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**SCHOTT**  
glass made of ideas

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AMIRAN® – Anti-reflective glass  
– nearly invisible



**SCHOTT**  
glass made of ideas



Have you noticed the main difference? ►



*Anti-reflective glass AMIRAN®*

*Conventional glazing*

## AMIRAN® – for a perfect view everywhere

Whenever the lighting levels in front of and behind ordinary glass differ considerably, it is usually very difficult to see what is outside while standing inside, due to the reflections.

AMIRAN® is an optical interference anti-reflective glass that has been dip-coated on both sides. Thin layers are applied to the glass, using the sol-gel coating technique. The mainly metal oxidic layers are hard, extremely scratch-resistant and offer high chemical resistance. The coating reduces residual reflections to approximately 1% yet, at the same time, increases the light transmittance to as high as 98%.



*Koala house, San Francisco Zoo  
left and right: conventional glass  
middle: AMIRAN®*



*Nurus Showroom, Istanbul*  
above: conventional glass  
below: AMIRAN®

### Quality features

- dramatic reduction in reflections
- Increased transmission
- extremely durable coating
- due to the weather-resistant coating, also well-suited for outdoor applications
- colors are displayed authentically
- easier to clean than glass with an anti-reflective coating that was applied using other technologies
- 99% UV protection with the laminated version that features a PVB foil

## AMIRAN® – the main benefits



### Virtually free from reflections and highly transparent:

Compared with ordinary glass that does not feature an anti-reflective coating, AMIRAN® reduces reflections to only one eighth. Whereas conventional glass produces residual reflection of approx. 8%, this figure now drops to only roughly 1%. In addition, light transmittance also increases substantially, from 88% with conventional float glass to approx. 98 % (with AMIRAN® on white glass).

### Opportunities to save money:

Thanks to the higher transmittance, lower costs are incurred for artificial lighting inside rooms. In addition, fewer spotlights are required to present the products on display in shop window applications. Furthermore, no more money must be spent on external solutions designed to prevent reflections, such as canopies, for instance. In combination with a low-E coating and the appropriate heat protection, reductions in heating costs can also be achieved.

### Convincing from a design standpoint:

Large sizes and the highest possible transparency give a building a completely different flair. AMIRAN® can be used to merge the boundaries between inside the building and outdoors and, therefore, makes it possible to execute innovative architectural ideas. Significantly improved night time viewing from the inside to the outside is yet another advantage. This glass also offers the ability to photograph through glass without glare.

### Numerous processing possibilities:

Like conventional glass, AMIRAN® can be processed into thermally toughened safety glass, laminated safety glass or insulation glass that offers protection from heat, the sun, and/or noise. (See also "technical information" on page 20).

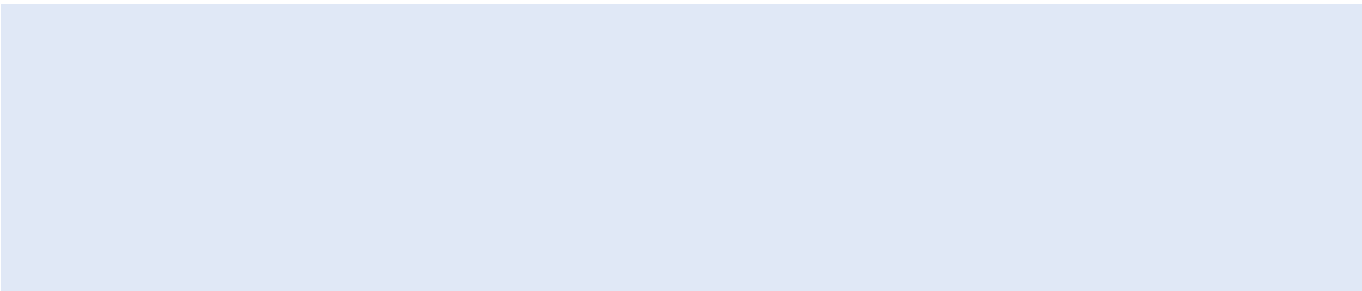
shop windows  
showrooms



*Nissan Showroom, Doha*  
above: conventional glass  
below: AMIRAN®

shop windows

*Ann Taylor Store, Los Angeles*



*BMW Showroom, Istanbul*  
above: conventional glass  
below: AMIRAN®



## Museums Display cases



*at the Altes Museum, Berlin*



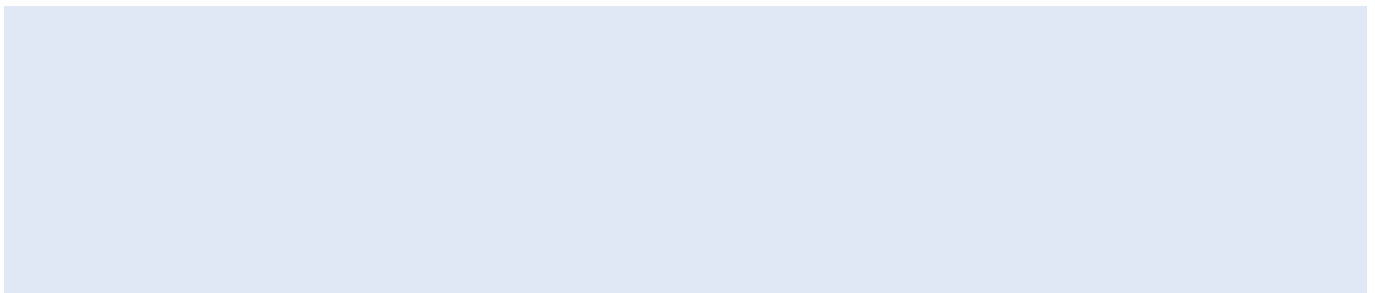
*The Green Vault, Dresden  
Balustrades glazed with AMIRAN®*



*Jasna Gora, Częstochowa*

# Radio Television

*Swiss public radio station DRS*  
*Undisturbed eye contact without any annoying reflections*

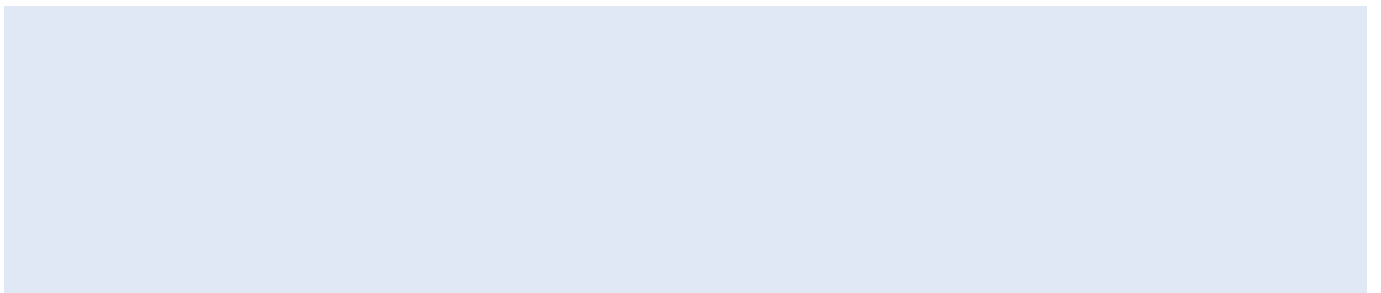


ABC Studio, New York  
Excellent transparency thanks to low reflection

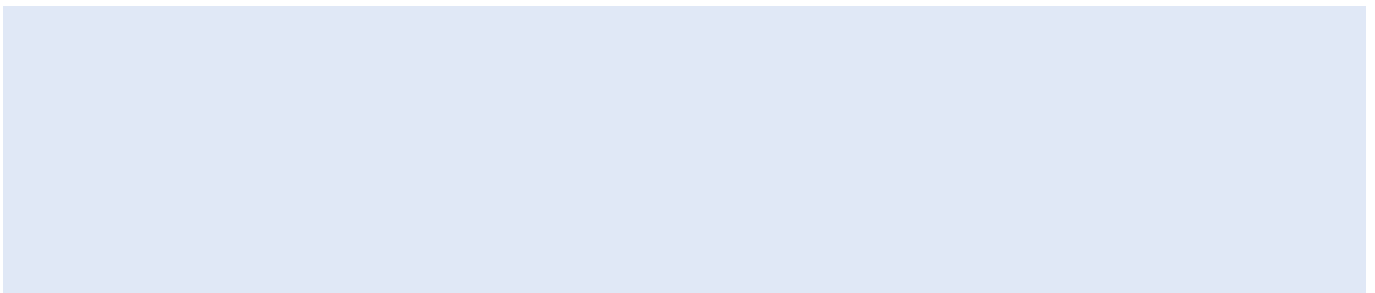


## Facades

*UBS Tower, Chicago*



111 South Wacker, Chicago



## Stadiums Windows

*Gottlieb Daimler Stadium, Stuttgart*  
Clear view of the playing field



*Pruva Restaurant, Istanbul*

*High transparency even with drastic differences in the lighting conditions*



## Manufacturing of AMIRAN®

### Applying coatings with the dipping method

The technique used to apply thin layers of solutions developed by SCHOTT differs entirely from the familiar vacuum techniques (vapor deposition and sputtering). With the sol-gel process, a cleaned glass substrate is dipped into baths with various coating solutions that contain metallic oxides. The exact thickness of the layers can be set very precisely by modifying the drawing speed. Using this thin-film technology, only 1 ml of fluid is required to coat a surface of 1 m<sup>2</sup>. After the drying phase, the layers are burned in at temperatures of between 450 °C to 500 °C.

Thanks to this hard coating, the predominantly metallic oxide layers are extremely scratch-resistant and offer high chemical resistance. Due to their high chemical purity, they also offer excellent optical characteristics.



## The Optical Effectiveness of Optical Interference Layer Systems

Through the use of different metallic oxides, a combination of highly refractive and low-refractive cover layers can be achieved. These interference layer systems consist of a number of thin layers with various optical characteristics and thicknesses.



Light is reflected at every interface between two materials with different indexes of refraction. For instance, the index of refraction for air is 1, whereas the index for float glass is 1.52. This causes the reflections that are typical of window glass, which reflects roughly 8% of the incident light. By selecting the appropriate layers with different indexes of refraction, these reflections can be controlled rather easily. The use of as few as 3 layers can reduce reflection to only around 1%.

**Stock sizes (net dimensions)**

3800 mm x 1770 mm

3210 mm x 1770 mm

**Glass thicknesses (monolithic)**

4, 5, 6, 8, 10, 12 mm

Other thicknesses are available upon request



Revelateurs Store, Sao Paulo

## Technical Data:

### Glass type

Base glasses may be:

- clear float glass
- white glass (especially low on iron oxide, very clear float glass)
- tinted float glass
- fire protection glass PYRAN®S
- other glasses upon request

With laminated glass and float glass with a low-E coating, only the side that will face the outdoors later is coated.

### Processing options

Like conventional glass, AMIRAN® can be processed (by qualified processing companies) into:

- toughened safety glass
- semi-tempered glass
- laminated safety glass (LSG)
- insulation glass, alternatively with heat and/or solar protection
- bent glass (not tempered, as toughened safety glass\* or as LSG\*)
- screen printed glass
- sound insulation glass
- security alarm glass
- special safety glass for protection from assault, for example

Furthermore, many different processing techniques, including drilling or edge processing, are possible.

AMIRAN® is CE-certified.

MGM Film Studios, Los Angeles



## Color Rendering

AMIRAN® on white glass does not alter the color of the products on display.

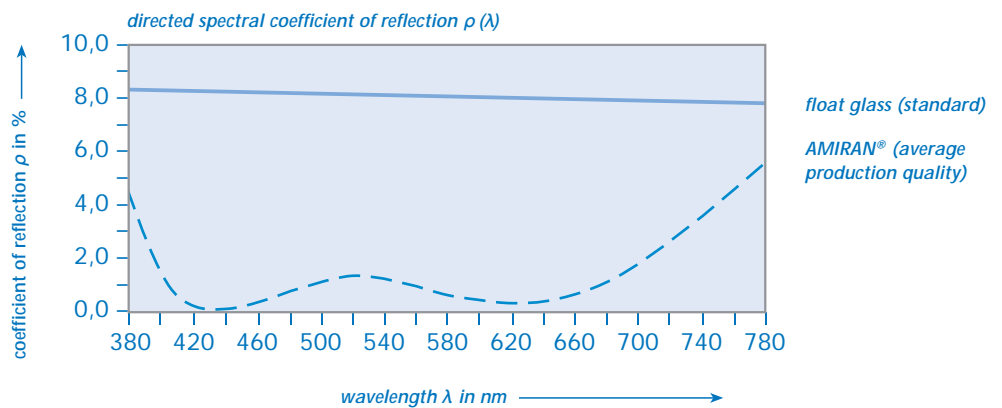
## UV transmittance

UV transmittance is significantly lower with AMIRAN® anti-reflective single glazed and double-glazed units than with ordinary clear float glass units. High UV protection is achieved with laminated AMIRAN®. UV transmittance of AMIRAN® laminated with double PVB-interlayer: approximately 1%

**Light transmittance  $\tau_{vD65}$**

AMIRAN® on float glass (standard) .....	96%
Float glass (standard) .....	90%
AMIRAN® on white glass .....	98%
White glass .....	91%

(for glass thicknesses of 4 mm)



**Residual reflection (with nearly vertical exposure to light)**

AMIRAN® as a single glass pane/laminated glass .....	approx. 1%
Float glass (standard) .....	approx. 8%

Insulation glass made of 2 x AMIRAN® .....	approx. 2%
Float glass (standard) .....	approx. 15%

Insulation glass AMIRAN®/AMIRAN® with LowE .....	approx. 3%
Float glass (standard) .....	approx. 15%

AMIRAN® is a glass with optical interference and anti-reflective properties. Reflections are reduced to a minimum during direct viewing from the front. When the angle of view changes, this also has an effect on the coefficient of reflection. The anti-reflective qualities of the glass remain in effect up to an angle of view of approx. 45 degrees.



## Cleaning

AMIRAN® can be cleaned like ordinary float glass using appropriate techniques. Even stubborn stains can be removed using suitable non-abrasive cleaners. Please refer to AMIRAN® Handling Instructions No. 2002 and hand out Cleaning Instructions No. 2001 to the building or shop owners.

## Instructions for use











It is recommended that AMIRAN® be protected by a protective film at the building site or only be installed once construction work has been completed, in order to avoid damage by other work being done, plastering, for example.








Concrete and brick facades should be designed in such a way that plaster, mortar or concrete that leaches out of the facade with rain water does not wash over the glass. No firmly bonded adhesive stickers or decorative film should be applied to AMIRAN®. Damage can occur when these are removed later.

*Akademie der Künste, Berlin*



# Technical Data Sheet on AMIRAN®

	Type	Structure 	max. dimensions in mm x mm	Available thicknesses in mm	Glass substrate	visual coefficient of reflection $\rho_{VD65}$ in %	Light transmittance $\tau_{VD65}$ in %	general color reproduction index $R_a$	heat transmission coefficient $U_g$ in W/(m <sup>2</sup> ·K)	solar heat gain coefficient g in %	UV transmittance $\tau_{UV}$ in %
AMIRAN® Single glazing	AMIRAN® (as toughened safety glass, optional)		3800 x 1770	4,5,6,8,10,12	Float glass	ca. 1	96	98	5,8	ca. 89	ca. 46
					White glass*	ca. 1	ca. 98	99	5,8	ca. 99	59
AMIRAN® laminated safety glass	AMIRAN® as LSG (with PVB foil)		3800 x 1770	8,4 to 13,5	Float glass	ca. 1	95	99	5,7	ca. 82	ca. 1
					White glass*	ca. 1	98	99	5,7	ca. 89	ca. 1
AMIRAN® laminated safety glass units	AMIRAN® (as toughened safety glass, optional)		3800 x 1770 depends on processor	depends on structure	Float glass	ca. 2	95	ca. 99	2,6	79	45
					White glass*	ca. 2	96	98	2,6	87	76
					AMIRAN® with heat protection (toughened safety glass, optional)		3800 x 1770 depends on processor	depends on structure	Float glass	ca. 3	80
					White glass*	ca. 3	85	ca. 98	1,1	51	14
	AMIRAN® with sun protection (toughened safety glass, optional)		3800 x 1770 depends on processor	depends on structure	Float glass	ca. 2,5	82	ca. 97	1,1	66	14
					White glass*	ca. 3	86	ca. 98	1,1	72	21
<i>For comparative purposes conventional float glass:</i>											
Single glazing	conventional float glass		dependent on manufacturer	dependent on manufacturer		ca. 8	90	98	5,8	86	62
	conventional white glass*		dependent on manufacturer	dependent on manufacturer		ca. 8	91	99	5,8	91	84
conventional insulation glass units	conventional float glass		dependent on manufacturer	dependent on manufacturer		ca. 15	80	97	2,6	75	39
	conventional white glass*		dependent on manufacturer	dependent on manufacturer		ca. 15	84	99	2,6	83	72

-  Glass pane
-  AMIRAN® coating
-  PVB foil
-  spacer
-  Space between panes (filled with either air or gas)
-  Solar control coating (Arcon Sunbelt Platin)
-  lowE coating (Arcon N30)

1. These values apply to monolithic glasses that are 4 mm in thickness. With LSG, the correct structure is 4/0.76/4 mm; with insulation glass units 4/16/4 filled with Argon gas.
2. These values are calculated based on the DIN EN 410 and DIN EN 673 norms.

\* especially low iron, clear float glass