ACHIEVE ENHANCED OPTICAL PERFORMANCE WITH ANTI-REFLECTIVE GLASS

DIGITAL SIGNAGE | WAYFINDING SIGNAGE | REFRIGERATED CASES | LARGE-SCALE LIGHTING

TRU VUE®

Light reflections on a digital sign or menu board distracts customers from the products and services being delivered. The content being conveyed does not look its best and results in frustration for customers. While customers may find it convenient to check their hair in the digital menu board or signage, reflection negatively impacts the ability to communicate and appeal to consumers.

ENHANCED BRAND PERFORMANCE WITH SMART COATING TECHNOLOGY

Choosing a cover plate with smart coatings alleviates this problem through enhanced visual performance of engineered optics. Over the years, Tru Vue Inc. has developed and commercialized smart coatings: anti-reflective, non-glare, and anti-static enhancements for customers to protect and conserve everything from fine art to electronic components. Such display enhancements are possible through the interplay of surface-optical properties applied via wet and sputtered deposition techniques. Non-glare (NG), Anti-glare (AG), and anti-reflective (AR) solutions reduce image distortion from reflection when applied to glass or hard clear plastic. NG & AG use diffusion mechanisms, which impact the readability and clarity of the image you are trying to read. AR coatings, on the other hand, incorporate multiple thin film layers to create a clear transparent coating with minimum reflection. Reflection may also be reduced through optical bonding of a cover plate during fabrication of the digital display.
As illustrated in Image 2, optical bonding eliminates internal reflections due to an air-gap between the cover plate and internal surfaces.

Image 1: External reflection image clarity issues (left) are exasperated when approaching display from an angle (right).

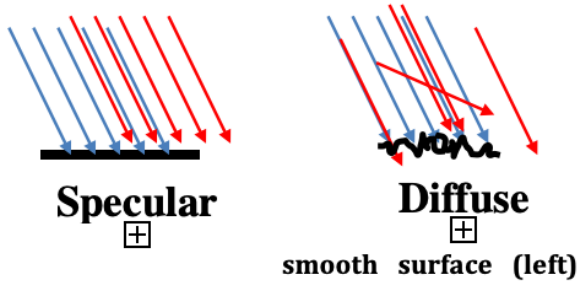
Image 2: Optically bonded display (left) versus AG air-gapped display (right)

NON-GLARE GLASS

Non-Glare (NG) glass is traditionally manufactured by acid etching of the glass, on either one or both sides, to provide uniform and evenly diffused surfaces for high resolution applications. The etching process does not impart any potential for electrical interference and oily fingerprints tend to not become highly reflective in the same way they would on a smooth surface. Thus reduction in reflection from an external light source is possible.

Figure 1, the blue lines represent external light shining onto a surface, and red lines show direction of the light after it has hit the surface. On a rough surface, the reflected light is dispersed allowing the user to focus on the transmitted image. In this way, the light is bounced off in many directions (diffused) to eliminate glare.
On a smooth surface with no smart coating, i.e. clear float glass, reflection is specular. Specular refers to the regular reflection like that of a mirror.

Figure 1: Light path shown for specular on a smooth surface (left) and diffuse reflection on a rough surface (right)



ANTI-GLARE GLASS

Anti-glare (AG) surfaces also traditionally use an etch process to create a surface roughness that breaks up and diffuses the reflected light. The difference of AG as compared to NG is that depending on the etch process, physical size and number of rough surfaces imparted, the amount of diffuse versus specular reflection is variable. A *glossmeter*[1] assigns a gloss unit to a specific surface and is used to distinguish quality level of AG glass. The gloss unit scale of a glossmeter is based on a highly polished reference blank standard with a defined refractive index having a specular reflectance of 100 gloss units at the specified angle. The lower the gloss reading the more diffuse the panel surface and the less glare a viewer shall see.

However, an inverse relationship exists between the degree of diffusion and the display's resolution. There is a trade-off between low gloss unit resulting in an unacceptable resolution loss, and the amount of specular reflection that bounces back to your eye causing glare.

VISUAL QUALITY MAY VARY

Picture frame quality glass is generally around 60 gloss units while display quality glass is as high as 130 gloss units. A twinkling rainbow effect, similar to moiŕe, called "sparkle" describes transmission of the image seen when using a higher gloss level. Lower gloss units may be used for a cover plate of a digital display if the plate is moved closer to the image plane. Further energy output may be tweaked to mitigate the resolution loss, though this is generally not a desirable path as it reduces unit efficiency. When looking across different manufacturers, even when matching gloss unit, the visual quality may vary and each glass may behave significantly different.

ANTI-REFLECTIVE GLASS

Unlike traditional non-glare surfaces that use roughness to diffuse light, *anti-reflective (AR) coatings*[2] use nanometer thin layers of stacked inorganic oxides to manipulate the index of refraction. This results in the ability to minimize external reflection without increasing energy output of the display unit. It also presents an option to design for reduced internal reflection through index matching materials. In optics, the index of refraction of a material is a dimensionless number that describes how fast light propagates through a material. While the speed of light is constant, as light travel through a material, the photons occasionally bounce off other particles. These photons do not travel in a straight line, thus appear to travel slower when moving through one material to another as is the case in fabricated display units of multiple layers. As an example, in an air gap the photons would appear to travel slower than in a vacuum where no particles exist to bounce off of, leading to the appearance of internal reflection. The fabrication technique of the digital display, if not optically bonded, will reduce the effectiveness of NG and AG substrate because they address only external reflection issues. AR coating offers the same external reflection solution and depending on index matching may also be able to address image distortion due to internal reflection. This interaction of photons with particles enables wavelength tuning for enhanced transmission and reduced reflection while maintaining a perceived clear surface on the coated cover plate. Standard, broadband AR coating reduces surface reflection from 5% to less than 0.5% per side of sheeted substrate. Consequentially, multiple reflections and "ghost" images are minimized and often eliminated by applying an AR coating to a glass surface. Further, the high transmission and low reflectance enables surface glare reduction, increases substrate brightness, and enhances contrast definition.

Additional considerations when selecting an AR glass may vary in significance dependent on the desired service location and anticipated time between cleanings. As example, due to the inclusion of tin-oxides in some but not all AR glass coatings available on the market, there exists a potential for electrical interference in haptic (touch) display applications. Similarly, surface energy varies between products thus build-up of finger print oils imparted by the user shall also vary. A second example is that of environmental factors. AR is an excellent approach to provide very good clarity and visibility in the bright outdoors, however not all suppliers of AR coatings have the same durability. Further, if any internal components are sun sensitive, then an AR

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[1] *BYK Additives & Instruments, glossmeters.com/gloss-meter.html, April 29, 2021.*
[2] *Tru Vue, tru-vue.com/solution/vista-ar-glass, April 29, 2021.*

coating may be paired with a UV blocking layer.

The thin film coatings on *Tru Vue Vista Anti-reflective Glass*[3], for example, disrupt the energy contained in light waves causing them to flow out of sync. This disrupted wave pattern virtually eliminates reflections from the surface.

BEST USE CASES

- QSR menu boards
- Outdoor retail signage
- Utilities and wayfinding signage
- Informational reader boards
- Refrigerated cases
- Large-scale lighting projects

DISTINCT ADVANTAGES OF ANTI-REFLECTIVE GLASS

- Easy to clean
- Promotes energy efficiency
- Available in large formats and specifications
- Made with *magnetron sputtered technology*[4]—a high-rate vacuum coating technique for glass that provides maximum durability, a smoother surface and abrasion resistance
- Optimizes the look and brightness of modern television and digital signage technology, no matter what the output Nit of a screen or display

CONCLUSION

In summary, careful consideration and understanding of the trade-offs need to be reviewed before an optical coating solution can be employed. Smart coated substrates (AR, AG, and NG) are all readily available in large format and at multiple thicknesses. While they each improve readability of a display, the mechanisms to address the different causes of reduced readability are different.

Contact the optical coatings sales experts at Tru Vue Inc. for more tips on display enhancements or for questions on best substrate choice for a specific application at (507)332-4100, or pheim@tru-vue.com.

THE TRU VUE DIFFERENCE

25 years of experience unlocks a distinct advantage when it comes to innovation in thin film technology. Our teams understand the critical nature of cosmetic specifications to ensure outstanding product quality products. Vista Anti-Reflective glass is manufactured using a magnetron sputtered technology that delivers peak performance in durability, scratch resistance and coating uniformity.

To learn more about our technical glass solutions, find a distributor near you or get in touch with our team; ***(507)332-4100*** *or* ***pheim@tru-vue.com.***

[3] *Tru Vue, http://tru-vue.com/wp-content/uploads/2020/04/Vista_AR_RM_042420.pdf, April 29, 2021.*
[4] *Tru Vue, https://tru-vue.com/2013/10/heraeus-sputtering-process-animation/, April 29, 2021.*

CHANGING THE WAY YOU VIEW GLAZING

Tru Vue is a manufacturer of high-performance glazing products for the custom picture framing, museum and engineered optics markets. We are a leader in anti-reflective coatings, as well as conservation-grade UV protection and specialty glazing products for these markets.

Founded in 1946 as Chicago Dial, Tru Vue began as a manufacturer of glass for radio dials and later TV screens. One of the company's first innovations was a process that etched the glass on TV screens, creating a non-glare surface that refracted light and allowed for a much clearer picture. This etched glass product is what brought Tru Vue into the picture framing market in 1970. Discovering that etched-glass technology eliminated the mirror-like reflections associated with framed art, Tru Vue again brought about industry-changing innovation with the introduction of double-sided, etched non-glare picture framing glass.

Today, Tru Vue sets the standard in glazing that enhances, protects, and beautifies. From custom framing to conservation and preservation in museums and galleries across the globe, to commercial optics, Tru Vue is known as a leader and innovator in the protection and conservation of all things framed and displayed. Whether it's Museum Glass®, Conservation Clear® and Conservation Reflection Control®, or our acrylic glazing products including Optium Museum Acrylic®, and Vista AR® no other company has such a complete portfolio of high-performance glazing options as Tru Vue.

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