SCHOTT
glass made of ideas

CONTURAN®

Technical Glazing

Pioneering. Responsibly. Together. These attributes have characterized SCHOTT, manufacturer of special glass, glass-ceramics and other innovative materials, for over 130 years. As #glasslovers and inventor of special glass, we are reliable partners for high-tech industries to enable new market launches and applications. Our goal is to become climate neutral by 2030.

SCHOTT works closely with architects and designers to extend the boundaries of design and create new opportunities for building culture – in terms of design and space, indoors and outdoors, aesthetics and functionality. That's what makes SCHOTT a qualified partner for architecture.

Cover: Display in Split, Croatia, equipped with CONTURAN® from Infinitus Ltd, imotion G6 outdoor LCD technology

Contents

All-rounder for your technical glass requirements

Technical glass from SCHOTT provides diverse protection for a range of different applications while being practically invisible. Find out all about the full range of innovative products we have to offer!

Everywhere we turn in the modern world we come across glass with astonishing qualities: it's becoming increasingly tougher, thinner and lighter. Glass continues to get better at protecting us from heat, the cold, ultraviolet light and infrared rays while being so transparent it's almost as if it isn't there.

Such intelligent, innovative properties of glass as an all-rounder product should also be available for special technical applications. This is what the technology company SCHOTT is all about with its more than 130 years of experience in glass engineering. We are pushing the boundaries to make glass an even better material for our customers' applications.

Our experts can advise you according to your specific needs – for a range of applications such as, the medical sector, refrigerator doors in supermarkets, touch applications, digital signage and lighting applications. From the wide spectrum of glass substrates, processing and finishing options, we can provide you with the right solution for your requirements.

Do you need an **anti-reflective glass** which provides minimal reflectance while allowing an optimal transmittance of light? **CONTURAN®** has demonstrated its worth on the market for more than 30 years in a multitude of variations and has an almost invisible appearance. It is perfect for applications such as displays for the medical and industrial sectors, for refrigeration and freezer appliances, and for lighting applications which require minimal disruptive ambient light and maximum light transmittance.

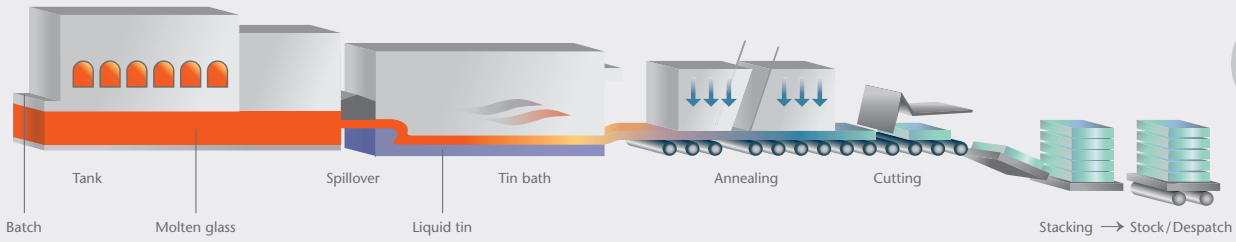
Discover on the following pages all about our detailed technical glass expertise and how its manufactured: from molten glass to display cover glass, from products with unique properties and the diversity of their applications.


SCHOTT CONTURAN®
From molten glass
to cover glass

Expertise from molten glass to cover glass

SCHOTT is much more than just a glass manufacturer. Our expertise covers the entire process chain from glass production and mechanical processing through to a broad spectrum of finishing. This enables us to create solutions for your technical glass requirements. Made in Germany.

Glass production: float glass process



Float glass process: The standard
Flat glass in large quantities is usually made using a float glass process. Liquid molten glass flows over a bath of tin, evenly disperses and slowly cools to create extremely smooth, homogeneous surfaces and with an ultra uniform thickness. A range of different glass types of can be "floated" in this way.

Soda-lime glass: Versatile
The basis for conventional float glass is generally soda-lime glass, often used in both technical and non-technical applications such as windows in buildings or windscreens for vehicles. This solution has the benefits of solid optical, mechanical and chemical properties, globally available and relatively inexpensive production costs. Float glass is offered in various types (e.g. light green or grey), in standard thicknesses from 1 – 19 mm and in standard sizes of up to 3.21 m x 6.00 m.

The glass alone cannot be used for special applications but with additional finishing – e.g. a coating with special optical properties – it can deliver what is required.

Special requirements need special glass with particular material formulations and properties which exceed those of soda lime glass.

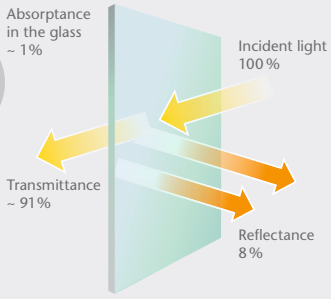
BOROFLOAT®: High quality
BOROFLOAT® is a tried and tested floated borosilicate glass. It is highly transparent with outstanding thermal resistance, high chemical durability and excellent mechanical strength. Its properties make it suited to a wide range of applications in laboratories and households, in optics, photonics, and optoelectronics. As a technical glass, it is primarily used in lighting applications and is able to withstand the extremes of temperatures associated with this usage.

Aluminosilicate glass: Resistant
Floated aluminosilicate glass impresses with its unmatched mechanical resistance. It can withstand impacts and shocks and offers the highest levels of flexural strength and scratch resistance. A high level of stability is achieved even in its very thin, light weight form. It is therefore ideal for mobile devices and is often used in combination with touch functions.

Surface finishing and their effects

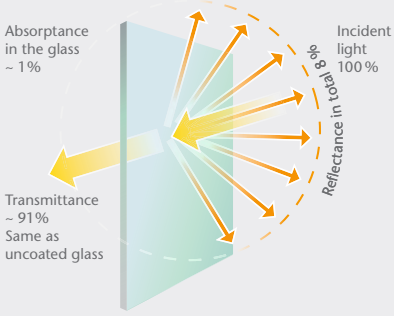
Untreated surfaces

Float glass



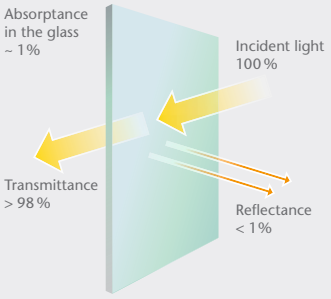
Etched surfaces

Anti-glare glass



Coated surfaces

Anti-reflective glass



For example: CONTURAN®, CONTURAN® Magic

Conventional float glass has dependable but limited optical properties. At just 91% transmittance, a significant amount of light is lost. The smaller share of this (approx. 1%) is absorbed by the glass itself. The other 8 % is reflected by the glass surface. This reflectance is perceived as highly inconvenient especially in applications which require clear viewing. Surface finishing can help here.

Anti-glare glass: Touch specialist
Chemical etching gives float glass a slightly diffused, roughened surface. This disperses reflections across a larger solid angle so that the remaining reflections seem less disruptive at any position taken by the viewer – transmittance and reflectance values remain the same as for float glass. Anti-glare glass is relatively insensitive to dirt or finger marks and is therefore especially suited to touch applications. It also has advantages for outdoor applications especially for bright, pointed and ambient light conditions.

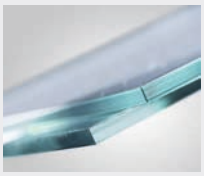
Anti-reflective glass: The CONTURAN® multi-talent
CONTURAN® anti-reflective glass is a float glass in various types with optical interference properties coated on one or both sides to minimize surface reflections. A special immersion procedure is used to apply multiple metal oxide layer just nanometers thick. Reflectance is reduced optically by up to 90 % and the glass appears invisible. At a transmittance of > 98 %, viewers can then focus on what's important.

CONTURAN® is therefore ideal for any ambient light condition and provides excellent viewing in outdoor applications. Its high level of transmittance makes it a first choice for display and lighting applications.

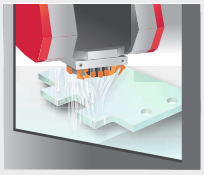
Expertise from molten glass to cover glass

Mechanical processing

CNC edge finishing



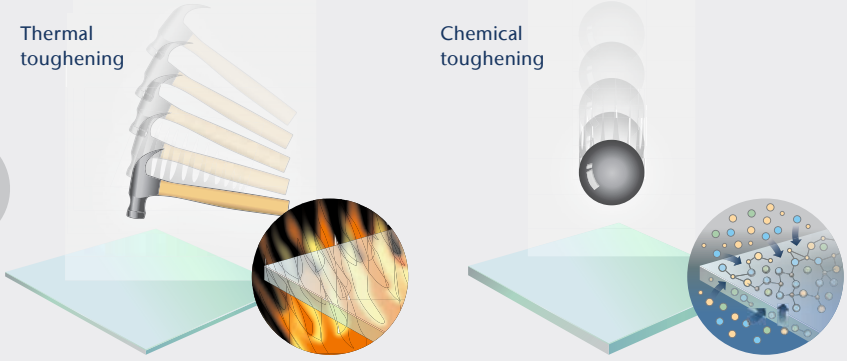
CNC processing



Finishing for display glass

Thermal toughening

Chemical toughening



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Mechanical processing
After surface finishing, the glass is cut and the sharp edges precision processed. The edges generally undergo grinding or polishing.

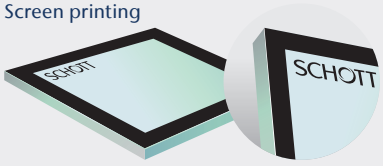
A polished glass edge is required when edges remain visible following installation. This fulfills not only cosmetic purposes, it also increases the mechanical and thermal strength. The diamond tools used for polishing can also be used to incorporate drill holes and cutouts.

Thermally toughened glass
Glass of 3 mm thickness or more has the option of undergoing thermal toughening. In a precisely controlled process, the glass is heated to over 600 °C and then quickly cooled with cold air. The different rates of cooling forms crack resistant compressive pressures on the glass surface and tensile pressures within the glass core. This results in a 3 – 4 times more mechanical and thermal strength compared to non-toughened glass. Tempered safety glass shatters into fine particles, heat strengthened glass into coarser fragments.

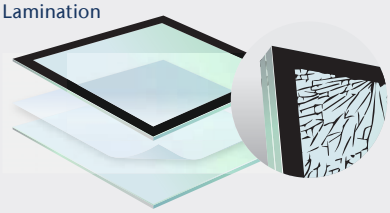
Chemical toughening
Glass of **less than 3 mm** is better suited to undergo chemical toughening. This process also creates surface compressive pressures but through ion exchange in a bath of molten salt. This involves, for example, sodium ions being replaced by much larger potassium ions to achieve toughening.

This process is recommended for thin glass applications in mobile devices requiring high levels of breakage resistance combined with low weight. Optical interference coated CONTURAN® anti-reflective glass can be toughened in this way. As the only one of its type, it permits chemical toughening through the anti-reflective layer.

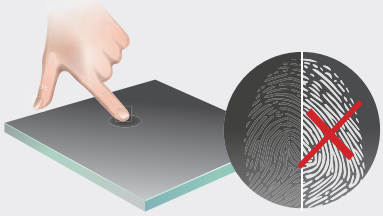
Screen printing



Lamination



DARO coating



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Screen printing
Customer motifs can be applied using screen printing. **Ceramic colours** fuse with the glass surface during thermal toughening to form a practically inextricable bond.

Organic colours can also be used which are solvent based and can, for example, be applied to chemically toughened glass. Colour shades are mixed according to customer requirements or based on the RAL or Pantone standards. Multicolour printing is also possible.

Lamination
Lamination involves the bonding of two or more glass plates in a vacuum using an adhesive layer. This procedure can be carried out after the coating, e.g. to give the glass an anti-reflective surface. Alternatively, it can take place at the end of the processing chain, after cutting, edge processing, printing and toughening. PVB or EVA films are generally used for the adhesive layer which also enable the production of standard compliant safety glass.

Furthermore, functional and design based films can be used to give safety glass additional properties, e.g. improved UV, IR and sound protection or colour effects. Modern safety glass systems also provide switchable functions for sun or privacy blinds.

DARO coating
The durable, anti-reflective and oleophobic DARO coating reduces reflections and finger markings and permits easy cleaning of surfaces – perfect for professional touch displays.

Using a procedure developed by SCHOTT, the easy to clean DARO coating is burnt in at high temperatures into glass that has already anti-reflective. This provides high levels of stability and long service lives.

From medicine to lighting – CONTURAN® triumphs

For a diverse range of anti-reflective glass applications, SCHOTT CONTURAN® delivers.

Medical technology

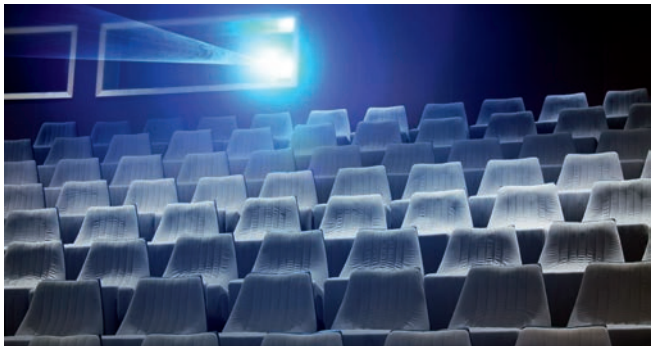
Displays for medical imaging require precise reproduction with the highest levels of screen resolution. CONTURAN® is therefore the first choice product with a multitude of benefits for these display types:

- the highly durable anti-reflective coating delivers clear viewing with no reflection interference
- suitable for high resolution HD and 4K screens
- chemically resistant surfaces allow daily cleaning
- available on mechanically superior aluminosilicate glass for highest levels of safety and protection
- optional easy to clean coating (DARO) for added convenience

Refrigeration and freezer technology

Anti-reflective glass for refrigeration and freezer equipment are excellent for presenting food. Systems using CONTURAN® can offer a multitude of options:

- clear view of the products on show
- increased heat insulation for reduced energy consumption
- long life coating with optional easy to clean surfaces (DARO) to meet the highest routine demands
- high colour rendering index
- for tempered or insulating glass
- special low-e version available
- diverse processing options such as curved glass for counters and cabinets



Lighting and imaging

For lighting technology and imaging devices, such as projectors, anti-reflective cover glass offers the highest levels of light transmittance and unparalleled thermal resistance. CONTURAN®, also based on the high quality BOROFLOAT® glass, can be used here. The benefits:

- optimal transmittance
- high colour fidelity for colour critical applications
- high thermal and chemical resistance
- optional easy to clean coating (DARO)

You are searching for the right glass for your application? We will find it!

Soda-lime float glass, borosilicate glass or aluminosilicate glass – SCHOTT has a product to match any requirement.

Outdoor displays & digital signage
Displays should remain easy to read when used outdoors and in strong sunlight. Cover glasses using an anti-reflective surface have persuasive benefits:
- clearly visible even under strong sunlight due to reduced reflections and high levels of transmittance
- chemically resistant surfaces for any weather conditions
- versions also available in a range of safety classes
- additional UV and IR protection to prevent display damage

Touch displays & industrial controllers
Professional displays used in industry or for touch applications in public spaces must meet the highest of demands. This is achievable using cover glass with anti-reflective surfaces with an optional easy to clean coating (DARO):
- optimal readability of display information even under unfavorable, highly lit conditions
- high levels of transparency, no unwanted reflections
- aluminosilicate glass as a substrate for thin, light weight and robust glass needs
- high levels of mechanical and chemical resistance
- optional easy to clean coating (DARO) with reduced finger and dirt markings

Transportation & traffic
Information displays at rail stations are subject to extreme weather and temperature conditions. Anti-reflective cover glass offers a broad range of protection and a clear view of displayed information:
- highest levels of light transmittance, excellent viewing and optimal readability even in bright sunlight
- chemically resistant surface for any weather conditions
- versions also available in a range of safety classes
- additional UV and IR protection to prevent display damage

All-rounders for technical glazing – The SCHOTT CONTURAN® family at a glance

CONTURAN® Standard
CONTURAN® Magic
Anti-reflective coating, high color rendering index, increased light transmission and improved contrast for displays.

CONTURAN® DARO: Do touch!
Reflections, dirt and fingerprints have no chance against CONTURAN® DARO. Combined anti-reflective and oleophobic surface protection provide glass ideal for professional touch screens.

CONTURAN® Low-e: A clear view of cool things
For manufacturing energy-efficient refrigeration units. In addition to its anti-reflective coating, the glass material also has a thin, pyrolytic low-e coating (low emissivity) which improves thermal transmittance in insulating glass by 40%.

CONTURAN®

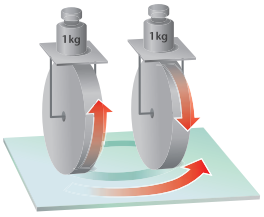
CONTURAN® Tough: The resilient one
CONTURAN® Tough is the only anti-reflective, chemically tempered glass. The product is ideal for mobile applications and HMI (Human Machine Interface) systems.

CONTURAN® BOROFLOAT®: Optimal transmission
CONTURAN® on BOROFLOAT® relies on the outstanding properties of BOROFLOAT® 33 for maximum transmission and highest color fidelity. Supplemented by high thermal and chemical resistance, the result is a glass for special challenges.

CONTURAN® Tough AS: A better choice
Exceptional mechanically and chemically resistant anti-reflective coating on break-proof aluminosilicate glass. Highly shock-resistant also for thin, lightweight glass for demanding requirements in industry and medical technology.

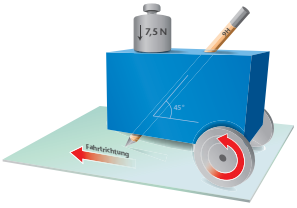
Longterm durability proven with chemical and mechanical tests

Taber Abraser Test



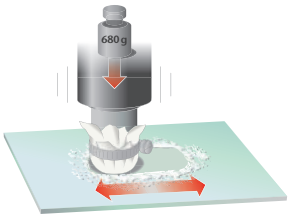
The mechanical durability of CONTURAN® also achieved top marks during testing: CONTURAN® successfully passed both the Taber Abrasion Test based on DIN ISO 3537:2018 (class 1-2) as well as the Tesa Test, highlighting its durability against the forces at play when adhesive tape is ripped from the coating.

Pencil Hardness Test



The Pencil Hardness Test based on ISO 15184 (highest class: 10H) achieved class 10H, a significantly higher score than so far gained by anti-reflective surfaces.

Cheesecloth Rub Test



The Cheesecloth Rub Test is another indicator of the good resistance of the coating. It is based on DIN ISO 9211-4 and simulates moderate abrasion. CONTURAN® shows an outstanding performance with more than 400,000 rubs without any visible effect.

Excellent coating resists also demand for every day cleaning in medical surrounding

CONTURAN® puts to the test

The industry test MFR MED 890 carried out the chemical resistance of the CONTURAN® layer intensively to the test bench.

The test applied standard, medical-sector cleaning agents containing various classes of active ingredients and then examined their impact on CONTURAN® over several hours. The surfaces and their appearance were assessed and evaluated.

Based on this test, we provide recommendations on the majority of the substances tested:

Class of chemical agent	Specific test medium	Result
Alcohol	Incidur-Spray (undiluted), Ethanol (96 % Vol.), Mykrozid liquid (undiluted), Meliseptol rapid (undiluted), Isopropyl (70 %)	✓
Aldehyde	Melsitt (10 % Vol.), Lysoformin (2 % Vol.), Aldasan 2000 (4 % Vol.), Kohrsolin (0.5 % Vol.), Dismozon (0.5 %)	✓
Peroxide compounds	Perform (3 %), Hydrogen Peroxide (3 %)	✓
Pyridine derivative	Spray Activ (undiluted)	✓
Benzine	Benzine / Petroleum ether (undiluted)	✓
Dish liquid	Regular dish liquid (1 %)	✓
Organic acids	Bio-AntiBact med	✓
Limewater	–	✓
Alkylamine	Incidin Plus (8.0 % Vol.)	✓
Quaternary compounds	Mykrozid sensitive liquid (undiluted), Morning Mist (1:64 diluted), Terralin protect (2.0 % Vol.), Microbac® Tissues (direct)	✓
	Taski Sprint DS 5001 (0.5 % Vol.), Sulfanios Fraicheur Citron (0.25 % Vol.)	○
Chlorine derivatives	Sodium hypochlorite (bleach; 10 %)	✓
	Terralin (0.5 % Vol.)	○
Antiseptic agent	Chlorhexidin (0.5 %) in Isopropyl (70 %)	○
Ammonia	Ammonia hydroxide solution (1.65 % Vol.)	○

✓ = safe to use
○ = residues may accumulate on the surface

CONTURAN® DARO made to touch, invisible to the eye

With its DARO product, SCHOTT fulfils a long held wish from industry and users: A coating for anti-reflective glass that is resistant to finger and dirt markings – ideal for touch displays.

Love is blind – this does not apply to a coveted consumer item: a touch display. The more often a hand moves across the touch sensitive surface, the more finger and dirt markings will hinder viewing.

Such an unsightly side effect can now be avoided: SCHOTT developed CONTURAN® DARO as a coating for its anti-reflective glass to repel impurities from the surfaces of displays. DARO is short for "**d**urable **a**nti-**r**eflective and oleophobic". The surface protection combines durable anti-reflection with resistance to finger and dirt markings – a breakthrough for all touch applications.

Finger markings less visible by up to 90 %

SCHOTT CONTURAN® DARO therefore fulfils a longed for wish. Anti-reflective coatings are popular in modern high resolution displays for enhanced contrast, but touch screen surfaces need to withstand extensive finger contact and maintain good readability. DARO aids this by clearly reducing dirt particles, liquids or finger marks that adhere to surfaces. Displays therefore remain easy to read for longer, and keep an appearance of high quality look through the cleanliness of their surfaces.

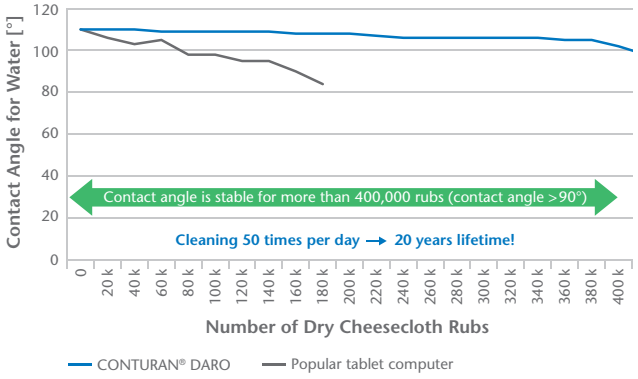
Because of its extreme smoothness, CONTURAN® DARO coating is able to reduce the visibility of finger markings by up to 90 %. It also offers a high level of transmittance and a residual reflectance of less than 0.5 % each surface. These properties provide enhanced contrast and very good visibility for low illuminated elements.

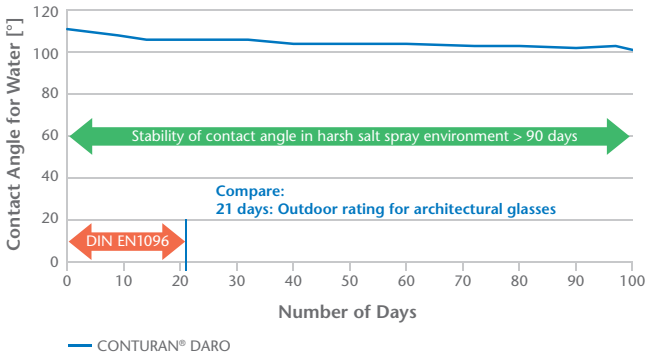
Certified durability

SCHOTT had high aims for durability when developing the DARO coating and subjected it to intensive testing using established procedures. The result: DARO withstands in excess of 400,000 mechanical swipe cycles which corresponds to a service life of over 20 years when subjected to 50 cleaning-swipes per day.

The coating also demonstrates top oleophobic properties with a contact angle in excess of 90°. In other words, liquids that come into contact with the DARO coating flow together to form condensed droplets instead of spreading outwards. The droplets drip away and/or can be removed with greater ease.

The coating's chemical resistance was also tested using a salt spray. It clearly exceeded a benchmark standard for outdoor applications and withstood not just the standard 21 test days but managed in excess of 90. According to the ABREX automobile standard, DARO also successfully withstood mechanical and chemical wear. On balance then, the DARO coating does not promise a lot as a long term, durable coating.

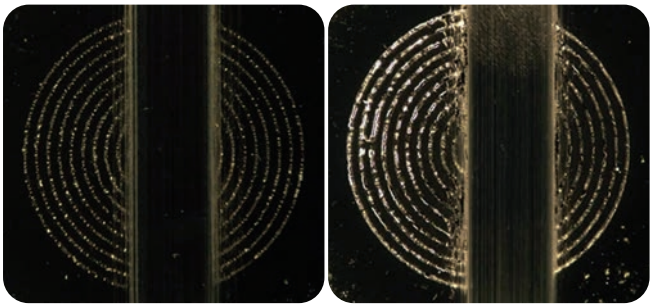




Easy-to-clean

The DARO coating not only provides protection against finger and dirt marks, it is also fast and simple to clean.

This can be seen in the two images on the right. On the DARO-coated glass (left), the marks are clearly less visible than on a standard coating after just a few cleaning swipes. The innovative protective coating reduces the number and duration of cleaning cycles.



In a cleaning test, CONTURAN® DARO (left) took on a standard anti-reflective glass (right). For standard type staining, the SCHOTT product appeared less dirty from the outset and required just three swipes to regain full cleanliness. In contrast, the comparison product showed clearly more traces of staining and remained unclean after three swipes.

CONTURAN® DARO: Areas of application

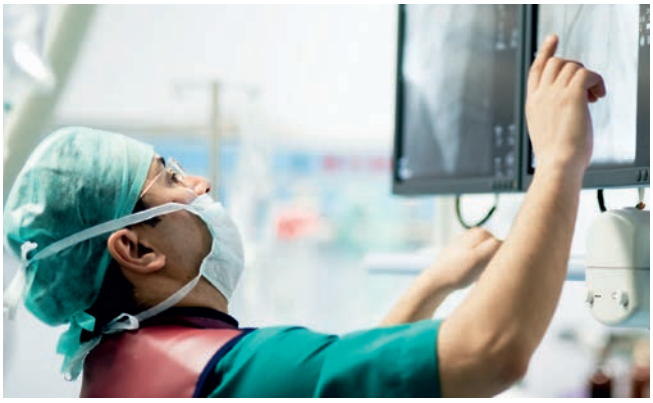
- technical touch displays and interactive kiosk systems
- displays in public spaces
- consoles in gaming rooms
- industrial displays and medical technology displays

CONTURAN® DARO	
Available as	stock sheets
Thickness	from 1.1 mm to 6.0 mm
Dimensions	990 mm x 1,770 mm (equals 72" diagonal)
Available on	all CONTURAN® types

Glass with highest mechanical stability meets proven anti-reflective coating for intelligent cover glass solution

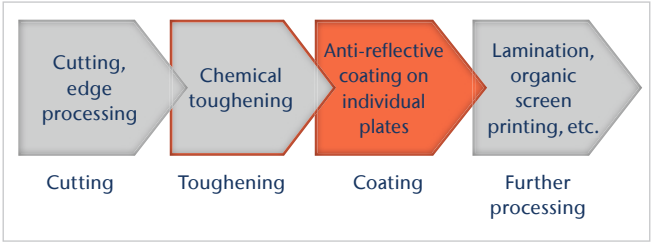
CONTURAN® Tough and CONTURAN® Tough AS are the first anti-reflective glasses that can be chemically toughened through to the anti-reflective layer – a major step forward in the manufacturing process.

You don't need a thick skin to be tough: anti-reflective display glass nowadays combines thin, light weight with robust material properties. This is possible by chemical toughening which strengthens glass measuring under 3 mm thickness.



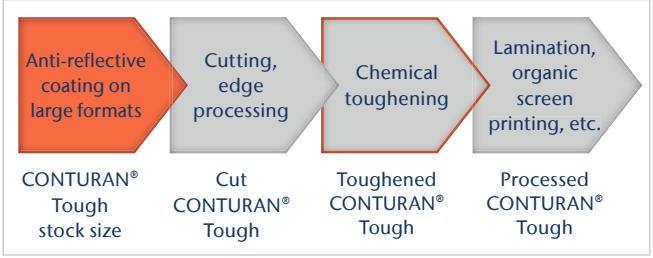
Especially in environments with highest demands for safety and mobility are light-weighted but mechanically strong cover glasses the first choice.
But the combination with optically superior and durable anti-reflective coatings is still hard to find due to complex process chains and therefore high manufacturing costs.

Complex process chain: Chemical toughening first then standard anti-reflection coating
Until now, toughening took place prior to anti-reflection coating because conventional sputtered anti-reflective coatings prevent the ion exchange required in the toughening process. However to introduce the coating at a later stage of the process chain requires a one-off production – an extremely inefficient procedure.



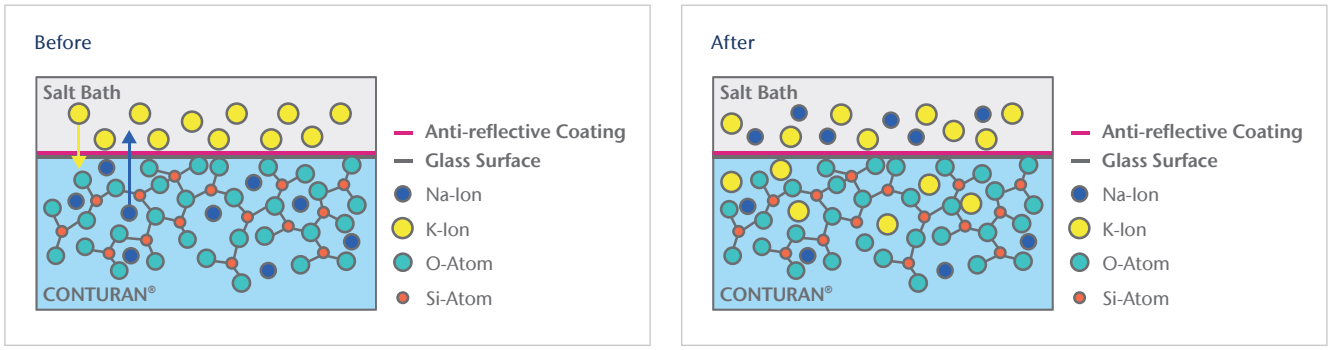
The difference is using CONTURAN® Tough or CONTURAN® Tough AS. The anti-reflective glass from SCHOTT is the only one of its kind which permits chemical toughening through to the anti-reflective coating due to SCHOTT's unique sol-gel coating. This provides notable improvements compared to standard procedures.

Efficient process chain: CONTURAN® Tough coating first then chemical toughening
CONTURAN® Tough enables ion exchange through the anti-reflective layer thereby greatly simplifying the process chain. Large format glass can be coated with anti-reflective layer first and then processed further. A much more efficient procedure.



What takes place during chemical toughening?

Glass strength can be increased using a special salt bath process. Smaller ions in the glass surface are replaced by larger ones from the salt bath in a process of ion exchange. This creates surface compressive pressures at the surface which increases glass strength. The process is known as chemical toughening and is especially suited to thin glass of less than 3 mm thickness which presents problems for the thermal toughening procedure.



The ion exchange at the glass surface generally involves sodium ions being replaced by potassium ions.
This increases compressive pressures which deter cracks in the glass.

Impressive strength for thin glass

The result of the chemical toughening process is a thin glass with an increased impact resistance but high surface flatness and therefore without any optical distortions. An ideal solution for demanding applications for highest levels of safety in medical environments or for rough conditions in production places.

Generally, chemically strengthened glass has several advantages vs. thermally toughened glass of comparable thickness:

- Higher mechanical strength
- Higher flexural bending strength
- Higher scratch resistance
- Higher thermal shock resistance

CONTURAN® Tough: The resilient one

SCHOTT adapted its well-known CONTURAN® coating to meet the requirements of the chemical toughening process. Based on a soda-lime glass, it offers improved mechanical stability in a thin and light weight glass.

CONTURAN® Tough AS: A better choice

Based on an aluminosilicate glass as high-ion-exchange (HIE) substrate, CONTURAN® Tough AS is the solution for highest demands.

It offers superior mechanical stability in a thin and light weight glass thickness. Hereby, it provides a more than 150 % higher break and impact resistance as a comparable standard soda-lime float glass.

Furthermore it offers the highest levels of flexural strength and scratch resistance without any optical distortions.

Benefits of CONTURAN® Tough

As an anti-reflective, chemically toughened glass, CONTURAN® Tough has many benefits:

- increased mechanical and thermal toughness
- scratch resistant
- high transmittance and low weight in a thin glass
- less than 1 % reflectance
- easy and flexible processing
- can be combined with an easy to clean coating (DARO) to protect against finger marks
- CONTURAN® complies to the recommendations of the EN 12337 standard

Benefits of CONTURAN® Tough AS

As an anti-reflective, chemically toughened aluminosilicate glass, CONTURAN® Tough AS has many benefits:150 % bruchfester als vergleichbares Floatglas

- 150 % stronger than a comparable float glass
- reduction of reflection by more than 90 % to below 1 %
- proven mechanical and chemical resistant anti-reflective coating
- reduced risk of breakage, increased safety
- weight reduction by using thinner substrate with same impact resistance
- compatible with high resolution touch displays
- in principle, various processing options are possible

CONTURAN® Tough and CONTURAN® Tough AS compared:

Technical values for chemical toughening	
Compressive stress	> 350 MPa
Depth of layer (DoL)	> 9 µm

Individual case values depend on the selected process parameters.

Specifications	
Glass thickness available	1,6 mm – 4 mm
Maximum dimensions	1.220 mm x 1.770 mm
Light transmittance	> 98 %
Base substrates	Soda-lime float glass Low-iron soda-lime float glass
Available as	Customized cover glass Stock-sheet

Technical details for CONTURAN® Tough

Technical values for chemical toughening	
Compressive stress	> 550 MPa
Depth of layer (DoL)	> 15 µm

Individual case values depend on the selected process parameters.

Specifications	
Glass thickness available	1,1 mm – 2,1 mm
Max. dimension	1,220 mm x 1,770 mm
Light transmittance	> 98 %
Mechanical impact resistance	IK08 (5J) based on EN 62262*
Available as	Chemically toughened and customized cover glass

* 2.1 mm glass tested with a free falling steel ball (1063 g) from a height of 50 cm.

Technical details for CONTURAN® Tough AS

schott.com

SCHOTT AG, Hattenbergstrasse 10, 55122 Mainz, Germany
Phone +49 (0)6131/66-2678, info.conturan@schott.com

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