have proved their worth in numerous industries as an ideal material for flameproof products. We make PANOX on the basis of our unique expertise in all processing stages of carbon fiber manufacture.



Market segments of our Business Unit Carbon Fibers

Typical applications

Automotive

- Thermal insulation
- Acoustic insulation
- Transmission components
- Fire proofing

Industrial Applications

- Fire resistant technology
- Chemical and heat resistant technology
- Railway interiors
- Steel industry
- Elevator braking systems

Typical products

- Insulation felts and fabrics
- Engine compartment insulation
- Hood liners
- Friction linings
- Brake pads

- Fire-resistant clothing
- Felts, woven fabrics and yarns
- Blended fabrics
- High temperature and chemical resistant bellows, packings and gaskets
- Welding blankets
- Friction linings

Materials used from SGL Carbon

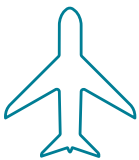
- PANOX® continuous tow fibers
- PANOX® crimped staple fibers
- PANOX® milled fibers
- PANOX® non-crimped staple fibers

- PANOX® continuous tow fibers
- PANOX® crimped staple fibers
- PANOX® milled fibers

Reliable, tried and versatile in application

PANOX is an internationally recognized industry standard for non-flammable and heat resistant technical fibers. Our oxidized PAN fibers are extremely versatile and can be easily used in a wide range of different textile processes to produce high performing, economic, flame proof and insulating fabrics.

PANOX from SGL Carbon is used in many different industries – such as the automotive industry, aerospace industry, energy sector as well as in many other industrial applications.



Aerospace

- Air cabin interiors
- Braking system applications

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- Fire blocker textiles for aircraft seats and air cabin interiors
 - C/C brake discs

-
- PANOX® continuous tow fibers
 - PANOX® crimped staple fibers
-



Energy

- Energy storage

-
- SIGRACELL® battery felts
 - Redox-Flow Battery felts
 - Carbon and graphite electrode and membrane materials

-
- PANOX® continuous tow fibers
 - PANOX® crimped staple fibers
-

We've got something against fire and heat

There are good reasons why PANOX has made its name as an industrial standard in the field of non-flammable textile fibers. Apart from high heat resistance, the thermally stabilized textile fibers are extremely resistant to chemicals and provide high electrical insulation. They are also outstanding for textile production stages and are easy to process.



PANOX[®] thermally stabilized textile fibers

PANOX is an oxidized polyacrylonitrile (PAN) fiber which does not burn, melt, soften or drip. It is made by means of thermal stabilization of PAN at 300 °C. This results in an oxidized textile fiber with a carbon content of approx. 62%. Thanks to its special properties, such as an LOI (Limited Oxygen Index) value of > 45% oxygen – depending on density of oxidation – PANOX can be used in many different fields as an effective protection against fire and heat.

PANOX: outstanding properties

- High LOI value of > 45 %
- Excellent fire class
- High temperature resistance
- Very good chemical resistance
- High electrical resistivity
- Low thermal conductivity
- Optimized for textile processing
- Ideal blending and processing behavior

The optimum fibers for textile processes

We supply PANOX fibers with a special sizing that guarantees excellent handling properties in textile processes such as stretch-breaking for tow-to-yarn conversion, and carding and needling for non-woven felt production. PANOX can be prepared on standard textile equipment and is easily blended with other fiber types such as aramid and polyester. Due to its moisture absorption properties, PANOX enhances the comfort and freedom of movement of protective clothing.

PANOX from SGL Carbon is available in different fiber diameters, and densities and is available in a range of formats to suit your processing steps: continuous tow, crimped and non crimped staple, and milled fiber.



↑ Oxidized PANOX fibers

Heat protection, fire protection and insulation at the highest level

With PANOX, SGL Carbon provides a textile fiber with a unique, stabilized chemical structure that does not burn, melt, soften or drip when exposed to heat or fire. This ensures the best possible protection to the wearer, and is why PANOX meets the Fire Class S-a in DIN 66083 for protective workwear, the highest protection requirement in its class, and ensures no melting or molten debris, and no afterglow or burning.

This means that end products containing PANOX fibers have excellent heat and fire protection in addition to high temperature resistance. On top of this are good insulative properties, due to the low heat conductivity of our material.

Nomenclature



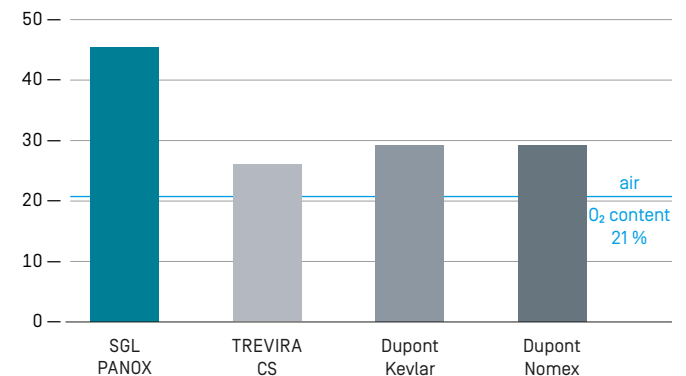
PANOX T320-1.7/1.37-A110

1 | 2 | 3 | 4 | 5

1 Brand name	PANOX
2 Fiber type	T = continuous fiber tow C = crimped staple fiber S = non-crimped staple fiber M = milled fiber
3 Continuous fiber tow Staple fiber Milled fiber	Filaments per tow Cut length in mm Nominal length in μm
4 Fiber properties	Linear density/fiber density
5 Finish	A110 = antistatic, A140 = antistatic

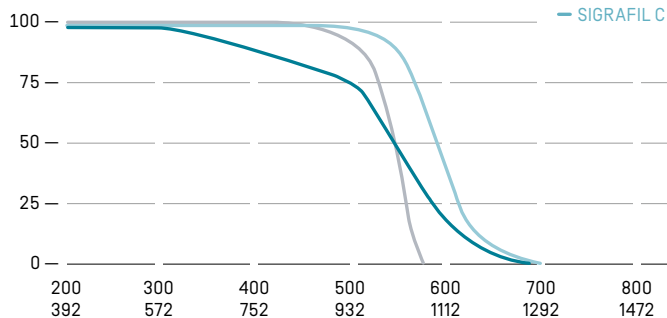
LOI values for non-flammable fibers

Oxygen content O_2 [%]



Thermal stability in air

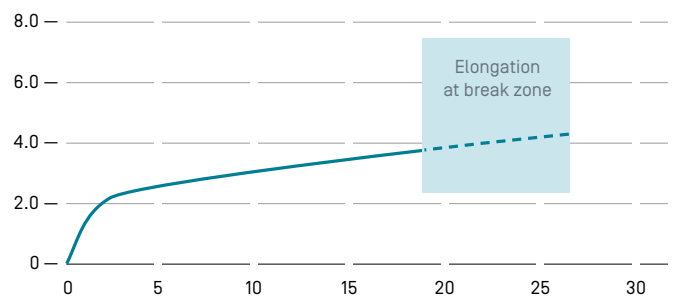
Sample weight [%]



Temperature [°C/°F]

Fiber elongation behavior

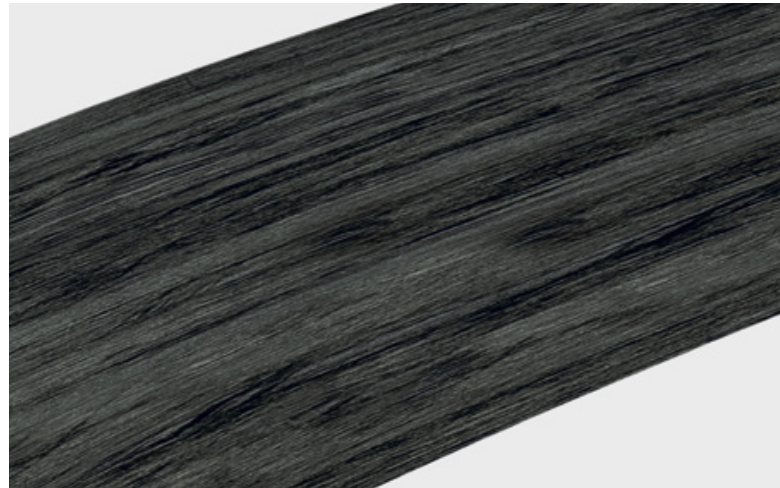
Load [cN]



Elongation [%]

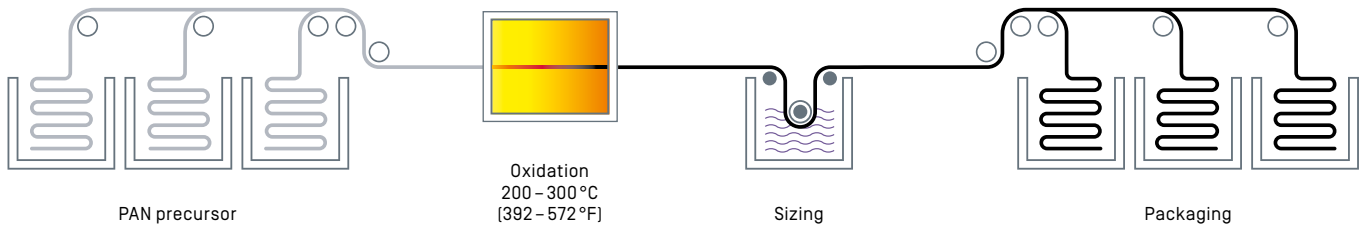
Continuous fiber tow for yarn manufacture

PANOX continuous fibers are supplied as a 320,000 filament tow with a special lubricating sizing to improve stretch breaking and tow conversion into yarns for knitted and woven textiles. Continuous fiber tows are available in two different fineness levels.



↑ PANOX continuous fiber tow

Manufacturing process of our PANOX® continuous fiber tows



Material data of our PANOX® continuous fiber tows

Typical properties	Units	T320-1.7/1.37-A110	T320-1.7/1.39-A110	T320-2.2/1.38-A110
Filaments per tow		320k	320k	320k
Linear density	dtex / den	1.7 / 1.5	1.7 / 1.5	2.2 / 2.0
Mass per unit length	g/m	55	55	72
Dry mass per unit length	g/m	51	52	68
Fiber density	g/cm ³	1.37	1.39	1.38
Moisture content	%	6	6	6
Elongation at break	%	22	20	20
Tensile strength	MPa	230	220	230
Tenacity	cN/tex	17	17	17
Sizing content	%	0.6	0.6	0.6
Sizing type		antistatic	antistatic	antistatic

Other types available on request.

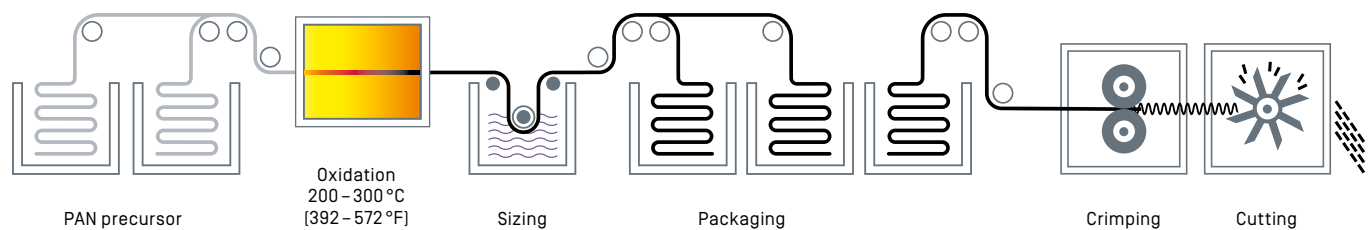
Crimped staple fibers for textile structures



↑ PANOX crimped staple fibers

Crimped PANOX fibers are made from continuous fiber tow. They are supplied with a special sizing that improves cohesion. Together with a carefully optimized crimp level, this ensures that carding processes run continually and reliably, with good productivity. Crimped staple fibers are available in a range of lengths to suit different non-woven processes and equipment.

Manufacturing process of our PANOX® crimped staple fibers



Material data of our PANOX® crimped staple fibers

Typical properties	Units	C63-1.7/1.39-A110	C63-2.2/1.38-A110	C63-2.2/1.38-A140
Linear density	dtex / den	1.7 / 1.5	2.2 / 2.0	2.2 / 2.0
Fiber density	g/cm ³	1.39	1.38	1.38
Moisture content	%	9	10	10
Elongation at break	%	20	20	20
Tensile strength	MPa	220	230	230
Tenacity	cN/tex	17	17	17
Sizing content	%	0.6	0.6	0.8
Fiber length*	mm	51 / 63 / 76	51 / 63 / 76	51 / 63 / 76
Nominal crimp count	per cm	6	5	5
Sizing type		antistatic	antistatic	antistatic

* Other fiber lengths available on request

Non-crimped staple fibers for visual surface effects

Non-crimped staple fibers are used in compounding and molding applications to provide a textured surface appearance to interior components in automotive, rail, and marine applications. As well as improving the cosmetic appeal of these surfaces, the PANOX fibers also improve the fire protection and chemical resistance of these parts.

Material data of our PANOX® non-crimped staple fibers

Typical properties	Units	S2-1.7/1.39-A110
Fiber length*	mm	2.0
Linear density	dtex	1.7
Fiber density	g/cm ³	1.39
Tensile strength	MPa	220
Sizing content	%	0.6
Sizing type		antistatic

* Other fiber lengths available on request



↑ PANOX non-crimped staple fibers

Milled fibers for friction-intensive applications

Milled PANOX fibers are used as a non-hazardous and heat resistant organic fiber filler for brake and friction compounds. These fibers are an excellent alternative to more hazardous materials such as asbestos. Typical applications include automotive brake pads, high-performance motor sport brake pads, brake linings for trains, and friction linings for elevators.

Material data of our PANOX® milled fibers

Typical properties	Units	M400-1.7/1.37-A110
Nominal fiber length	µm	400
Linear density	dtex	1.7
Fiber density	g/cm ³	1.37
Sizing type		antistatic
Sizing content	%	0.6
Fiber content with length < 250 µm	%	max. 60
Fiber content with length > 1000 µm	%	max. 5
Fiber content with length > 2000 µm	%	max. 1

Successful together

Every day we strive to ensure our customers' success. So we place considerable value on consistent high quality in our continuous fiber tow and crimped staple fibers – so that our customers' textile processes run smoothly and to ensure that their products can reliably meet the high quality standards for their often highly demanding applications.

On the basis of our comprehensive knowledge of fiber conversion and textile processing, we are able to support our customers in their process development, so they receive the precise end products that they need.



The image shows a close-up of three large industrial rollers in a textile processing machine. Each roller is covered with a thick layer of fiber tow. The top roller has a reddish-orange fiber, the middle one has a bright orange fiber, and the bottom one has a yellowish-orange fiber. The rollers are mounted on a grey metal frame with various bolts and components visible. The background is a plain, light-colored wall.

Reliability and economy in textile processes

Whether for carding non-woven textiles or cable conversions for technical spinning yarns, our PANOX fibers are optimized for stability of textile processing. Continuous 320k fiber tows are packed in 150 kg boxes. In this way, downtime in subsequent fiber processing can be minimized and cost effectiveness increased.

Crimped PANOX staple fibers are marked by optimized fiber friction and the best cohesion properties for industrial carding processes, thus promoting economic production of non-wovens.

Special quality assurance programs ensure a reliably high quality in SGL Carbon products. Our uniquely integrated value creation chain, from the polyacrylonitrile precursor to the oxidized fibers also guarantees economical manufacture and an attractive price structure.

Smart Solutions

Be it materials, components or production processes, we put our customers first. With our in-depth material, engineering, and application know-how, we develop customized, reliable and high-quality solutions for our customers.

The following examples show a selection of our unique product range.

Mobility

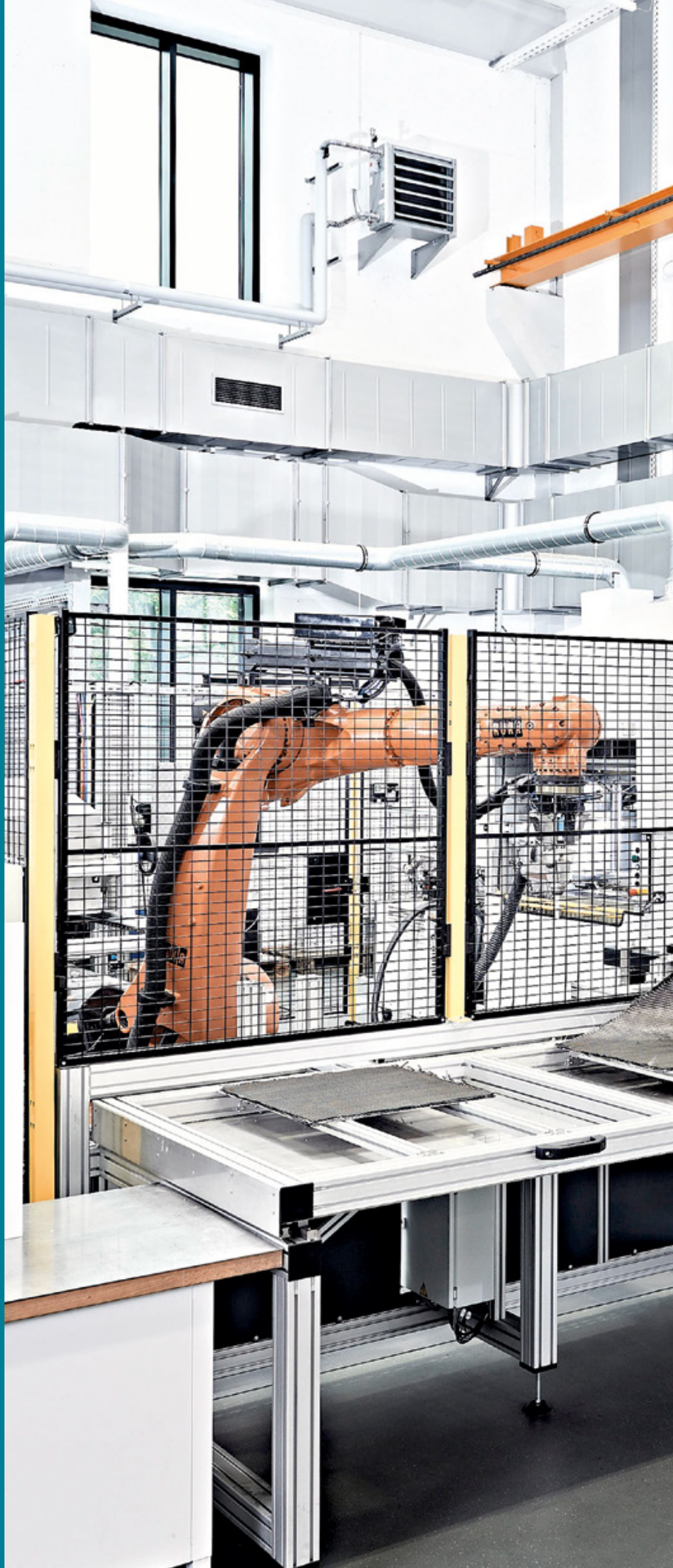
- Lightweight components and structural parts based on fiber-reinforced composites for automotive and aerospace manufacture
- Graphite anode material for lithium-ion batteries in electric vehicles
- Carbon-ceramic brake disks for sports cars and luxury sedans

Energy

- High-temperature solutions based on specialty graphites and fiber materials for the photovoltaic industry
- Carbon fiber materials for rotor blades
- Gas diffusion layers for fuel cells
- Systems for more efficient heat exchange and heat recovery
- Carbon fibers for pressurized gas containers

Digitization

- Carbon, graphite, and CFC components for polysilicon and monocrystal pulling in the semiconductor industry
- High precision, coated graphite carriers for the production of LEDs



SGL Carbon

We are a global leader in the development and manufacture of carbon-based solutions. Our materials and products made from specialty graphite, carbon fibers and composites serve many industries that are shaping the trends of the future: climate friendly mobility, semiconductor technology, LED, solar and wind energy, and the manufacture of lithium-ion batteries.

We are driven to grow with products and technologies that benefit society and reduce environmental and climate impacts.

Together with our customers, we develop intelligent and sustainable solutions that contribute to a smarter world.



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