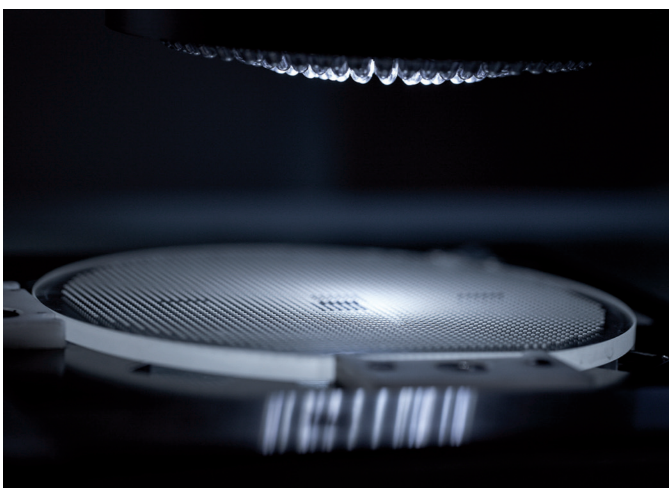
BOROFLOAT® 33 & Glass Wafers: A Union of Inspiration & Quality

The sum of its properties is what makes it unique.

More than 20 years ago, SCHOTT set up the first micro-float production line for what would soon become one of the most influential specialty glass materials. The result was BOROFLOAT® – the world's first floated borosilicate glass. With high-quality German engineering at its core, BOROFLOAT® quickly became an outstanding example of what seamless interaction between advanced know-how, innovative technology and professional curiosity – all in combination with the developmental drive of our team of experts – can deliver.

The performance requirements for glass wafers used for anodic bonding or as carrier wafers in wafer thinning processes are mainly determined by their ability to perfectly match those of the silicon wafer to which they shall be permanently or temporarily bonded. Well-adapted thermal expansion behaviour is as important as excellent flatness and process robustness. BOROFLOAT® glass wafers provide such outstanding material properties along with exceptionally high UV transmission – a special requirement for high speed laser de-bonding processes.



BOROFLOAT® is one of the leading, most well-established glass wafer materials used in the semiconductor industry today.

BOROFLOAT® - The sum of its properties is what makes it unique for glass wafers

- Outstanding thermal resistance
- Exceptionally high transparency
- High chemical durability
- Excellent mechanical strength

Glass wafers made of BOROFLOAT® glass offer outstanding thermal resistance

The glass composition of BOROFLOAT® is tailored to perfectly match the thermal expansion coefficient of silicon which is essential for good bonding behavior.

Wafers are often exposed to thermally changing environments during processing. The low coefficient of linear thermal expansion (C.T.E.) allows BOROFLOAT® glass wafers to easily handle elevated temperatures and – often even more importantly - sudden thermal changes without breaking or warping.

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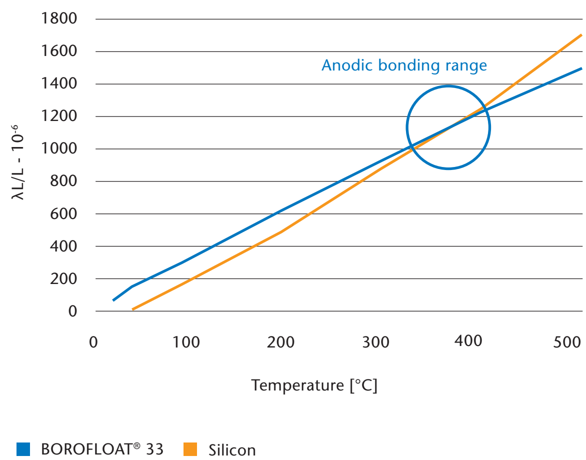
Thermal expansion



Thermal properties

Coefficient of	
Linear Thermal Expansion (C.T.E.) $\alpha_{(20 - 300\ °C)}$	$3.25 \times 10^{-6}\ K^{-1}$ *
Specific heat capacity $c_{p\ (20 - 100\ °C)}$	0.83 kJ/(kg·K)
Thermal conductivity $\lambda_{(90\ °C)}$	1.2 W/(m·K)

* According to ISO 7991.

Maximum operating temperatures

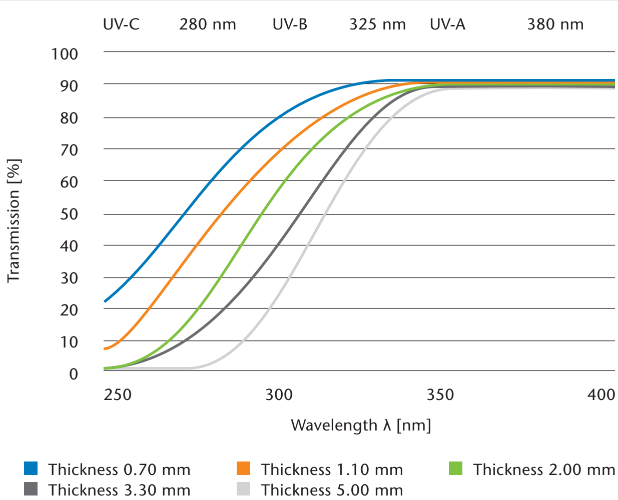
Maximum Operating Temperature	
For short-term usage (< 10 h)	500 °C
For long-term usage (≥ 10 h)	450 °C

* The maximum operating temperaturesfor BOROFLOAT® should be seen in conjunction with RTD (Resistance to Thermal Differences) and RTS (Resistance to Thermal Shock) values. Such values and test methods are available on request.

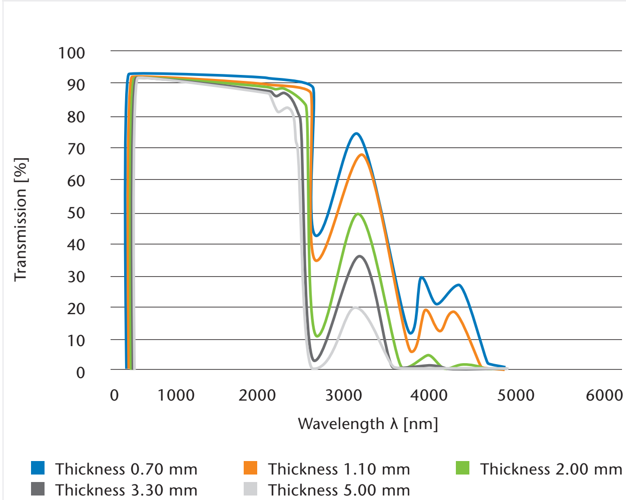
Carrier wafers with unmatched light transmission allow for exceptional UV bonding

Laser de-bonding through glass carrier wafers offers the fastest de-bonding time as well as a good price / performance ratio. Deep UV light transmission at the relevant laser wavelength range is crucial for the principal feasibility and efficiency of this type of wafer de-bonding. The laseractivated release will be achieved through irradiation using a 248 nm or 308 nm excimer laser. Extra-low iron BOROFLOAT® glass of desirable 0.5 mm carrier thickness shows over 90 % transmission at 308 nm and still over 35 % for 248 nm, thus significantly outperforming other thin flat glasses.

Transmission in UV range



Transmission



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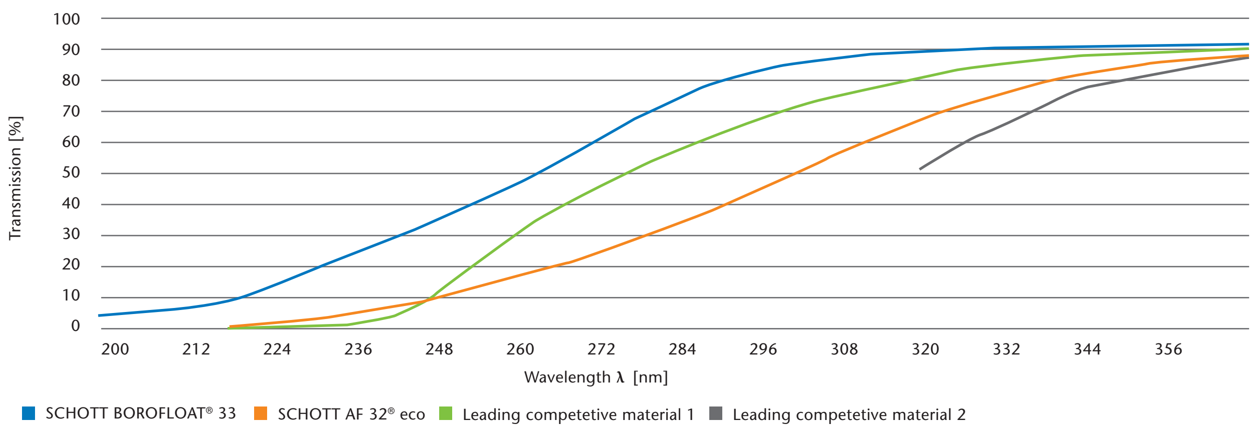
UV-Transmission for typical carrier wafer thickness 0.5 mm



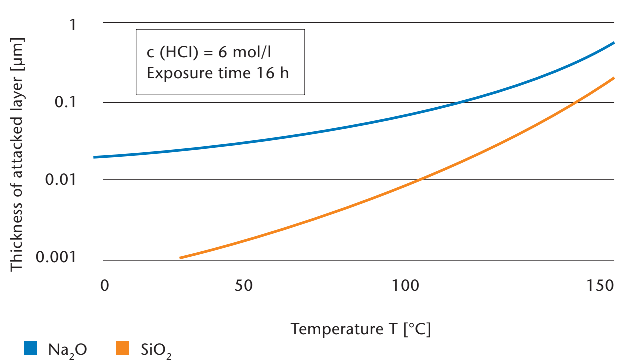
Acids, alkalis and organic substances have virtually no negative impact on BOROFLOAT® glass wafers

Outstanding chemical resistance is another critical feature given that wafers are exposed to many chemicals throughout the highly sophisticated etching and chemical mechanical planarization (CMP) processes. In certain technologies, mask-based chemical etching technologies using an aggressive cocktail of corrosive chemicals are also applied in order to create high definition surface channels where the high chemical durability of BOROFLOAT® 33 is key to deliver perfectly shaped design structures of unmatched accuracy with controlled channel depth.

Chemical resistance

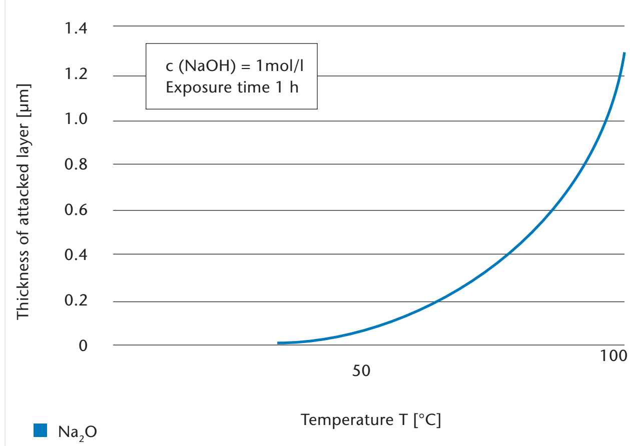
Hydrolytic resistance	(according to ISO 719 / DIN 12 111)	HGB 1
	(according to ISO 720)	HGA 1
Acid resistance	(according to ISO 1776 / DIN 12 116)	1
Alkali resistance	(according to ISO 695 / DIN 52 322)	A 2

Resistance to acids



Acid resistance of BOROFLOAT® 33 as a function of temperature (very low loss of mass).

Resistance to alkalis



Alkali resistance of BOROFLOAT® 33 as a function of temperature (moderate loss of mass).

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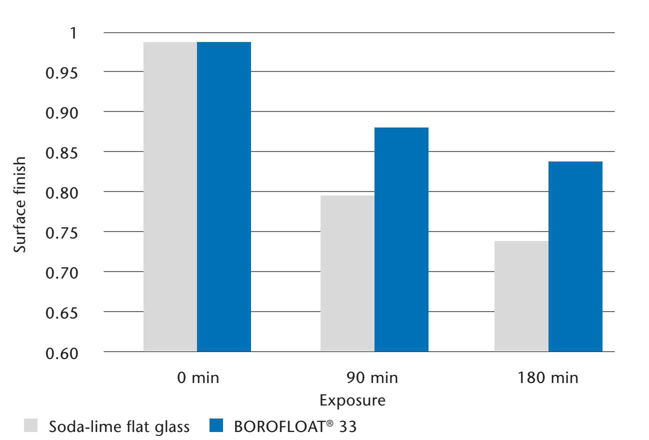
Glass wafers made of BOROFLOAT® stand out for their reliable process robustness

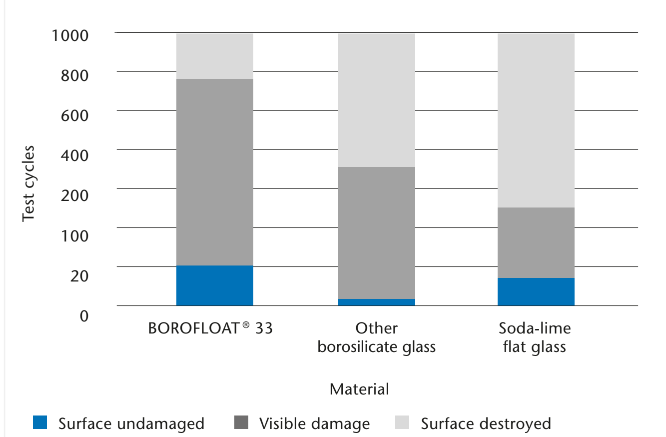
Many wafers require microstructures which are often created via ultrasonic drilling, powder blasting or a combination of photolithography and dry etching. Mechanical strength and stability during a process where thousands of accurate features have to be machined are essential in order to produce high precision textured wafers with a consistently perfect surface pattern and accurate size. As shown in the graph below, BOROFLOAT® glass has an exceptional abrasion resistance compared to other alternative substrates.

Comparison of sand abrasion BOROFLOAT® 33 & soda-lime flat glass



According to a study conducted by the Fraunhofer Institute for Applied Optics and Precision Engineering, BOROFLOAT® 33 displayed the highest resistance to mechanical forces in comparison to other Materials.

Resistance to abrasion



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