ICON PROTECTION AGAINST DUST, UV-RADIATION AND VANDALISM BY SPECIAL NON-REFLECTIVE GLASS

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One of the main concerns of Museums and Art Galleries in fulfilling their social and cultural mission is to secure for their visitors the best possible sensory perception of their exhibits. This is an extremely difficult task, where many parameters have to be considered. If for example paintings will be exhibited unprotected, they may offer an immediate optical contact to the visitor, but at the same time they are exposed to dust, light and occasional vandalisms. Dust and light can seriously affect in the long run the quality of the painting. It is, therefore, imperative that paintings and objects of museum value must be protected.

One way of defense against dust and light is to take certain protection precautions applied to the exhibit space as a whole, such as air-filters for the air circulation and window glazing with UV-protection for the natural lighting, or special lamps for the artificial lighting. This, however, is not always advisable or even possible -take, as example, icons in churches- and on the top this does not protect against vandalisms.

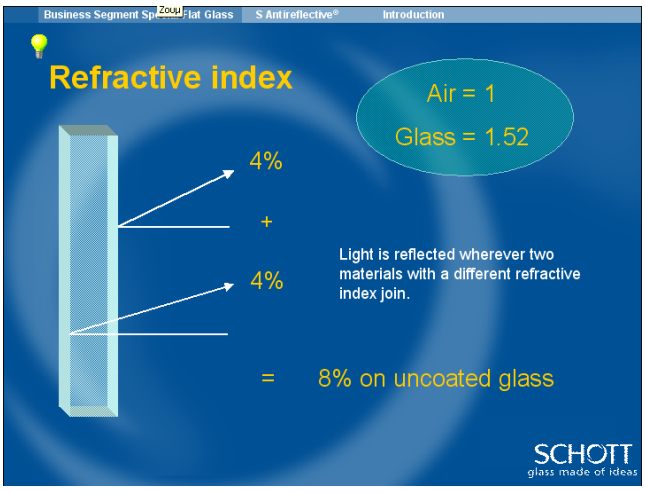

Figure 1

The other way is glass protection for each individual exhibit.
Window glass does protect against dust; it does, however, not offer any protection against UV-light and vandalisms; “UV-protection” window glass is a normal laminated window glass, which offers in addition to protection against UV-light, also protection against vandalisms. In both cases, however, we encounter a serious problem: Approx. 8% light reflection from the glass surface can not be avoided [Figure 1]. This creates a highly disturbing mirror effect. The only reason, therefore, for using window glass with all its limitations is the price, at the

expense of the quality and the end result.

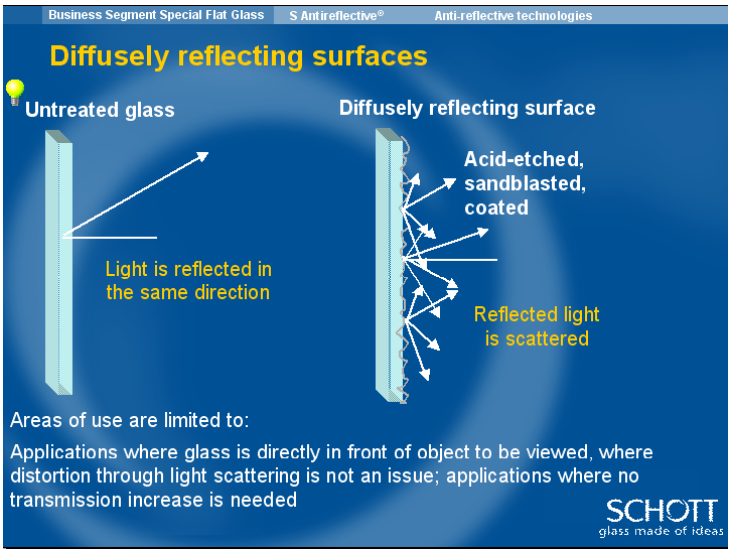

Figure 2

How could we eliminate this undesirable effect? There are two main options to confront the problem:
1. Diffuse antireflective glass
2. Optical Interference coated antireflective glass.

1. Diffuse antireflective glass:

The cheap way to partially overcome anti-reflection is by etching the window glass surface with hydrofluoric acid or by sandblasting [Figure 2]. The end result is, however, repulsive and it is unbelievable that this kind of window glass is still offered, at least in Greece: [a] its appearance is gray-colored and hazy, [b] in addition, it has to be applied on the top of the painting by touching it, because otherwise the view becomes completely blurred.

2. Optical Interference antireflective glass:

Optical Interference antireflective glass can be produced either [a] by sputtering or [b] by a dip-coating process.
[a] Sputtering produces, however, a slightly rough surface, and dirt can not be easily removed.
[b] The dip-coating process, instead, does not affect the totally even glass surface, which can be easily cleaned. It is also more resistant to environmental altering conditions according to the International Testing Standards.

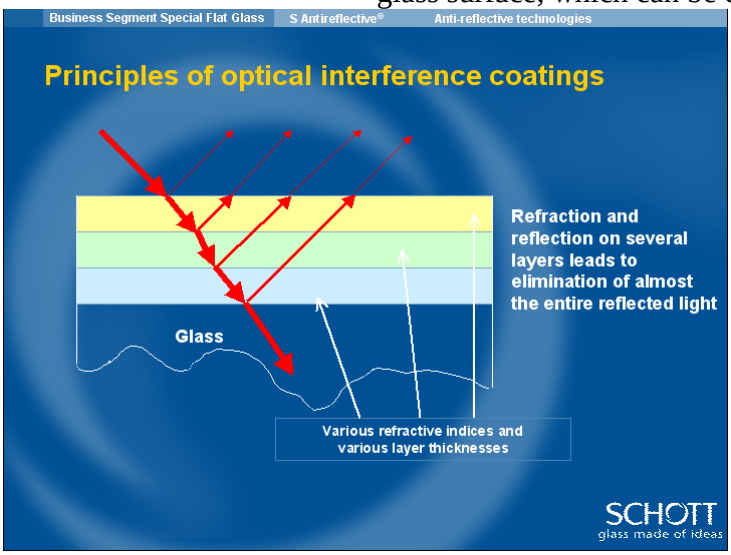

Figure 3

The dip-coating process for producing optical Interference antireflective glass constitutes, thus, the ideal solution: Several layers of a thickness of 50-100 nm, exact to +/- 1 nm, are applied on both glass surfaces by a dip-coating process. This creates an optical interference coating, which eliminates light reflection from 8% down to 0,9% [Figure 3].

How can this be achieved? We all know that light has a dualistic nature, possessing both undulatory

and corpuscular characteristics. Optical interference is a manifestation of the undulatory nature of light: when we have light waves, where "peak-on-peak" coincide, waves reinforce each other, whereas when we have light waves where "peak-on-valley" coincide, waves eliminate each other. The interference of the reflections from both coating sides leads, thus, in the case of "peak-on-peak" to the elimination of the total reflection. Due to the varying light wavelengths, however, single layers can not eliminate all of the reflected light. Only refraction and reflection of several layers with different Refractive Indexes leads to elimination of almost the entire reflected light.

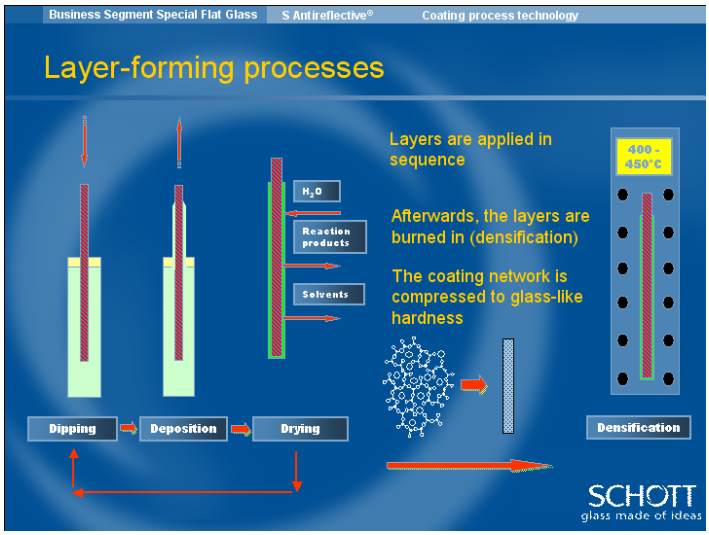

Figure 4

The antireflective dip-coating of glass [Figure 4] is an extremely precise process: After cleaning, layers are applied in several dipping and deposition successive steps. By drying, water, reaction products and solvents are removed and through densification at approx. 450°C, the coating network is compressed to glass-like hardness.

The result is the anti-reflective MIROGARD®. It is manufactured by SCHOTT, the leading producer of technical glasses. It has a worldwide reputation for guaranteeing the highest possible viewing enjoyment of art:

- SCHOTT MIROGARD® is a completely transparent special glass with an antireflective coating on both surfaces.
- Window glass reflects about 8% of light. This results in an undesirable mirror effect. With SCHOTT MIROGARD® reflections are reduced to approx. 1% and this means that they are virtually eliminated. In other words: when viewed in the normal way SCHOTT MIROGARD® is as good as invisible.
- It is absolutely neutral on color.
- Window glass has a light transmission of only 91%. With SCHOTT MIROGARD® a light transmission of 99% is achieved. Thus, the brilliance of colors in works of art is appearing without any loss of their original quality.
- Window glass has only a limited Ultra-Violet protection of approx. 44 percent in the spectral range of 300nm to 380nm. If there is no requirement to provide splinter protection but increased UV protection is still important, then SCHOTT MIROGARD®-plus can provide UV-protection up to 84%. It is only 2 mm thick but it combines in a unique

way protection against UV-radiation and outstanding anti-reflective properties with unaltered color rendering.

- With SCHOTT MIROGARD Protect® UV-protection is increased to approx. 99%. In addition, being a laminated glass, it also protects the work of art against vandalisms and damage caused by splintering in the event of glass being broken.

Summarizing, there are 3 antireflective MIROGARD® types:

MIROGARD®, MIROGARD®-plus and MIROGARD Protect®.

Technical Specifications:

Properties:	MIROGARD®	MIROGARD-plus®	MIROGARD Protect®
Light Reflection	< 1%	~ 1%	< 1%
Light Transmittance	99%	98%	98%
Without any reddish or blue/violet tint	√	√	√
Absolute smooth surface [Dip-coating process]	√	√	√
High Resistance against climatic changes [acc. to International Tests]	√	√	√
Extremely easy cleaning [acc. to International Tests]	√	√	√
UV – Protection	~ 48%	~ 84%	~ 99%
Protection against vandalisms	–	–	√

Figure 5

The application of MIROGARD®, as described above, is not restricted only to paintings [Figure 5], but is also common for showcases of icons and art objects [Figure 6]. In this case the anti-reflective AMIRAN® from SCHOTT is being used, with exactly the same specifications as MIROGARD®, except thicker, 6 mm or more.

Figure 6

The world's leading museums and galleries, among others the Guggenheim Museum, New York, the Tate Gallery, London, the Musée du Luvre, Paris, the Hermitage, St. Petersburg, the van Gogh

Museum, Amsterdam, the Kunstmuseum, Basle, the Musées Royaux des Beaux Arts de Belgiques, Belgium, the Leopold Museum and the Albertina Museum, Vienna, the Alte und Neue Pinakothek and the Buchheim Museum, Munich, the State Museum of Prussian Culture, Berlin, in Greece, among others, the Benaki Museum, the National Art Gallery and private Collections place their confidence in the proven quality of SCHOTT MIROGARD® and SCHOTT AMIRAN®.