

**SCHOTT**  
glass made of ideas

Technical Glazing

SCHOTT CONTURAN®

From molten glass  
to cover glass

GO DIGITAL

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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.

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.



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## 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 specialist 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, refrigerated shelves 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 reflection while allowing an optimal transmission 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 transmission.

Are you looking for anti-glare glass combined with touch functions for applications in difficult light conditions? Then our **anti-glare glass** could be the answer with its etched, diffuse surfaces.

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 their diversity of their applications.



SCHOTT CONTURAN®

# From molten glass to cover glass

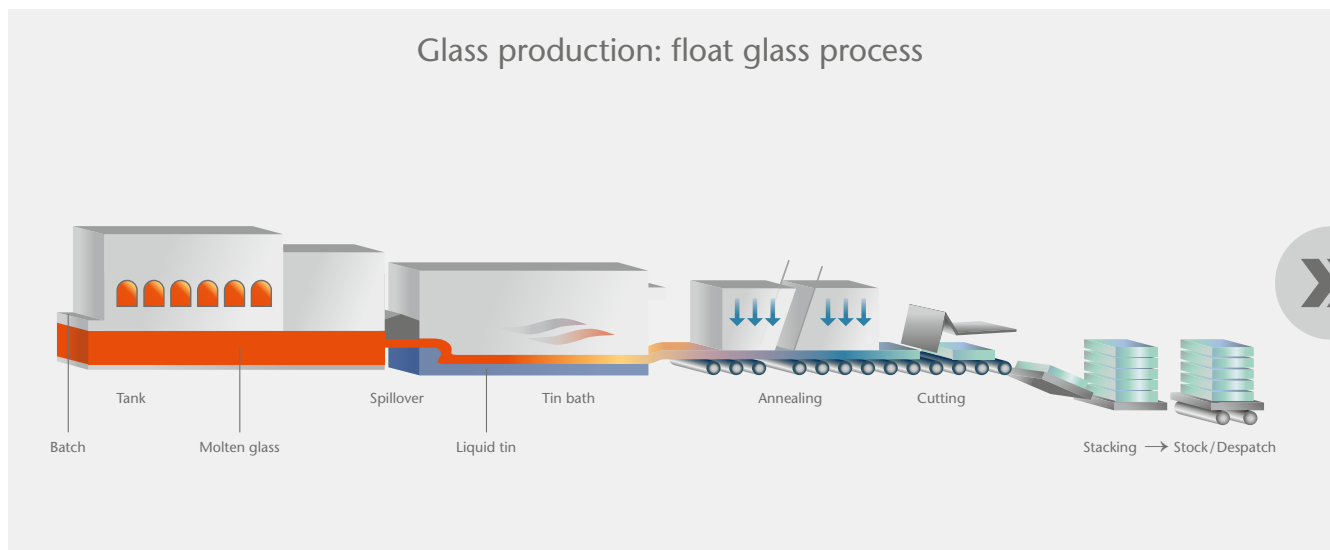
Unique expertise in glass, its processing and coating enable us to bring cover glass into practically any form and function, and to provide the electronics industry with high-quality display applications, Made in Germany.

*What's your next milestone?*



## 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.



### Float glass process: The standard

Flat glass in large quantities is usually made using a float glass process. Liquid molten glass flows into 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 opto-electronics. As a technical glass, it is primarily used in lighting applications and is able to withstand the extremes of temperatures associated with this usage.

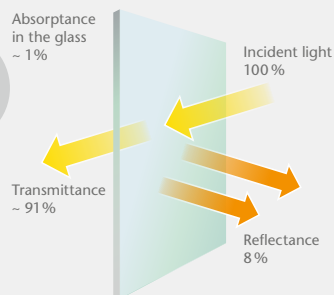
### Aluminosilicate glass: Resistant

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

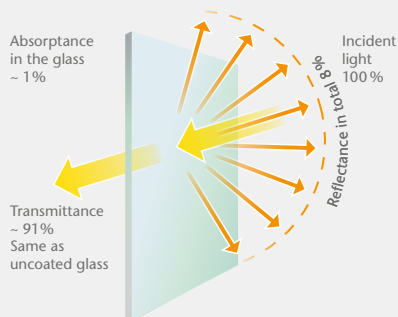
### Untreated surfaces

#### Float glass



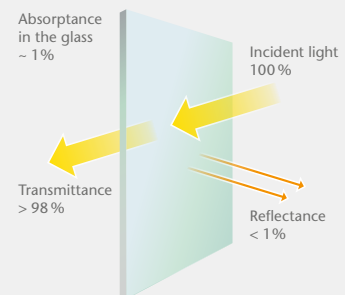
### Etched surfaces

#### 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% transmission, 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 reflection 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 – transmission and reflection 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.

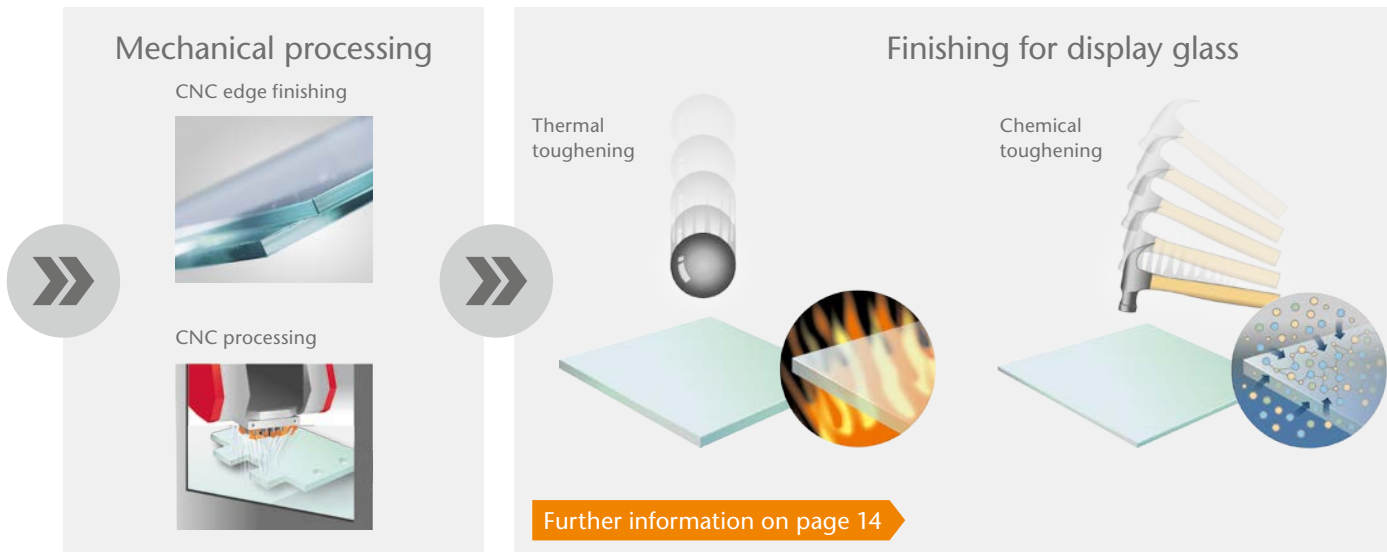
#### **Anti-reflective glass:**

##### **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 layers just nanometers thick. Reflections are reduced optically by up to 90% and the glass appears invisible. At a transmission 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 transmission makes it a first choice for display and lighting applications.

## Expertise from molten glass to cover glass



### 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 cut-outs.

### Thermally toughened glass

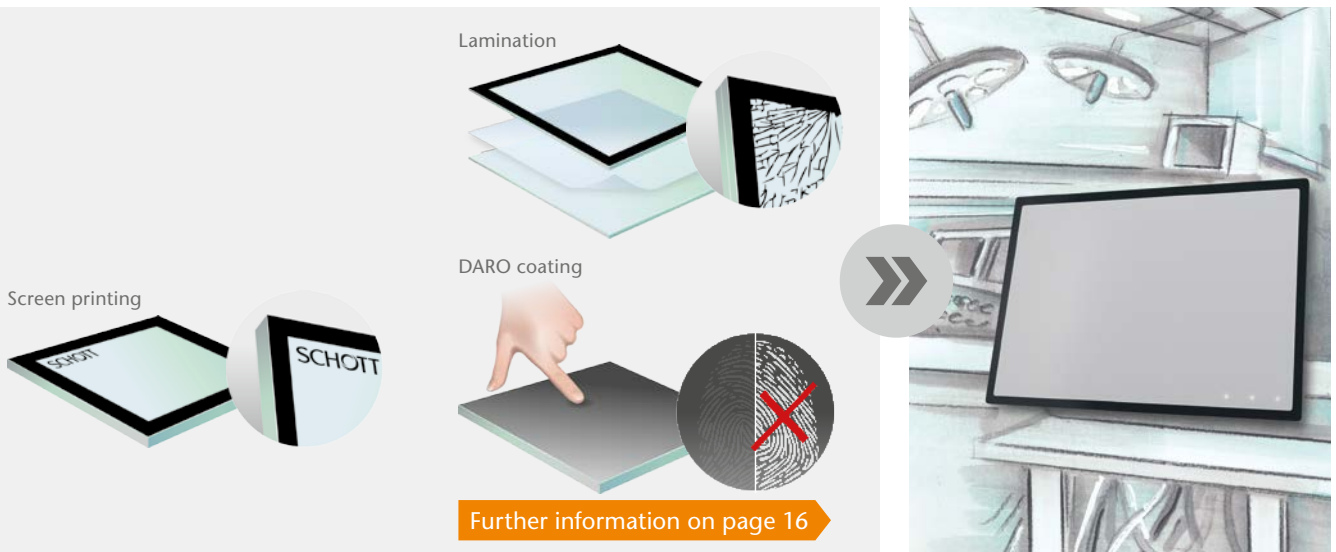
**Glass of 3 mm thickness or more** has the option of undergoing thermal toughening. In a precisely controlled process, the glass is heated to over 600 °C and then quickly cooled with cold air. The different rates of cooling forms crack resistant compressive pressures on the glass surface and tensile 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** can 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

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 make the glass anti-reflective. 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 precision 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
- high colour rendering index
- optional shatter protection
- optional easy to clean coating (DARO) for added convenience

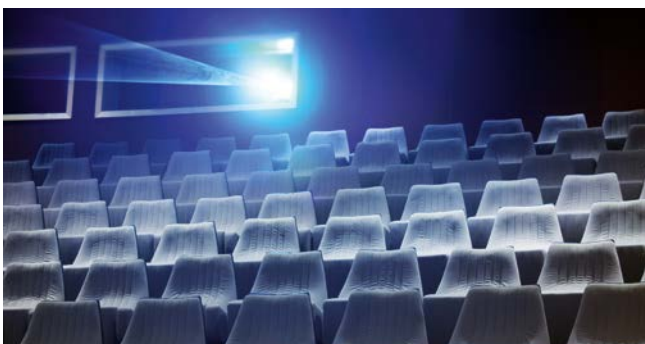
### Refrigeration and freezer technology



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 transmission and unparalleled thermal resistance. CONTURAN®, also based on the high quality BOROFLOAT® glass, can be used here. The benefits:

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

## Do you need a tailor made solution? We will design, construct & supply you one!

Float or aluminosilicate glass, anti-reflective or anti-glare surfaces, with or without an easy to clean coating – 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 glass using anti-reflective or anti-glare surfaces have persuasive benefits:

- clearly visible even under strong sunlight due to reduced reflections and high levels of transmission
- 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-glare or 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 transmission, 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

## CONTURAN® – One product for all your needs

Choose from a wide portfolio with features and characteristics for any application.

### CONTURAN® times three: Standard, Magic & Grey



Anti-reflection, high colour rendering index, enhanced contrast effects – if these are your needs, then anti-reflection **CONTURAN® Standard** is the glass of choice. **CONTURAN® Magic** is based on an extremely pure substrate while also offering the level of light transmission required in lighting applications. **CONTURAN® Grey**, by contrast, uses grey glass to provide enhanced contrast in displays.

### CONTURAN® Tough: Uniquely tough



**CONTURAN® Tough** is the only anti-reflective glass that has undergone chemical toughening. The product is ideal for mobile applications, for HMI (Human Machine Interface) systems and – in combination with our easy to clean coating (DARO) – for touch applications. [Read more from page 14.](#)

### CONTURAN® Low-e: Saves you energy



**CONTURAN® Low-e** is energy efficient, anti-reflective glass for any type of refrigeration and freezer equipment. It combines the highest levels of thermal insulation with reflection free viewing, optimal for refrigeration and freezer appliances as well as for counters in supermarkets or cigar and wine coolers at home. **CONTURAN® Low-e** is available as monolithic or insulating glass, both in flexible forms.

### CONTURAN® DARO: Touch Me!



With **CONTURAN® DARO**, reflections, dirt and finger marks have no chance. The glass is the first to combine anti-reflection and oleophobic surface protection – ideal for professional touch displays. [More on this from page 16.](#)

## CONTURAN® IR Protect: Let it shine



CONTURAN® IR Protect offers different levels of infrared protection in addition to anti-reflection properties. Outdoor displays, which are often exposed to direct sunlight, are thereby protected against overheating and damage. The glass is also equipped with high level transmission across the visible light spectrum.

Glass	Soda-Lime (float / low-iron / grey)						BOROFLOAT®	Alumino-silicate Glass**
	Anti-Reflective				Anti-Reflective + Low-e	Anti-Glare	Anti-Reflective	
Product	CONTURAN®	CONTURAN® Protect	CONTURAN® IR Protect	CONTURAN® Tough	CONTURAN® Low-e	SCHOTT Anti-Glare	CONTURAN®	CONTURAN® Tough AS
Reflectance*	0.9%	0.9%	0.9%	0.9%	3.0%	8.0%	0.9%	0.9%
Transmission*	99%	98%	> 91%	99%	91%	91%	99%	99%
UV protection		✓	✓					
Thermal toughening	✓	✓	✓		✓	✓	✓	
Chemical toughening		✓	✓	✓		✓		✓
Weather resistant	✓	✓	✓		✓	✓	✓	✓
Bendable	✓	✓	✓		✓	✓	✓	✓
Splinter protection		✓	✓					
Improved insulating					✓			
Easy to clean via DARO	✓	✓	✓	✓	✓		✓	✓
Medical Displays	✓	✓		✓			✓	✓
Food Displays	✓	✓			✓			
Outdoor & digital signage	✓	✓	✓	✓		✓		✓
Transportation	✓	✓	✓	✓		✓		✓
Touch Displays	✓	✓	✓	✓		✓	✓	✓
Industrial Equipment	✓	✓		✓		✓	✓	✓
Lighting	✓	✓		✓			✓	

\* Luminous reflectance  $\rho_{VA}$  / luminous transmittance  $\tau_{VA}$  based on substrate 2 mm low-iron glass or equivalent

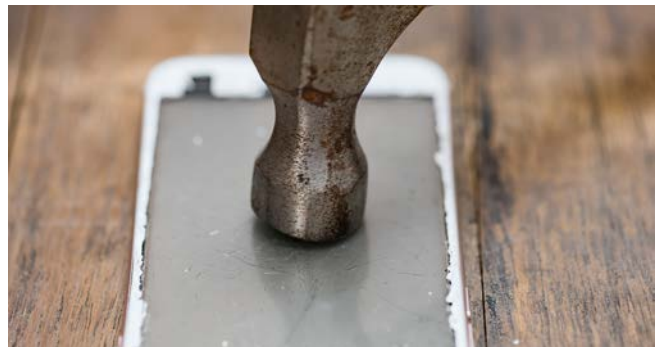
\*\* Available in 2017

## Thin, strong, efficient: CONTURAN® Tough

Chemical toughening makes anti-reflective display glass significantly stronger, which at SCHOTT extends right through to the anti-reflective layer – a major step forward in the manufacturing process.

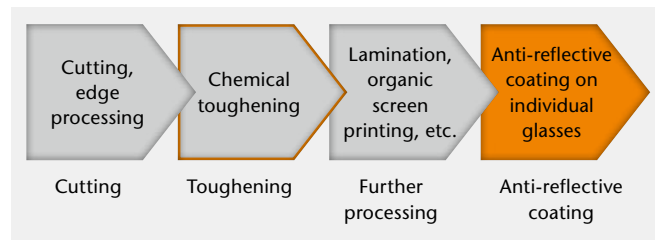
You don't need a thick skin to be tough: anti-reflective display glass nowadays combines thin, light weight with robust material properties. This is possible by chemical toughening which hardens glass measuring under 3 mm thickness.

Glass which contains anti-reflection can enjoy a "toughening bath" only at high manufacturing costs.



### Complex process chain: Chemical toughening first then standard anti-reflection

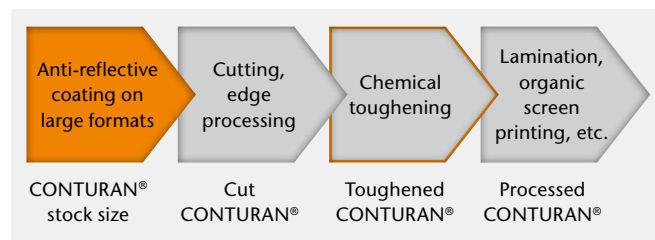
Until now, toughening took place prior to anti-reflection because conventional anti-reflective coatings prevent the ion exchange required in the toughening process. However to introduce the coating at the end of the process chain requires a one off production – an extremely inefficient procedure.



The difference using CONTURAN®. The anti-reflective glass from SCHOTT is the only one of its kind which permits chemical toughening through to the anti-reflective coating. This provides notable improvements compared to standard procedures.

### Efficient process chain: CONTURAN® coating first then chemical toughening

CONTURAN® enables ion exchange through the anti-reflective layer thereby greatly simplifying the process chain. Large format glass can then be made anti-reflective first, and then processed further – a much more efficient procedure compared to processing non-coated glass.



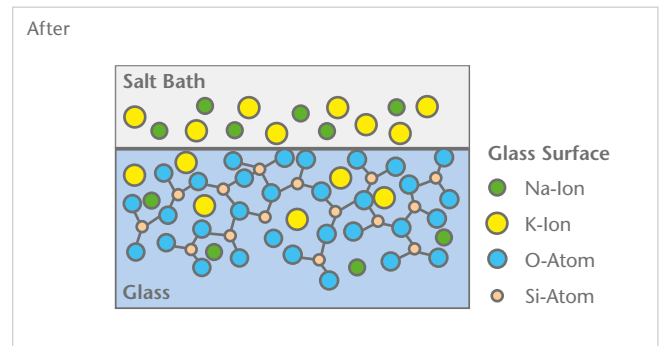
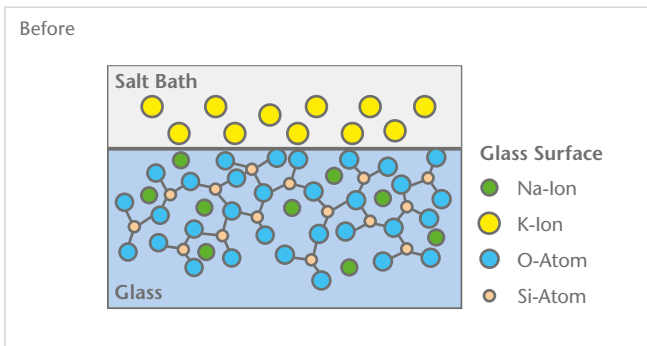
**What takes place during chemical toughening?**

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 3.2 mm thickness which presents problems for the thermal toughening procedure.

**Benefits of CONTURAN® Tough**

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

- increased mechanical and thermal toughness
- scratch resistant
- high transmission and low weight in a thin glass
- less than 1% reflection
- 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



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.

Technical values for chemical toughening	
Compressive stress	350 MPa are possible
Depth of penetration	350 MPa are possible
Depth of penetration	9 µm

Individual case values depend on the selected process parameters.

Specifications	
Glass thickness available	1.6 mm – 4 mm
Maximum dimensions	1,220 x 1,770 mm
Light transmittance	> 98 %
Available as	<ul style="list-style-type: none"> <li>• CONTURAN® Standard</li> <li>• CONTURAN® Magic</li> </ul>



## 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-reflective and **o**leophobic”. 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 transmission and a residual reflection of less than 0.5% per page. 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.

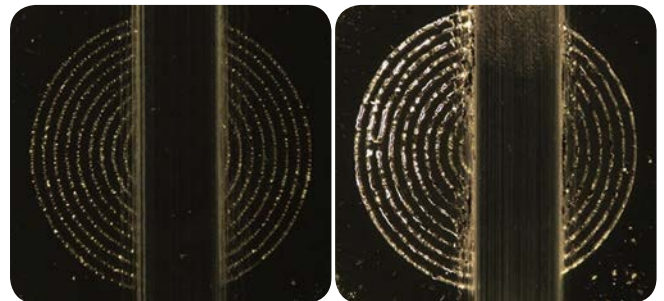
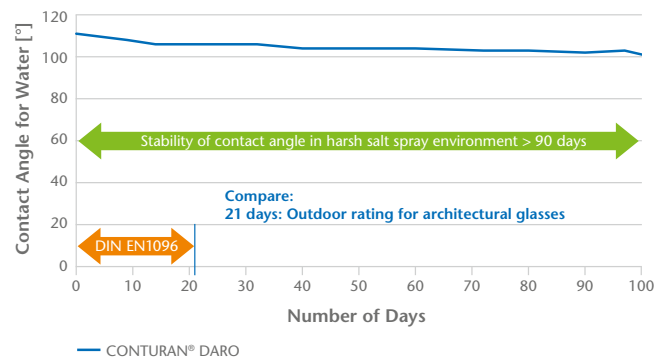
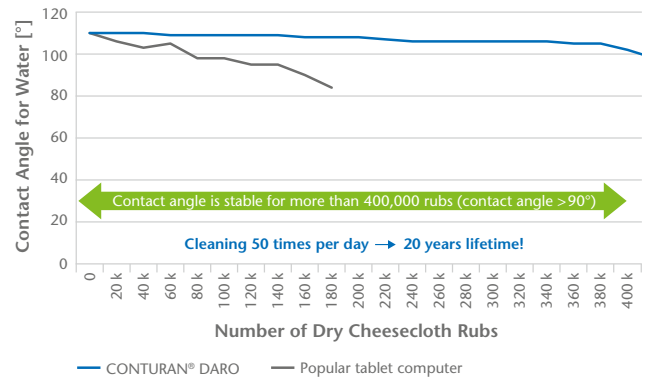
**Easy to clean**

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.

**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



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 unclear after three swipes.

CONTURAN® DARO	
Available as	<ul style="list-style-type: none"> <li>• processed glass</li> <li>• stock sheets</li> </ul>
Thickness	from 1.1 mm to 6.0 mm
Dimensions	up to 990 mm x 1,770 mm (equals 72" diagonal)
Available on	all CONTURAN® types
Processing Options	Can be combined with all required processing steps, as <ul style="list-style-type: none"> <li>• thermal toughening</li> <li>• chemical toughening</li> <li>• silk printing</li> <li>• lamination</li> </ul>

# Get to know CONTURAN®.

Watch our animated scribble video and instantly see CONTURAN® in use.

Problem + SCHOTT = Solution

Success

Hauptbahnhof A

Information

Haus Sport

From glass melt to cover glass - display glass made in Germany.

Watch our video!



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