SCHOTT
glass made of ideas

NEXTREMA®

Glass-ceramics engineered and designed for extreme conditions

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SCHOTT is a leading international technology group in the areas of specialty glass and glass-ceramics. With more than 130 years of outstanding development, materials and technology expertise we offer a broad portfolio of high-quality products and intelligent solutions that contribute to our customers' success.

This is also what the SCHOTT NEXTREMA® brand stands for. With high-performance glass-ceramic, SCHOTT offers a portfolio of materials that opens completely new fields of application for engineers and designers with its exceptional technical properties. As a real multi-talent, NEXTREMA® demonstrates what makes glass-ceramic a ground-breaking and unique solution, particularly in high temperature environments.

NEXTREMA®
High-tech & functional design material

In the construction of technical applications, your main interest are physical and chemical parameters, robustness under extreme temperature loads and high chemical resistance.

With NEXTREMA®, we offer you a high-tech material with a variety of features. Particularly in high-temperature environments, where other materials such as plastic, conventional glass or metal show their limitations, NEXTREMA® is your alternative.

Colors and shapes are your world. You know that design is crucial for innovation and differentiation.

No NEXTREMA® is like another. We would like to supply you with glass-ceramic that corresponds to your requirements as precisely as possible. This is why NEXTREMA® is available in six types, different shapes, and appearances. This material will give your design a ground-breaking face.

Are you ready for innovative developments? Then start thinking of solutions never seen before.


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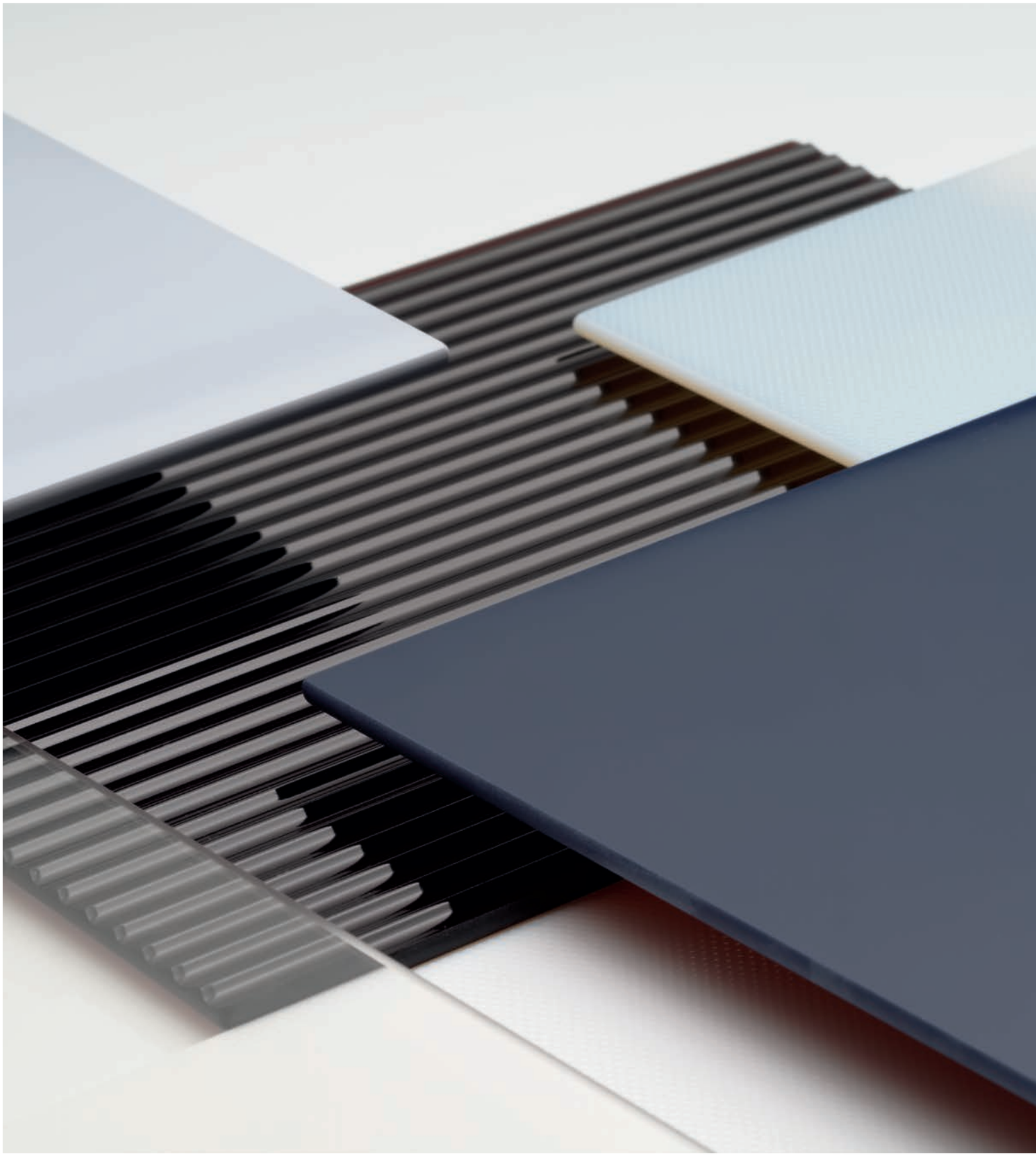
Design



NEXTREMA®
An all-round talent

With NEXTREMA® we offer engineers and designers a unique and homogeneously colored glass-ceramic material platform that suits your needs.

All six types have the following material benefits in common:

Operating temperature up to 950 °C (1,742 °F)

Warm, warmer, hot: NEXTREMA® glass-ceramic shows its real strength under conditions of extreme temperatures. We have the right type of NEXTREMA® for the widest range of temperatures – up to 950 °C (1,742 °F).

Near zero thermal expansion

The innovative potential is expanded with NEXTREMA®, not the material itself. The intelligent microstructure of NEXTREMA® results in near zero thermal expansion, enabling the glass-ceramic to keep its shape in a high temperature environment.

Thermal shock resistance

Nothing shocks NEXTREMA®. Quick change of temperature? Fire and ice? Thanks to the thermal shock resistance of NEXTREMA®, thermal material failure is a thing of the past.

Wide transmittance spectrum

Specific to the type and thickness of NEXTREMA®, there are different transmission ranges. These are important for certain technical applications.

Surface resistance and gas impermeability

Thanks to its unique surface finish, NEXTREMA® has multiple resistance to acids and bases. This means it can be used in aggressive environments.

Process inert

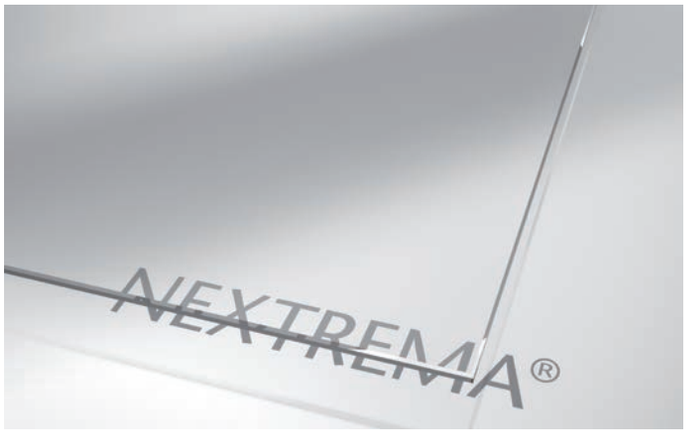
Without discussion: NEXTREMA® is practically process inert. Even under extreme conditions, the material will not have negative interactions with the process environment. There are no interfering process factors such as gas emissions from organic components.

Robustness at high temperatures

Strong under heat: NEXTREMA® exceeds where other materials fail. This is why exceptionally high mechanical stability under high temperatures is important. It makes the crucial difference even with thin plates in large formats.

All materials at a glance

In addition, each material type has further specific material benefits to offer engineers and designers alike a unique glass-ceramic material platform that suits your needs.



NEXTREMA® transparent (724-3)

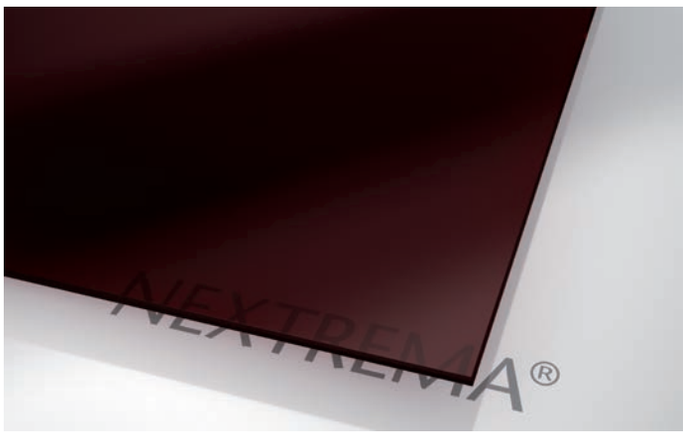
- Highest thermal shock resistance of all NEXTREMA® types
- Excellent transparency
- High transmission in short wave infrared (IR) range

NEXTREMA® translucent white (724-5)

- Broadest overall IR transmission window of all NEXTREMA® types below 2,800 nm
- Highest level of chemical resistance against acids and alkali solutions
- Visible light reduction in combination with high IR transmission

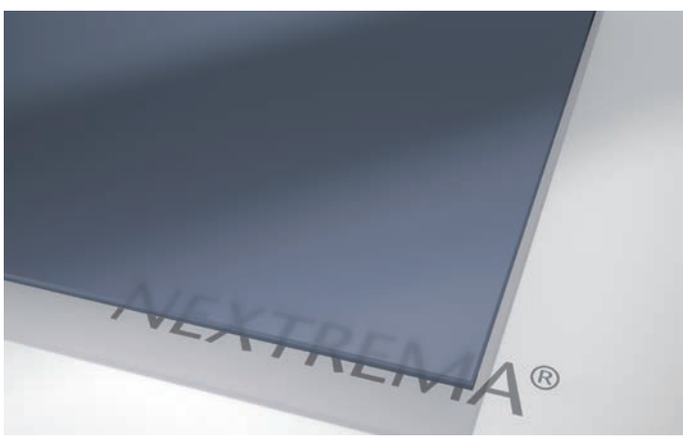
NEXTREMA® opaque white (724-8)

- Highest maximum temperature resistance of up to 950 °C (1,742 °F)
- Visible light diffusing properties
- Highest level of chemical resistance against acids and alkali solutions



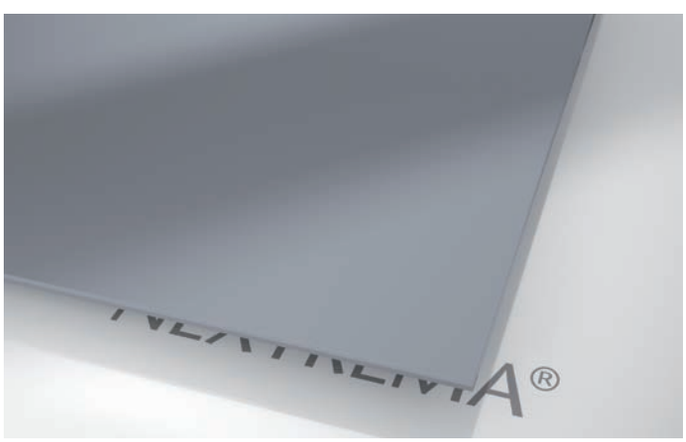
NEXTREMA® tinted (712-3)

- Highest bending strength of all NEXTREMA® types (of up to 165 MPa)
- Visible light reduction in combination with high IR transmission
- Thermal shock resistance of up to 800 °C (1,472 °F)



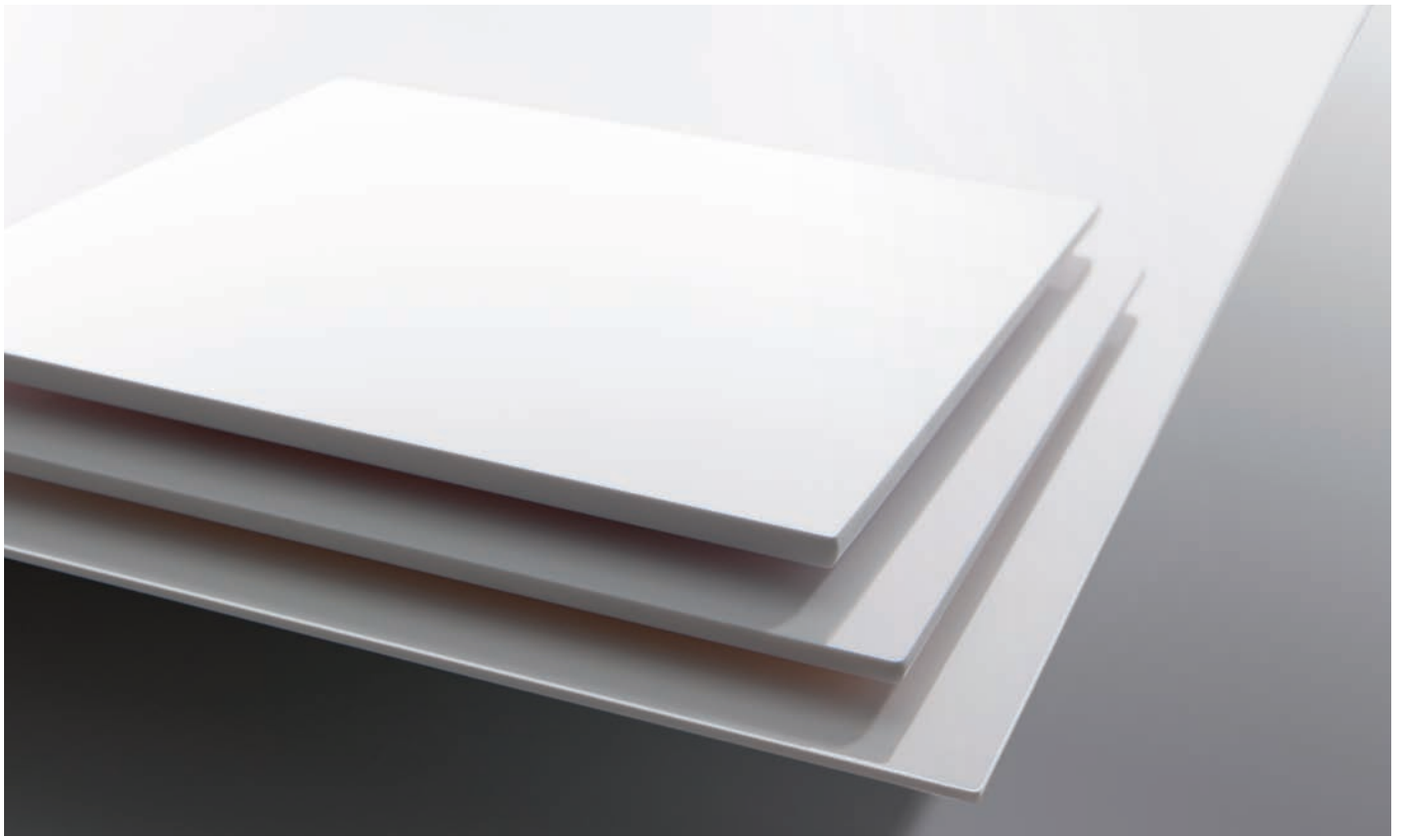
NEXTREMA® translucent bluegrey (712-6)

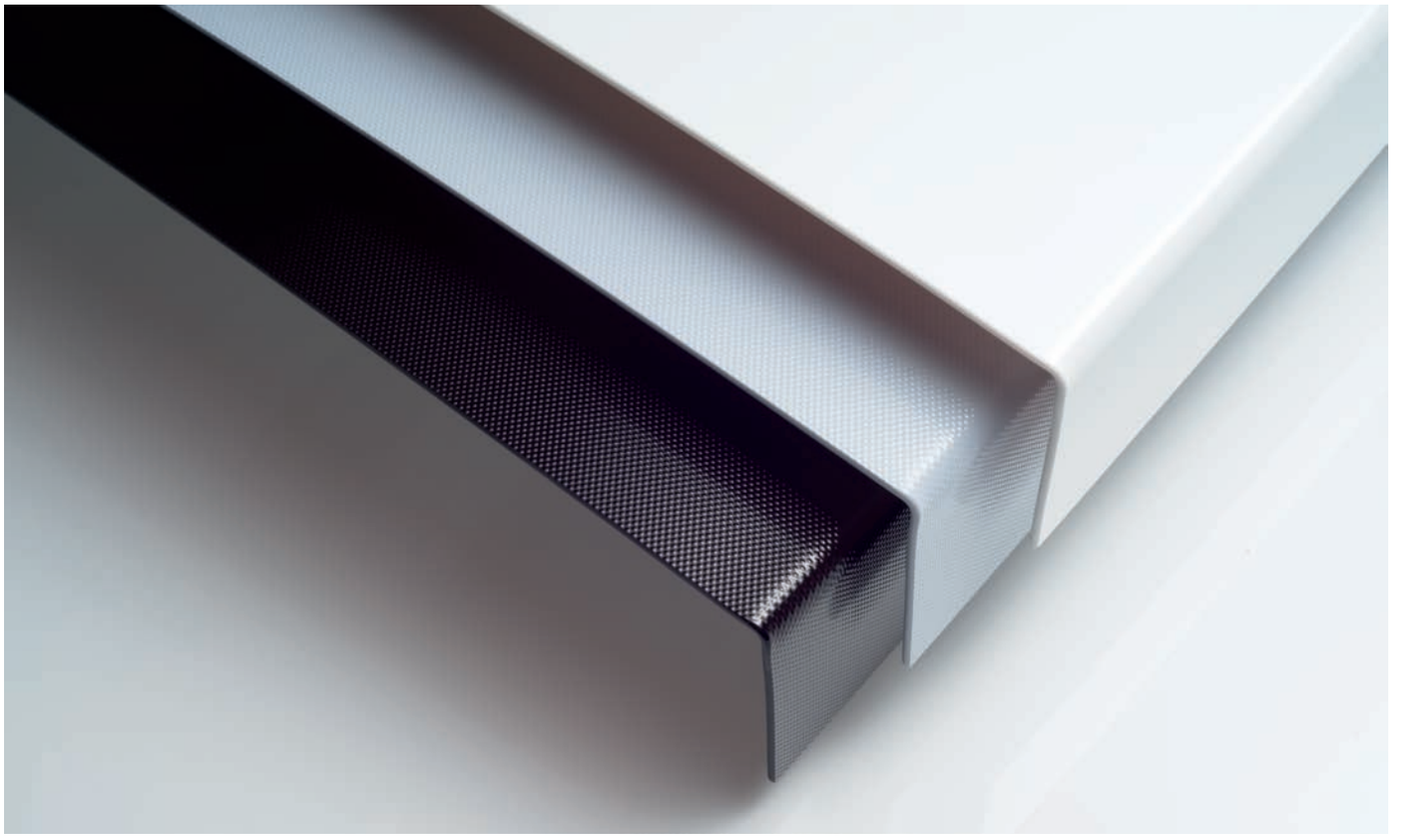
- Highest maximum temperature resistance of up to 950 °C (1,742 °F)
- Unique translucent design
- Visible light reduction in combination with high IR transmission



NEXTREMA® opaque grey (712-8)

- Highest maximum temperature resistance of up to 950 °C (1,742 °F)
- Highest thermal insulation properties of all NEXTREMA® types due to lowest overall transmission in IR range





Standard forms of delivery

Current status of availability by material and form of delivery on request. Not all combinations are available. Other forms of delivery are available upon your request.

Flat random sheets (without any edge treatment)

Length	1,600 mm or 1,954 mm
Width	900 mm or 1,100 mm
Thickness	3, 4, 5 mm (standard)
	≥ 6 mm (on request)

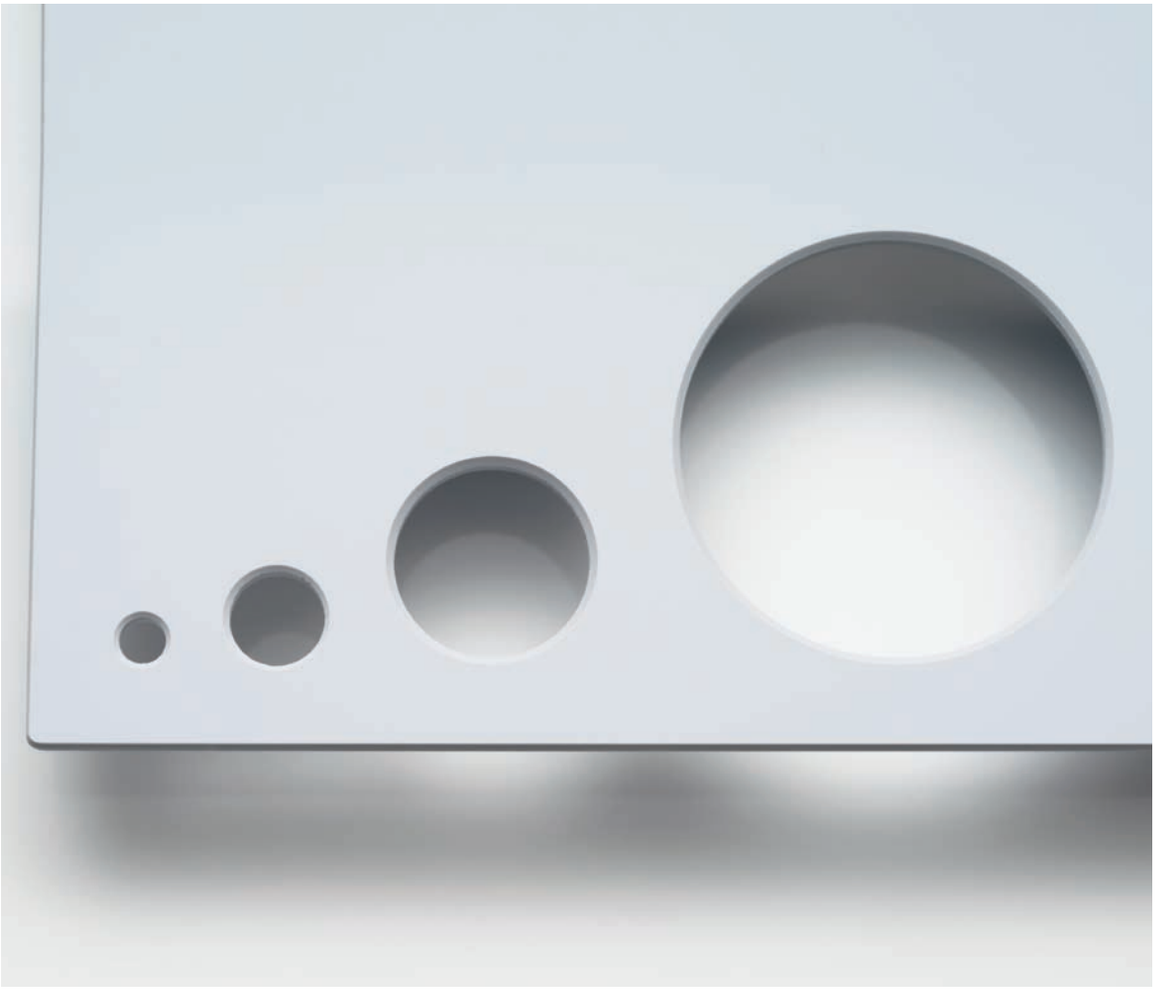
Flat cut-to-size panels

Diameter	20 – 1,075 mm
Thickness	2 – 6 mm (standard)
	8 – 16 mm (on request)

Thickness	Standard length Min. – Max.	Standard width Min. – Max.	Profile
2 mm	50 – 1,915 mm	50 – 860 mm	On request
3 mm	50 – 1,930 mm	50 – 1,075 mm	C, U, V
4 mm	50 – 1,930 mm	50 – 1,075 mm	C, U, V
5 mm	50 – 1,930 mm	50 – 1,075 mm	C, U, V
6 mm	50 – 1,930 mm	50 – 1,060 mm	C, U, V
≥ 8 mm	50 – on request	50 – 960 mm	C, U, V

Bent panels

Formats of bent panels on request. Various shapes are available.
Please contact us for further information.



Mechanical treatment

Grinding profile	Seamed, C-,U-,V-Shape, others on request
Drilled borehole	Ø 10 mm – Ø 200 mm
Bevelled edges (width)	5 mm – 20 mm
Lasering, polishing, sandblasting and printing*	on request

*Printing and decoration only on flat surface for laboratory and infrared (IR) heaters or hot plates.

Grinding profiles

C-shape

U-shape

V-shape

Dimensional tolerances and material defects

With regard to the specific format all of the following characteristics refer to the net size, as agreed upon with the customer. Other forms of delivery are available on request.

Flat cut-to-size

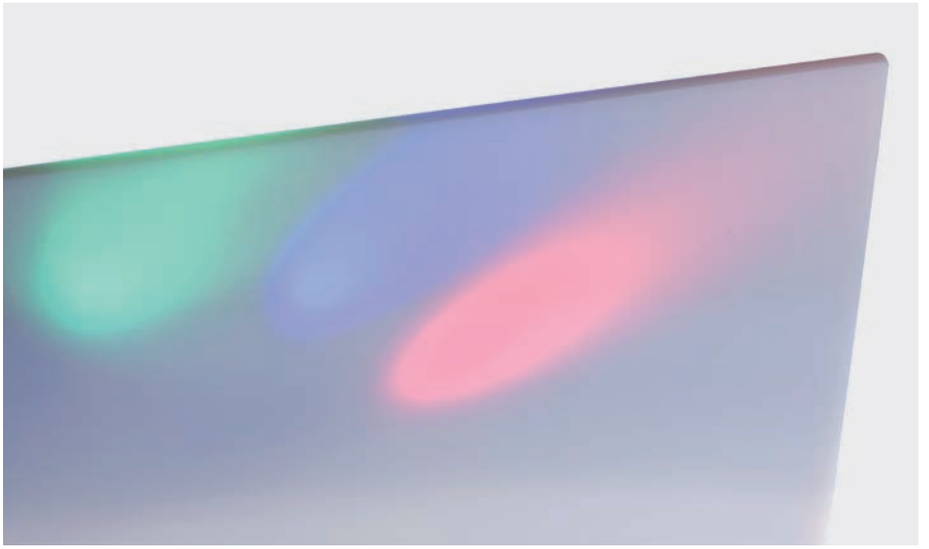
Characteristics / Areas / Location	Tolerance
Thickness t	
t = 2.0 mm	± 0.3 mm
t = 3.0 / 4.0 / 5.0 mm	± 0.2 mm
t = 6.0 mm	± 0.3 mm
Edge length l	
l ≤ 500 mm	± 1.0 mm
l > 500 mm	± 1.5 mm
Squareness (ISO 1101) (depending on the edge length l)	
l ≤ 500 mm	≤ 1.0 mm
l > 500 mm	≤ 1.5 mm
Flatness along the diagonal D (depending on edge length l)	
l ≤ 300 mm	≤ 0.3 mm
l > 300 mm	Max. 0.3% x D
Corner radius r	
r ≤ 5 mm	± 5.0 mm
r ≤ 20 mm	± 1.0 mm
r > 20 mm	± 2.0 mm
Drilled holes	
Diameter of drilled holes	± 0.5 mm
Borehole position to reference	± 1.5 mm

Other forms of delivery are available on request.

Technical features

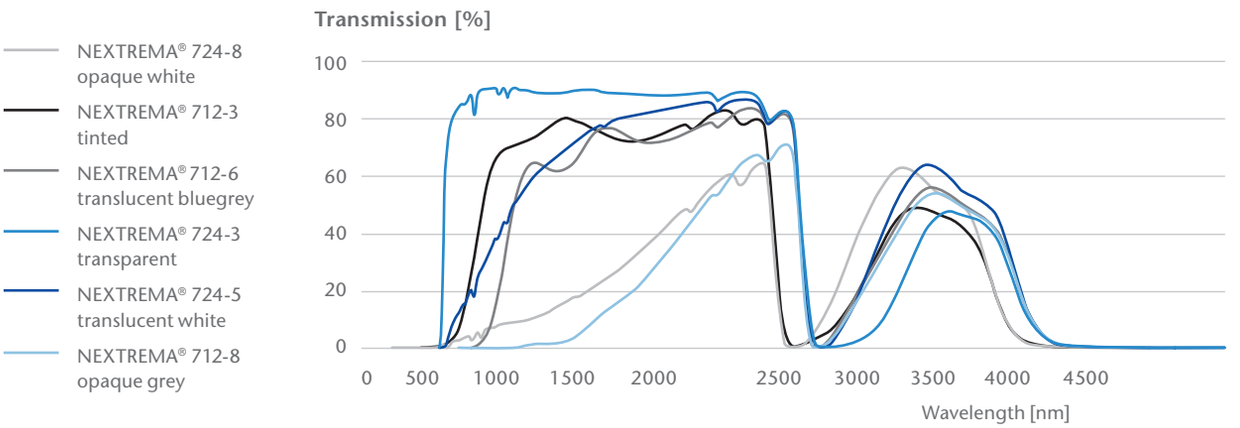
All technical data presented in this product brochure must be understood as typical average values. Detailed information on the different material types is documented in separate material data sheets or will be provided on the customer's special request. Specifications are subject to change without prior notice.

Values, for which no generally accepted measuring method exist, such as by a technical standard, are specified and explained. Please contact us for detailed information.

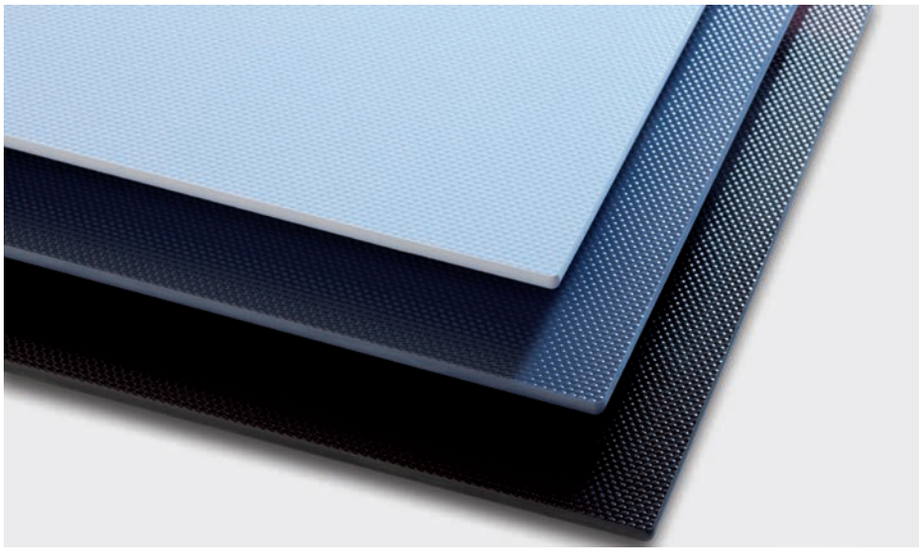


Optical characteristics

General appearance
Transparent, translucent white, opaque white, tinted, translucent bluegrey and opaque grey. One side with nubs available on request. Grooved surface for tinted, translucent bluegrey and opaque grey on request.



This graph is based on data from individual measurements. Deviations may result from manufacturing process. Typical transmission graph of different ceramization states with sample thickness of approximately 4 mm.



Mechanical characteristics (at room temperature)

ρ approx. 2.5 – 2.6 g/cm³	Density
E approx. 84 – 95 x 10³ MPa	Modulus of elasticity (ASTM C-1259)
µ approx. 0.25 – 0.26	Poisson's ratio (ASTM C-1259)
$HK_{0.1/20}$ approx. 570 – 600	Knoop hardness (ISO 9385)
σ_{bB} approx. 100 – 165 MPa	Bending strength (DIN EN 1288, Part 5, R45)

The impact resistance of NEXTREMA® depends on the kind of installation, size, thickness and geometry of the panel, type of impact and especially on drilled holes and their position in the material.

Therefore, information regarding impact resistance can only be given with knowledge of the respective and defined application (especially in combination with the technical standards regarding impact resistance that have to be met for some applications). The quality of the grinding profile has an important influence according to the impact resistance.

Impact resistance

0 % Porosity (ISO 9385)

Material 724-3 (t = 4 mm)	**$R_a \leq 0.20$ µm** **Rms ≤ 0.25 µm**	Roughness

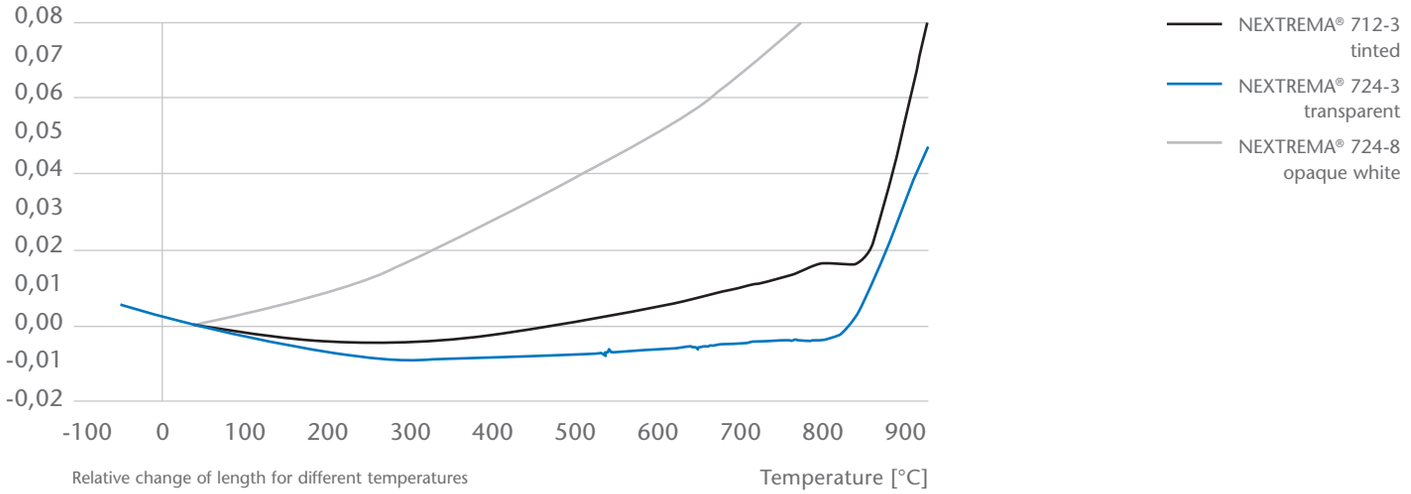
Thermal characteristics

Excellent temperature and thermal shock resistance
NEXTREMA® performs even when exposed to high temperatures or rapid temperature changes. Due to its excellent resistance to temperatures of up to 950 °C (1,742 °F) and thermal shocks NEXTREMA® is the ideal solution for high temperature applications where glass properties are beneficial.

Coefficient of linear thermal expansion (DIN ISO 51045-1, DIN ISO 7991)
In certain applications, the coefficient of mean linear thermal expansion and, therefore, the total change of length of a NEXTREMA® part within a specified temperature range is important to its function. The following mean coefficient values and the graph on the right show the temperature dependency.

CTE in different temperature ranges	
$\alpha_{(-50\ °C;\ 100\ °C)}$	$-0.8 – 0.6 \times 10^{-6}\ K^{-1}$
$\alpha_{(0\ °C;\ 50\ °C)}$	$-0.8 – 0.6 \times 10^{-6}\ K^{-1}$
$\alpha_{(20°C;\ 300\ °C)}$	$-0.4 – 0.9 \times 10^{-6}\ K^{-1}$
$\alpha_{(300°C;\ 700\ °C)}$	$0.1 – 1.6 \times 10^{-6}\ K^{-1}$

Thermal expansion in dependence on the temperature (for selected NEXTREMA® types)



$C_{p\,(20-100\,°C)}$ 0.80 – 0.85 J / (g x K)

Specific heat capacity

$\lambda_{\,(90\,°C)}$ 1.5 – 1.7 W / (m x K)

Thermal conductivity (DIN 51936, ASTM E 1461-01)

MTG 400 – 800 K
Resistance of the material to temperature differences between a defined hot zone and cold edge of room temperature, without cracking due to thermal stress.

Maximum temperature gradient (MTG)

TSR 600 – 820 °C (1,112 – 1,508 °F)
Resistance of the material to thermal shock when the hot material is splashed with cold water at room temperature, without cracking due to thermal stress.

Thermal shock resistance (TSR)

The temperature / time load capacity specifies the maximum permissible temperatures for load times of the material, below which no cracking should occur due to thermal stress. The temperature / time load data for uneven and even temperature distributions (e.g. homogeneous heating conditions) within the material are different.

Temperatur / time load capacity (TTLC)

Homogeneous heating of the material

TTLC / Short term load (1h)	[°C] > 650 – 950 / [°F] > 1,202 – 1,742
TTLC / Continuous load (5,000 h)	[°C] > 550 – 850 / [°F] > 1,022 – 1,562

Inhomogeneous heating of the material

TTLC / Short term load (1h)	[°C] 450 – 750 / [°F] 842 – 1,382
TTLC / Continuous load (5,000 h)	[°C] 400 – 560 / [°F] 752 – 1,040

Chemical characteristics

Principal constituents (reference: DIN EN 1748-2-1)
The principal constituents of all the ceramic materials are as follows:

Component	Symbol	Percentage per mass
Silicon dioxide	SiO_2	50 % – 80 %
Aluminium oxide	Al_2O_3	15 % – 27 %
Lithium oxide	Li_2O	0 % – 5 %
Zinc oxide	ZnO	0 % – 5 %
Titanium oxide	TiO_2	0 % – 5 %
Zirconium oxide	ZrO_2	0 % – 5 %
Magnesium oxide	MgO	0 % – 8 %
Calcium oxide	CaO	0 % – 8 %
Barium oxide	BaO	0 % – 8 %
Sodium oxide	Na_2O	0 % – 2 %
Potassium oxide	K_2O	0 % – 2 %
Other (trace content on request)		0 % – 5 %

The materials do not contain any harmful substances according to the European directive 2002/95/EC “Hazardous Substances in electrical and electronically Equipment” and fulfill the terms of RoHS without any concerns.

End of life usage

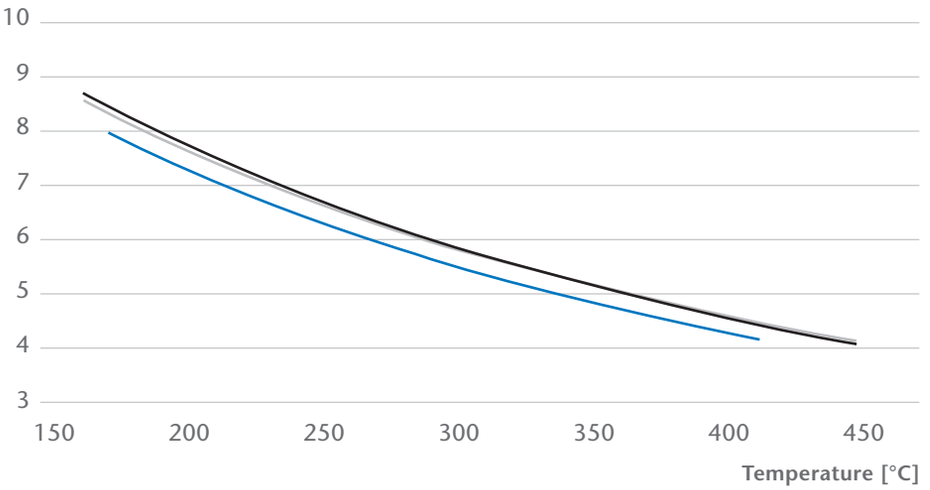
Federal Republic of Germany waste disposal regulations differentiate five classes of waste, Z0 (non-restricted disposal), Z3 (household waste), and up to Z5 (highly toxic waste). All NEXTREMA® materials are classified as non-restricted disposal. Local government regulations may differ. Please contact the local authority if needed. NEXTREMA® must not be disposed of in recycling boxes for standard glass (e.g. glass bottles).

Chemical resistance

The chemical resistance of NEXTREMA® is more extensive than that of most other comparable materials.

Acid resistance (DIN 12116)	S	1 – 2
Alkaline resistance (ISO 695)	A	1 – 2
Hydrolytic class (DIN ISO 719)	HGB	1

Specific electrical volume resistance at different temperatures for selected NEXTREMA® types (log ρ [Ω · cm])



Electrical characteristics

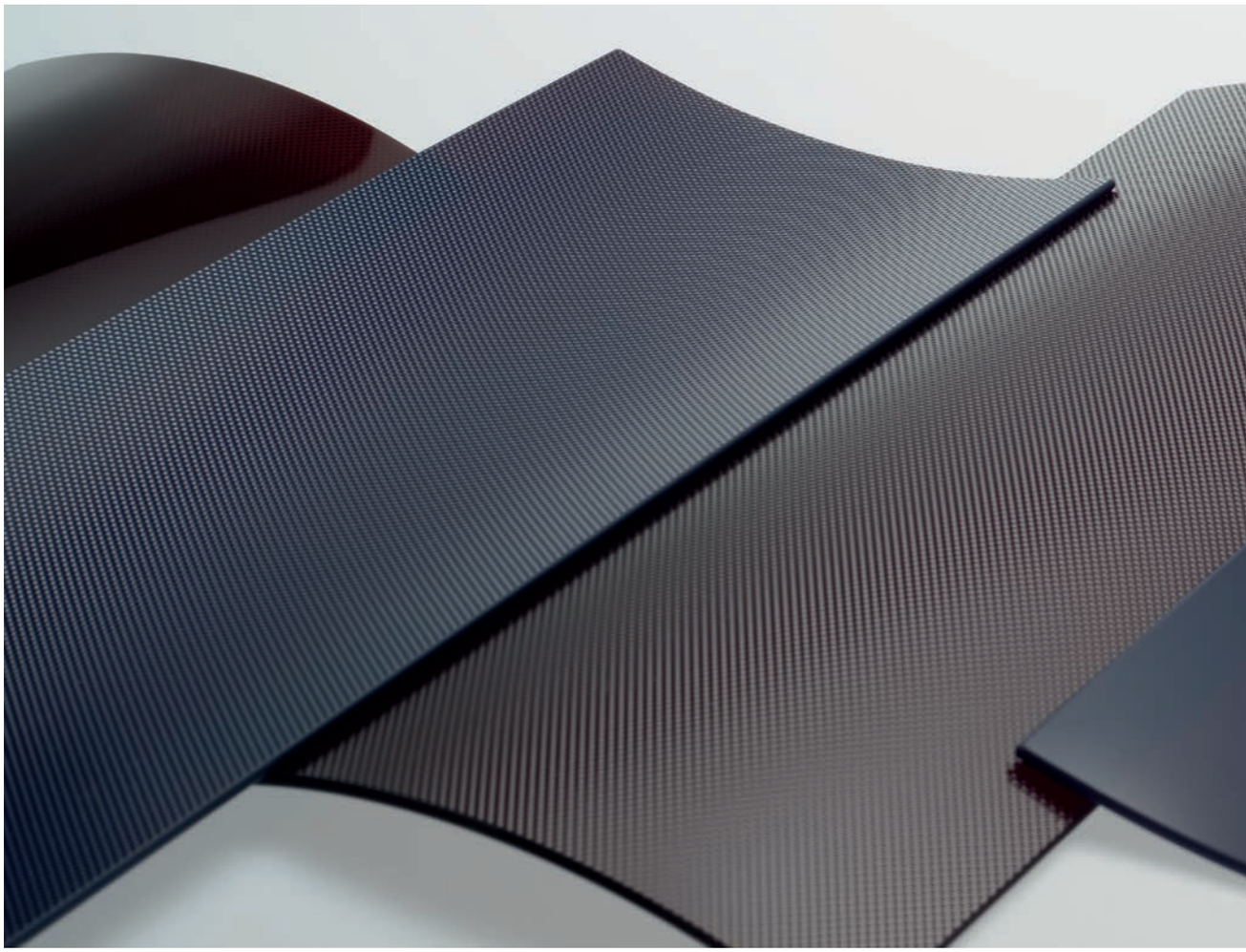
Specific electrical volume resistance (DIN 52326)		
log p $_{(250\ °C)}$	Ω · cm	6.6 – 7.2
log p $_{(350\ °C)}$	Ω · cm	5.2 – 5.7
t $_{K100}$	°C	175 – 207

$\epsilon_{R\ (1\ MHz,\ 25\ °C)}$	**6.5 – 7.8**	Dielectric constant (DIN 53483)
tan δ $_{(1\ MHz,\ 25\ °C)}$	**0.002 – 0.02**	Dielectric loss tangent (DIN 53483)

Acoustic characteristics

$V_{Long.}$ [m/s]	**6,300 – 6,700**	Acoustic velocity (ASTM C-1259)

The acoustic velocity value is valid for longitudinal propagation of acoustic waves and is a calculated value, using measurements according to the referred standard.



NEXTREMA® is open for your ideas

Can you imagine NEXTREMA® being used in your product solution or project?
Then do not hesitate to contact us for further technical evaluation and consultancy.

We will gladly be of assistance:

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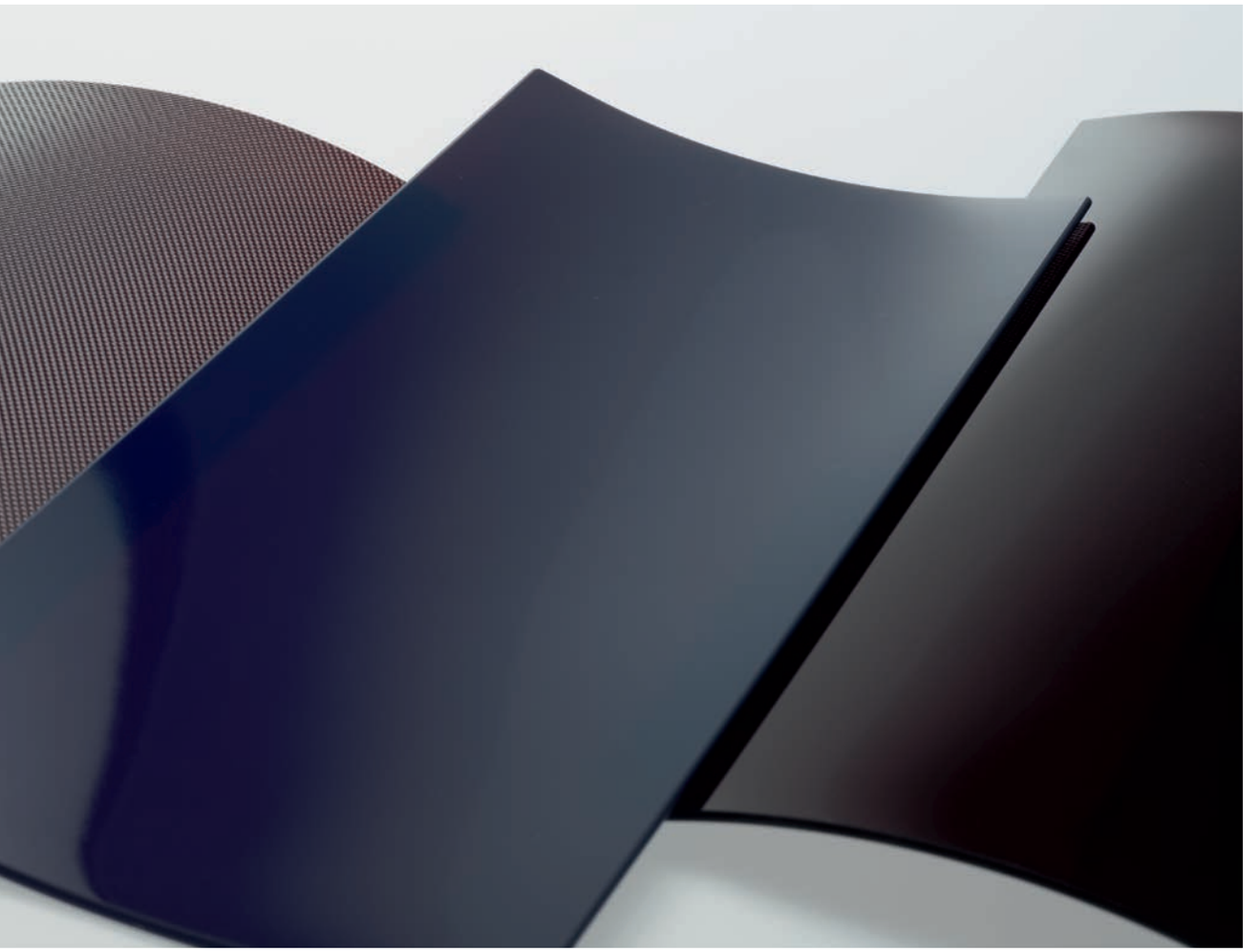
www.schott.com/nextrema



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50127 ENGLISH/US 04/2019 ali/schmidt Printed in Germany