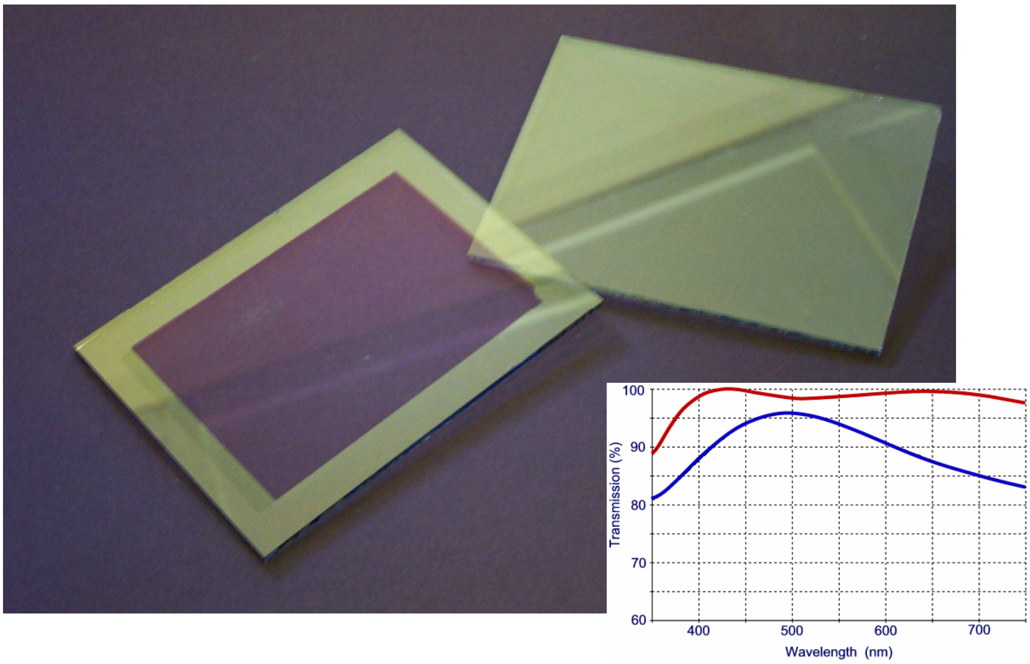
ITO COATED GLASS - FOR EXTREME PERFORMANCE



How does this translate into reality ? . See for yourself !

The figure left shows 2 sheets of 10 Ω/square glass, photographed agaInst a dark background showing a reflection of the ceiling one is untreated and the other has a central windowed area coated with TSL s proprietary AR coating, the difference is striking. Imagine the improvement in your application. The inset graph shows transmission before and after.

TSL has developed a proprietary, cost effective AR coating for ITO coated glass
ITO (Indium Tin Oxide - a transparent semiconductor) is often used to coat glass to provide surface electrical conductivity, whilst still maintaining good transparency. This is necessary, for example, to prevent electrostatic charge build up, and more importantly to provide EMC screening, for visual displays in electrically noisy environments.

Clarity is an important consideration for such display filters, but choosing an EMC-shielded filter often involves a trade-off between clarity and shielding effectiveness. Conventional meshed windows offer good shielding (up to 80dB), but have poor light transmission (~60-70%), and can produce very undesirable optical distortions as a result of aliasing and Moiré etc.
Thin metallic coatings are also sometimes used, which avoid the distortions but offer worse transmission, and shielding effectiveness.

ITO is often the best compromise. At Torr Scientific we can provide ITO coated glass with surface resistivities as low 10 Ω / square giving good EMC attenuation ~ 40dB (depending on geometry), and good transmission ~ 80%.

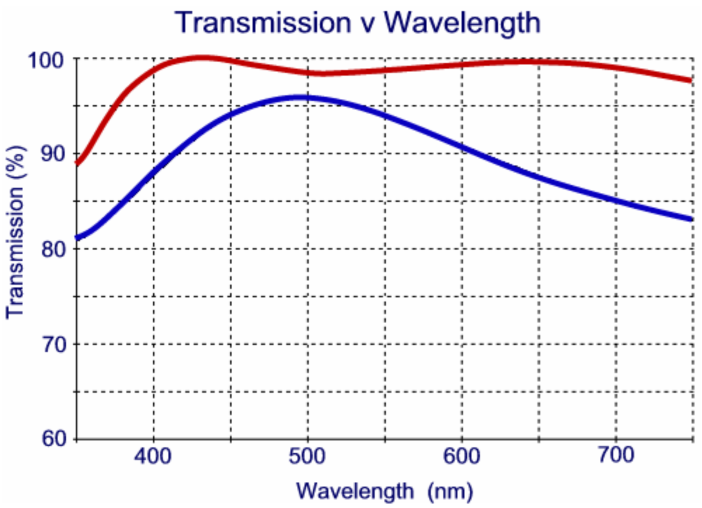
All windows and viewports, however suffer Fresnel reflectivity losses

$$R = [(n-1)/(n+1)]^2 \text{ per face}$$

which typically gives ~ 8% total for crown type glasses e.g. float glass. Indium tin oxide, however, having a much higher refractive index n = 2.05 (@550nm), produces a greater reflection. Obviously, the resulting reduction in transmission is undesirable, but more seriously, when viewing low luminosity screens in high ambient light conditions, visibility is impaired by reflections from the background.

There is an oft-quoted rule of thumb when talking about ITO coated glass, which states that the best transmission that can be obtained with 10 Ω/square glass is ~ 80%, and that for higher transmissions (~ 90%) it is necessary to use >100 Ω/square, thereby reducing the shielding effectiveness.

It is for this reasons that Torr Scientific have developed a proprietary, cost effective AR (Anti-Reflection) coating for ITO glass, which means that you can have simultaneously good conductivity <10 Ω / square, and good transmission >90% - something that would not be possible with a mesh.



For anti-static applications, surface resistivities of the order of 1000 Ω/□ are more than adequate to cope with most problems and BS EN 50014:1993 (*) in particular. This is the thinnest practical continuous layer that can be deposited.

At this thickness the transmission / reflectivity is not noticeably affected except at the UV end of the spectrum.

For screening applications, good quality ITO has a conductivity such that the thickness at 20 Ω/□ is easily corrected to minimise reflection using our AR coating giving > 95% transmission over the visible wavelength range

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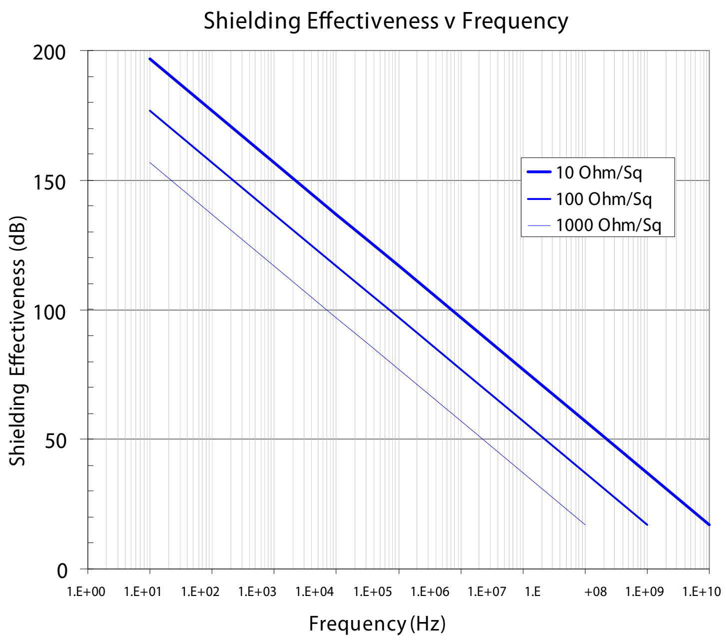

The shielding effectiveness (/ attenuation) for a coating cannot be easily defined in terms of a simple single figure of merit, as the effectiveness depends upon

- connections to the coating
- whether one is concerned with far field or near field shielding
- whether it s primarily a magnetic or electric field

There is a simple formula relating shielding effectiveness SE in (dB) to frequency f (Hz) and sheet resistance R_s Ω/□

$$SE = 20 \text{ Log } [7\text{x}10^{11} / (f \text{ x } R_s)]$$

And this is plotted left for coatings of 10, 100, & 1000 Ω/□

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(*) BS EN 50014:1993 Electrical Apparatus for Potentially Explosive Atmospheres states that an insulating area 100mm by 10mm shall have a resistance of less than 10^8 Ω.
The thinnest ITO with a sheet resistance of 1000 Ω/□ over this area (0.1 □) will have resistance of 100 Ω/□ therefore