

The background of the entire page is a close-up photograph of several glass wafers. The wafers are circular and appear as overlapping, semi-transparent blue discs. The lighting creates a gradient from a deep blue at the edges to a lighter, almost white center, highlighting the smooth, polished surfaces and the slight thickness of the glass. The composition is abstract and geometric, focusing on the curves and layers of the material.

SCHOTT
glass made of ideas

Glass Wafer

SCHOTT is an international technology group with more than 125 years of experience in the areas of specialty glasses, materials and advanced technologies. With our high-quality products and intelligent solutions, we contribute to our customers' success and make SCHOTT part of everyone's life.

SCHOTT Advanced Optics, with its deep technological expertise, is a valuable partner for its customers in developing products and customized solutions for applications in optics, lithography, astronomy, opto-electronics, life sciences, and research. With a product portfolio of more than 100 optical glasses, special materials and components, we master the value chain: from customized glass development to high-precision optical product finishing and metrology.

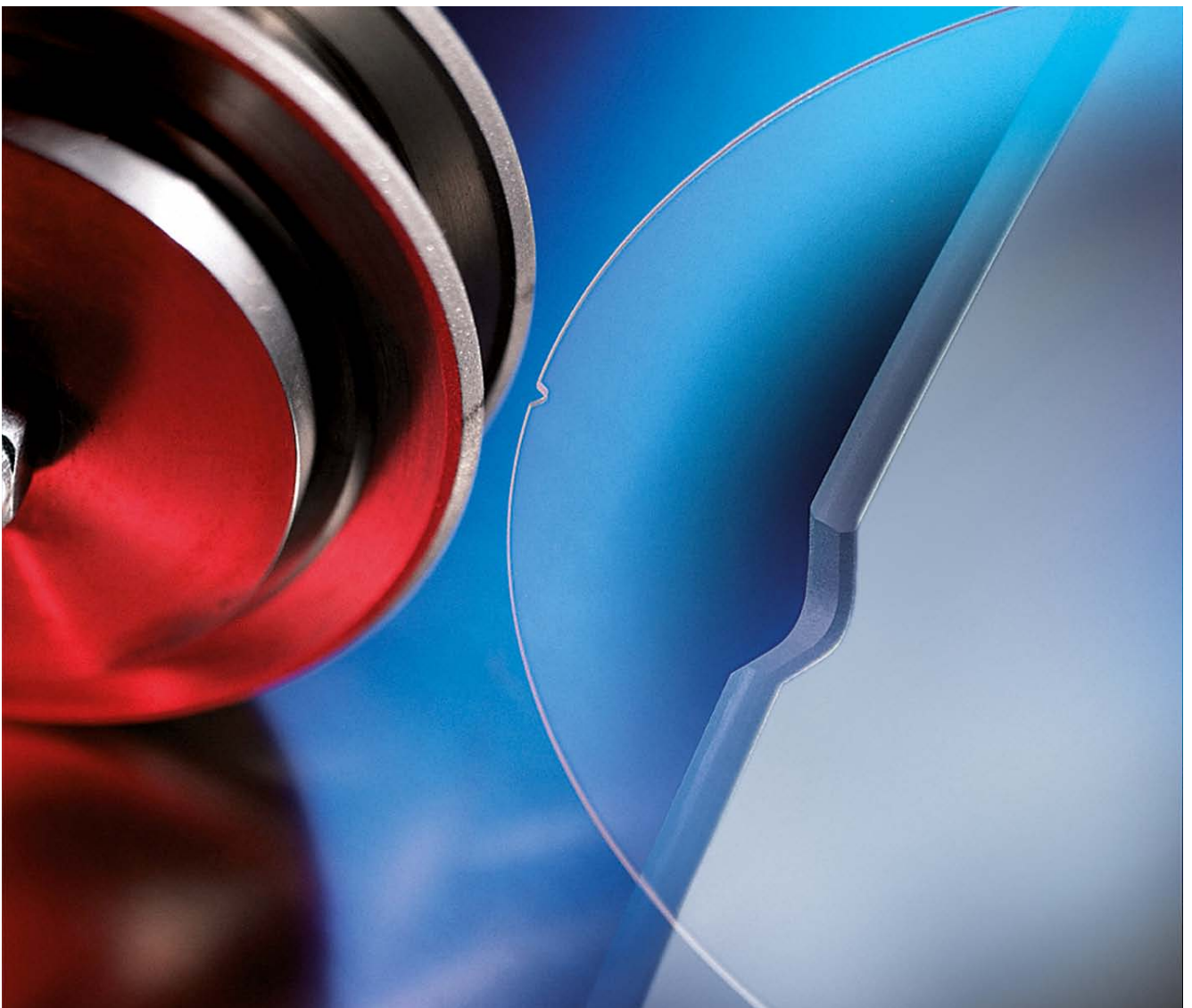
SCHOTT: Your Partner for Excellence in Optics.

Unique Wafer Portfolio with Solutions for Your Applications

As “Your Partner for Excellence in Optics” Advanced Optics holds very close relationship with its customers and develops solutions and products reflecting the market’ needs.

This is a reason why SCHOTT is today the world’s leading supplier of thin and ultra thin glass wafers made of different materials in sizes between 4” and 12” with different surface qualities and customized features. Applying proprietary production processes, leveraging a selection of different materials and the continuous expansion of state-of-the-art processing capabilities make our wafer-offerings unique in the industry.

Our wafer-offerings and processing technologies are presented in this catalog.



Typical Applications

Wafers are used in a great variety of applications within the Semiconductor, Electronics and Biotech industry.

Wafers can be found in nearly every CMOS (complementary metal oxide semiconductor) or CCD (charges coupled device) image sensor in the market of smart phones, tablet PCs and digital cameras. The combination of semiconductor image sensors and SCHOTT glass wafers in state-of-the-art packaging technologies such as Wafer Level Chip Size Packaging (WLCSP) meets the demands for smallest form factors and highest quality levels.

Thin glass wafers are also used as carrier substrates and spacers for compact and cost efficient lens systems. For other applications like MEMS (micro electro mechanical systems) sensors in automotive and consumer products SCHOTT is supplying structured glass wafers with holes or cavities to meet the specific needs of those products.

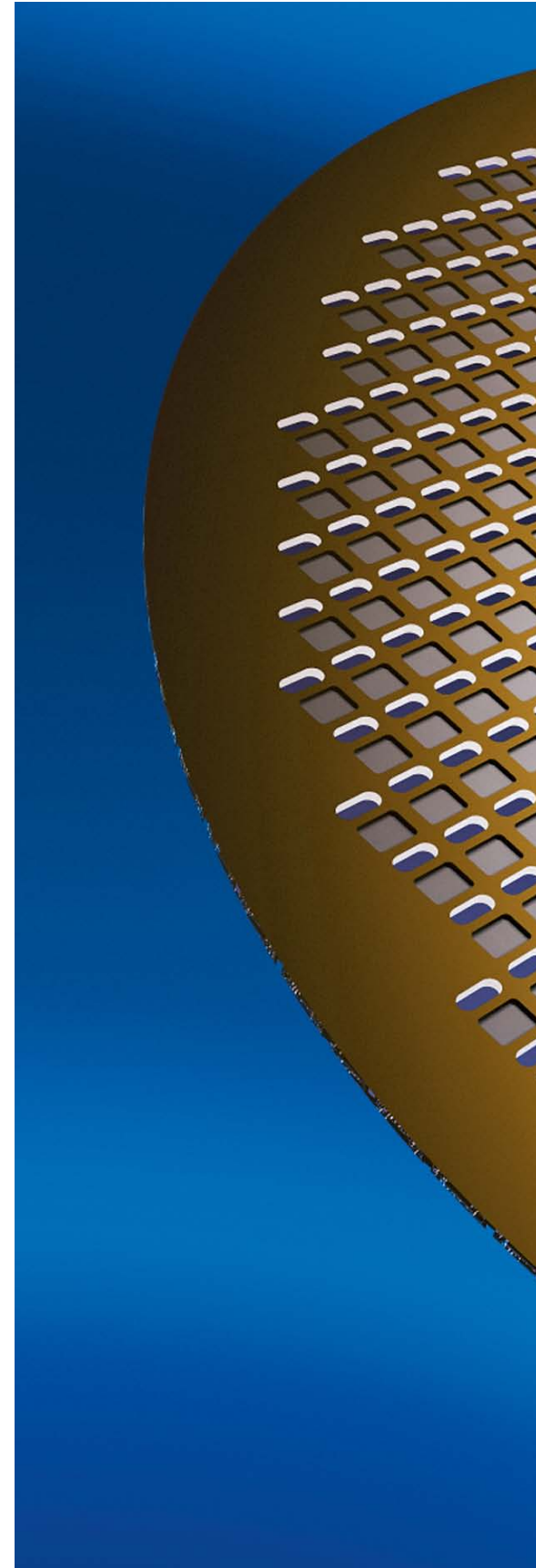
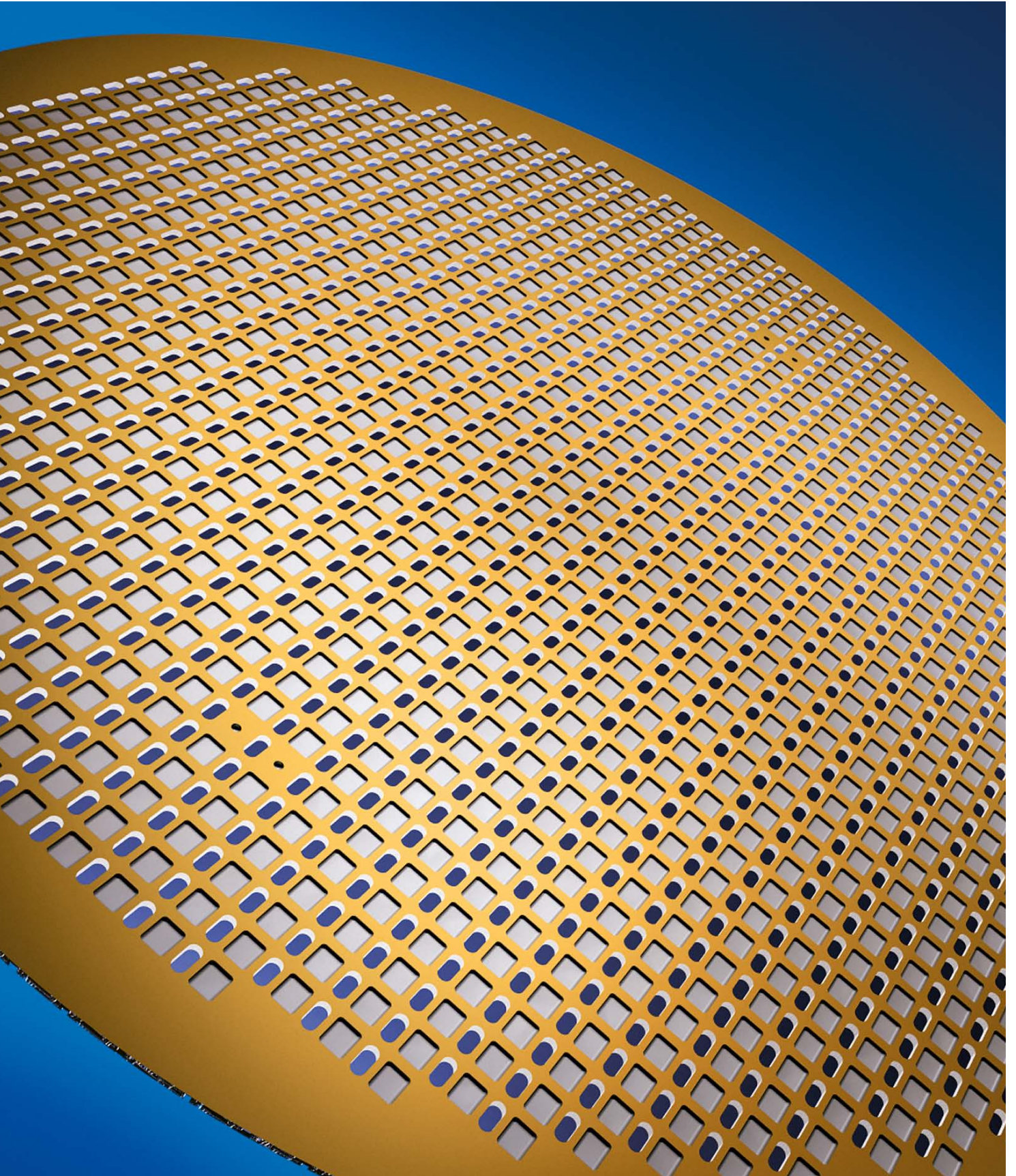


Figure 2
Structured glass wafer





Thin Glass at SCHOTT

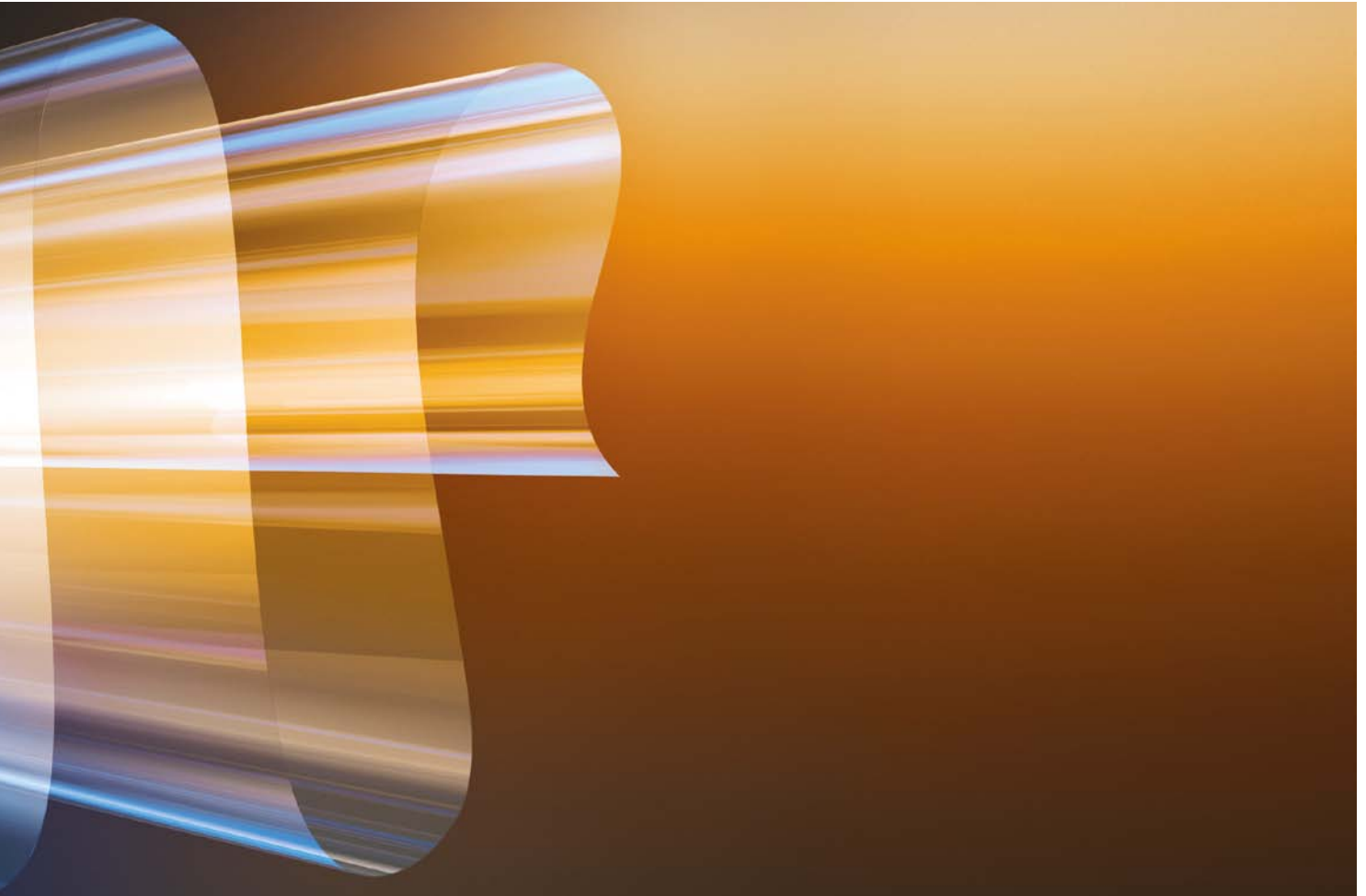
SCHOTT has a long standing history in producing thin glass and developed various proprietary production processes. The thinnest glass substrates available from SCHOTT are less than 50 µm in thickness and will soon be even commercially available on a reel.

This expertise forms the principle pillar for being the leading supplier for Wafers. The relevant materials for our wafer-offerings are made in a special down-draw process. Detailed characteristics of these glass types (AF 32[®] eco, D 263[®] T eco, MEMpax[®]) are presented on the following pages.



SCHOTT is also contributing to environmental safety and sustainability and offers the “green” glass types AF 32[®] eco and D 263[®] T eco from a melting process which does not utilize any hazardous refining agents.

Through offering such eco glass types SCHOTT has done a major step in supporting the realization of “green” end-user products.



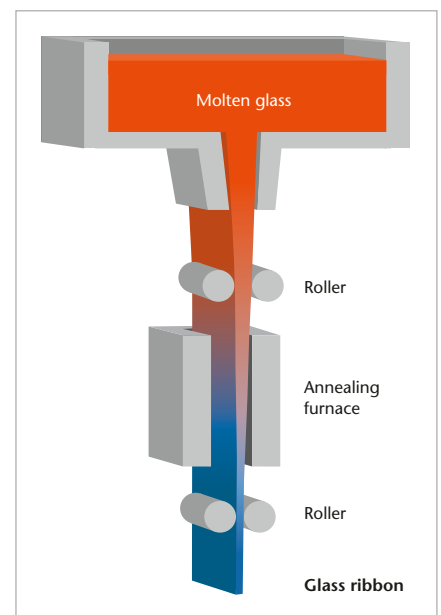
Down-Draw Process

The key characteristics of the down-draw process (AF 32[®] eco, D 263[®] T eco, MEMpax[®]) are:

- Fire-polished surface with surface roughness < 1 nm
- Wide thickness range, from 1.1 mm down to 25 μm
- Fast changeover between different glass types
- High flexibility regarding throughput and thickness

Figure 3
Thin glass (50 μm)

Figure 4
Down-Draw process at SCHOTT



AF 32[®] eco Thin Glass



Technical Data	
Dimensions	Round and square custom size wafer formats, e.g. 6", 8" or 12"
Thickness	0.03 mm up to 1.1 mm
Luminous transmittance τ_{vD65} (d = 0.5 mm)	91.9%
Coefficient of mean linear thermal expansion α (20 °C; 300 °C) (static measurement)	$3.2 \cdot 10^{-6} \text{ K}^{-1}$
Transformation temperature T_g	717 °C
Dielectric constant ϵ_r at 1 MHz	5.1
Refractive index n_D	1.5099
Density ρ (annealed at 40 °C/h)	2.43 g/cm ³

Specifications

- CTE matching silicon
- High transmittance
- Fire-polished surface with low roughness
- Environmentally friendly production without hazardous refining agents

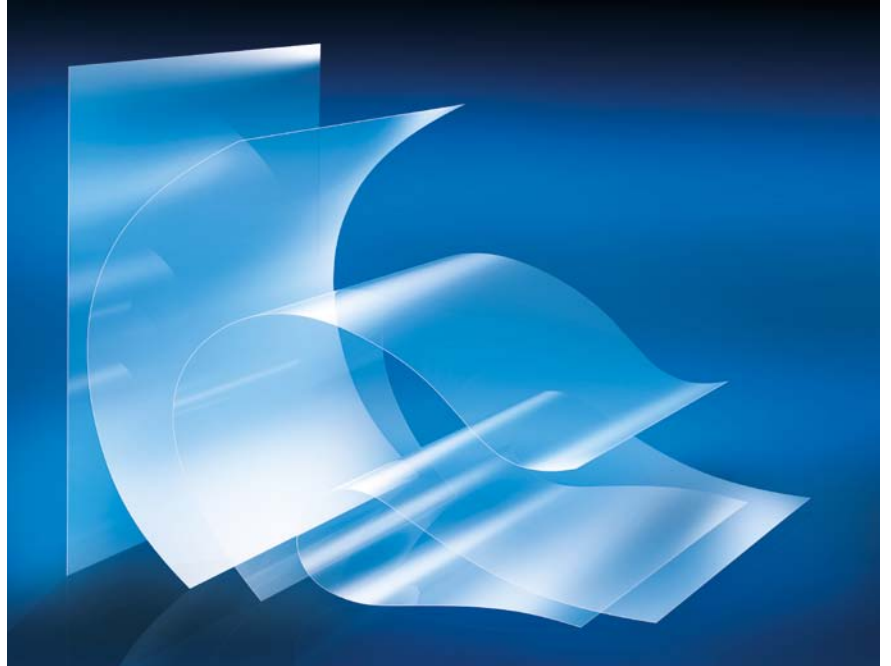
Applications

- Wafer Level Chip Size Packaging
- Wafer Level Optics
- Microsheet

Forms of Supply

- Wafer from 4" to 12" diameter
- Sheet up to 300 mm x 300 mm
- Microsheet on reel (sampling)

D 263® T_{eco} Thin Glass



Technical Data

Dimensions	440 mm x 360 mm, other size on request
Thickness	0.03 mm up to 1.1 mm
Luminous transmittance τ_{vD65} (d = 1.1 mm)	91.7%
Coefficient of mean linear thermal expansion α (20 °C; 300 °C) (static measurement)	$7.2 \cdot 10^{-6} \text{ K}^{-1}$
Transformation temperature T_g	557 °C
Dielectric constant ϵ_r at 1 MHz	6.7
Refractive index n_D	1.5230
Density ρ (annealed at 40 °C/h)	2.51 g/cm ³

Specifications

- High chemical resistance
- Stable against sunlight and heat
- High luminous transmittance
- Environmentally friendly production without hazardous refining agents

Applications

- Resistive touch panel applications
- Substrate glass for IR cut-off filter for camera modules in mobile phones
- Microsheet

Forms of Supply

- Wide range of thicknesses
- Variety of in-stock sizes and shapes
- Microsheet on reel (sampling)

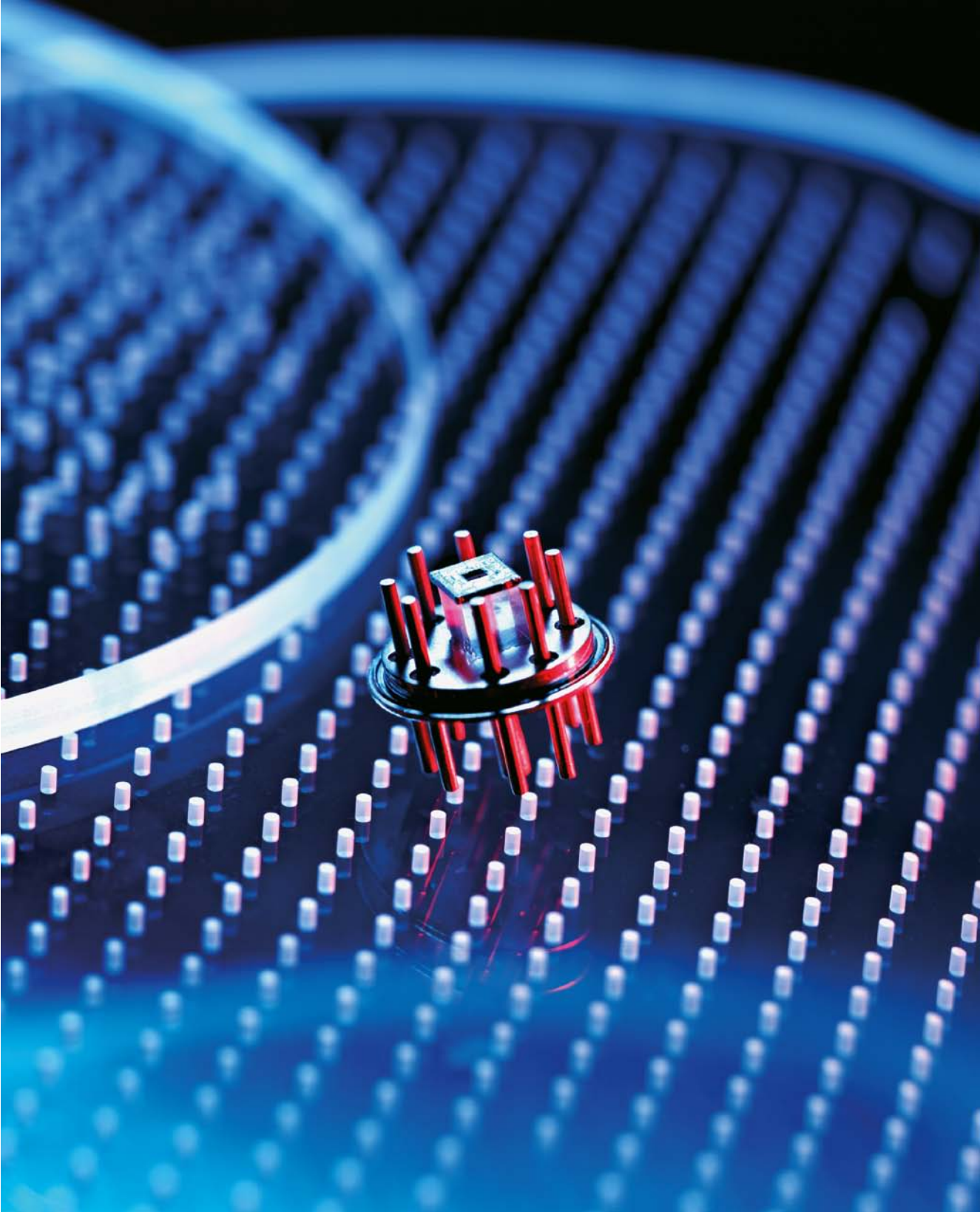


Figure 5
Structured wafer for sensor application

MEMpax®



Technical Data

Dimensions	6", 8" or 12" Wafer
Thickness	0.1 mm to 1.1 mm
Luminous transmittance τ_{vD65} (d = 0.5 mm)	91,7%
Coefficient of mean linear thermal expansion α (20 °C; 300 °C) (static measurement)	$3.25 \cdot 10^{-6} \text{ K}^{-1}$
Transformation temperature T_g	525 °C
Dielectric constant ϵ_r at 1 MHz	4.6
Refractive index n_D	1.4714
Density ρ (annealed at 40 °C/h)	2.2 g/cm ³

Specifications

- Fire-polished surface
- CTE matching silicon
- High thermal stability
- Enabling anodic bonding with silicon wafers
- Excellent transmission
- Physical and chemical properties identical with Borofloat® 33

Applications

- MEMS
- Wafer level packaging
- Biotechnology
- Optical sensors
- Lighting solutions

Forms of Supply

- 6", 8" or 12" wafer

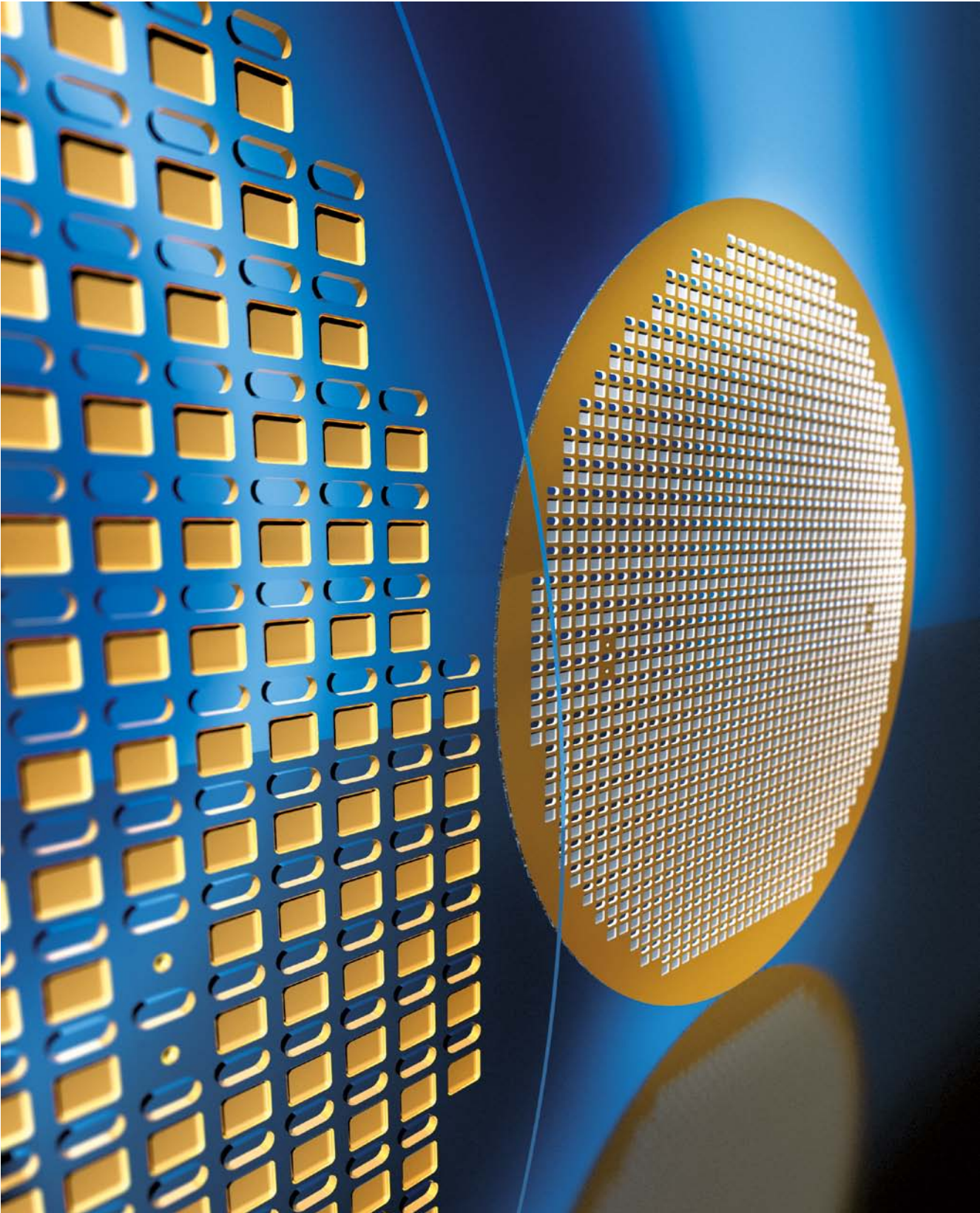


Figure 6
Structured glass wafer

Main Competences in Glass Wafer Processing

Besides offering wafers made of different materials and different sizes SCHOTT has built up extensive experiences and know-how in glass processing.

Learning from a SCHOTT history of glass melting and processing of more than 125 years and leveraging a strong network with experts and partners SCHOTT is able to offer wafers in almost any customized structure, surface quality and with individual features. This makes our products unique!

Here you find an overview, details of our competencies are given on the following pages.

Process capabilities



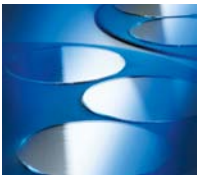
Cutting

- Laser or Diamond Cutting
- Wafer sizes 4" – 12" (round)
- Substrates up to 400 x 500 mm



Edge Treatment

- Flat or Notch
- C- or facet shape
- Seaming



Surface Refinement

- Polishing or Lapping
- Coating



Structuring

- Ultrasonic Lapping
- Powder Blasting



Washing Process

- Ultrasonic Washing
- End cleaning with DI water



Clean Room Packaging

- Clean Room Production
- Inspection and Measurement under Clean Room Conditions
- Packaging into flow boxes

Our Competencies in Detail

Polishing

With our state-of-art polishing operations and long experience in polishing of thin glass, we can meet and exceed all industry standards and customer requirements.

Properties	Fire polishing	Standard polishing	Advanced polishing
Materials	AF 32® eco D 263® T eco MEMpax®	AF 32® eco D 263® T eco BOROFLOAT® 33	AF 32® eco D 263® T eco BOROFLOAT® 33
Edge grinding	Cut C-shape Facet	C-shape Facet	C-shape Facet
Notch	Possible	Possible	SEMI
TTV	≤ 5 μm	≤ 10 μm	< 2 μm to 5 μm
Flatness (warp)	Depending on raw material	≥ 20 μm	10 μm to 20 μm
Roughness (Ra)	< 0.8 nm	< 2 nm	≥ 5/1 to 10/5 (> 3 μm to 5 μm visible)
Surface defects (Scratch/Digs) according to MIL-PRF 13830B	≥ 5/1 to 10/5 (cut 40/10)	≥ 10/5 to 20/105	≥ 5/1 to 10/5 (> 3 μm to 5 μm visible)

Table 1
Options for polishing

Structuring

With the Powder blasting technology and the Ultrasonic lapping process SCHOTT has established a variety of capabilities to provide specific solutions for structured glass wafers.



Figure 7
Sonotrode

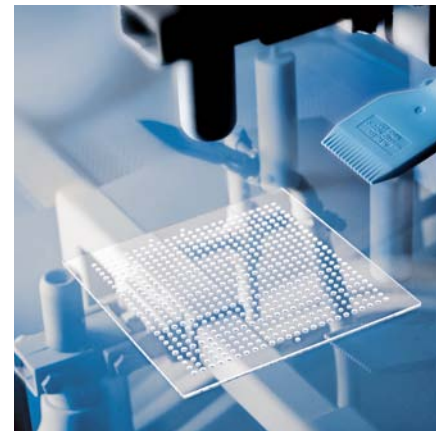


Figure 8
Structured substrate

Table 2
Process capabilities

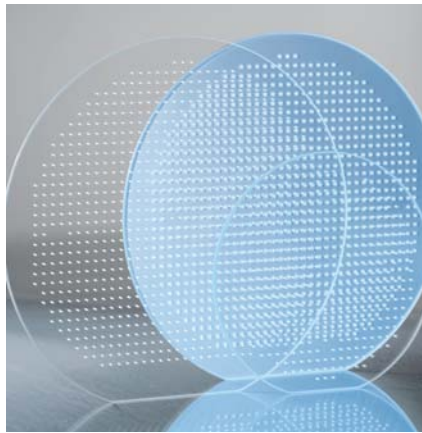
	Ultrasonic lapping	Powder blasting
Size	100 mm to 200mm	Max. 400 mm x 400mm
Thickness range	0.4 mm up to 3 mm	0.05 mm up to 3 mm
Different hole configurations	Round holes	Round, rectangular holes and caverns
Positioning tolerances	± 65 µm*	± 65 µm*
Min. hole diameter	0.4 mm	0.1 mm

*Tighter tolerances on request

Edge Treatment

Our expertise in edge treatment offers the choice between flat and notch orientation marking according SEMI industry standards. Wafer edges can be processed to C-shape or facet shape.

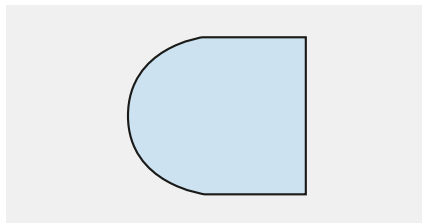
Options for edge processing



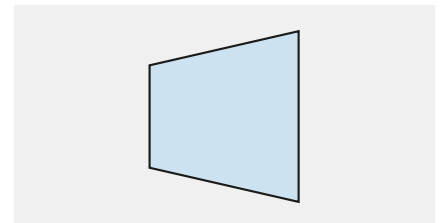
Flats



Notches



C-Shape



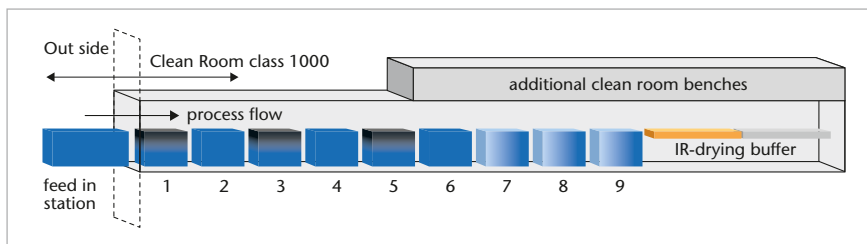
Facet Shape

Ultra Sonic Washing

Our expertise in ultra sonic washing under clean room conditions enables us to provide highest precision and to deliver products into the semiconductor industry.

Key characteristics of the washing process

- High cleaning results with sour and alkaline cleaner
- End cleaning with DI-Water
- Drying with Infrared lamps
- Situated in a clean-room (Class 1000) and packaged in flowboxes (class 100)



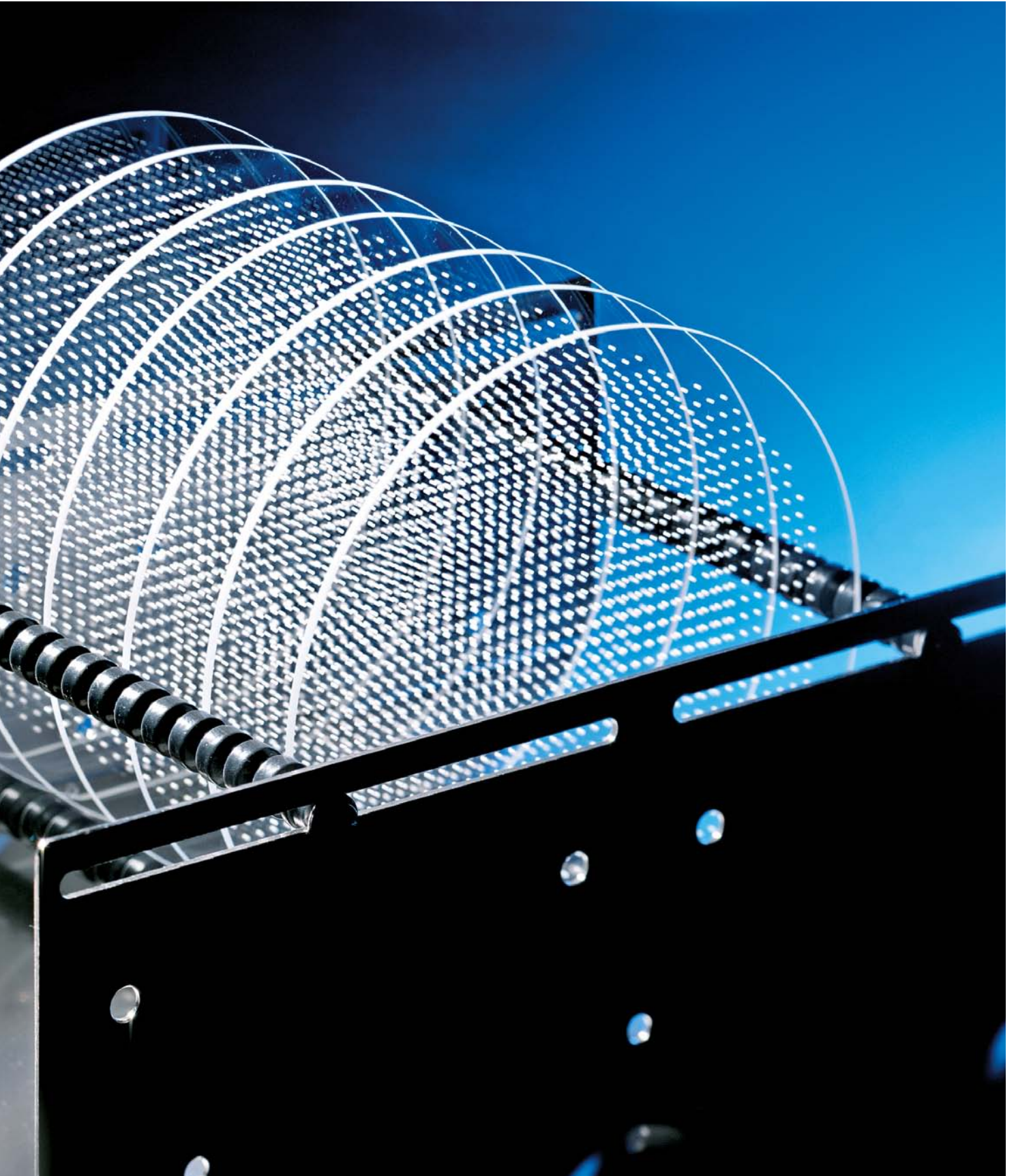
Clean Room Packaging

We have the capability of Clean Room Production where all wafers are inspected under clean room conditions (class 1000) using special measurement and testing instrumentation. Wafers can be packed in wafer shipment boxes (flow boxes) and under clean room condition.

Figure 9
Ultra sonic washing process

Figure 10
Carrier with structured glass wafers





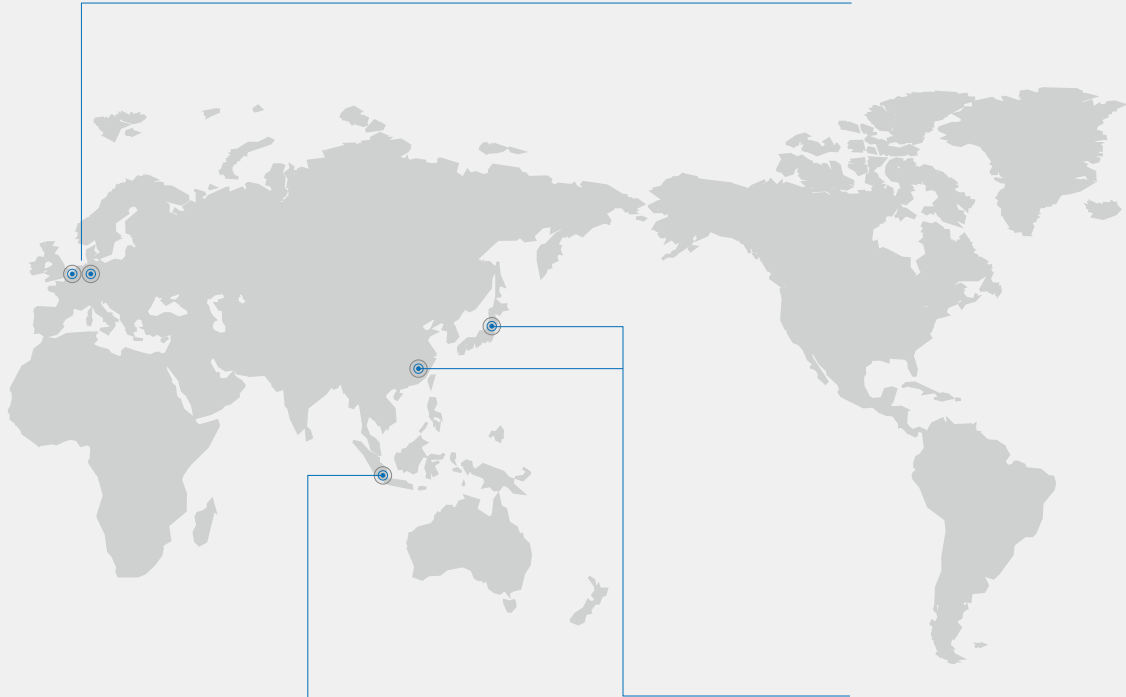
Wafer Manufacturing Network



Advanced Optics
SCHOTT AG
Mainz, Germany
*Headquarter, R & D,
Product Management*



Advanced Optics
SCHOTT AG
Grünenplan, Germany
*Production & Thin Glass
Competence Center*



SCHOTT
*Customer Service &
Technology Center*
China, Japan



SCHOTT Glass Malaysia Sdn. Bhd.
SCHOTT Glass Malaysia Components Sdn. Bhd.
Perai, Penang, Malaysia
Wafer Processing, Polishing, Structuring

Quality Assurance

Quality control is based on statistical process control, as well as on rigorous final inspection of the finished component. Glass properties are measured for every melt. Measurement instruments include a broad range of interferometers, spectrophotometers, physical property test systems, vision systems, and a laser test bed.



Figure 11
 EN ISO 9001:2008 Certificate

Advanced Optics

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