Dignity Electronics

TOUCH PANEL ENHANCEMENTS

Touch Panel Enhancements - Overview

An introduction to some of the terms regarding touch panel enhancement:

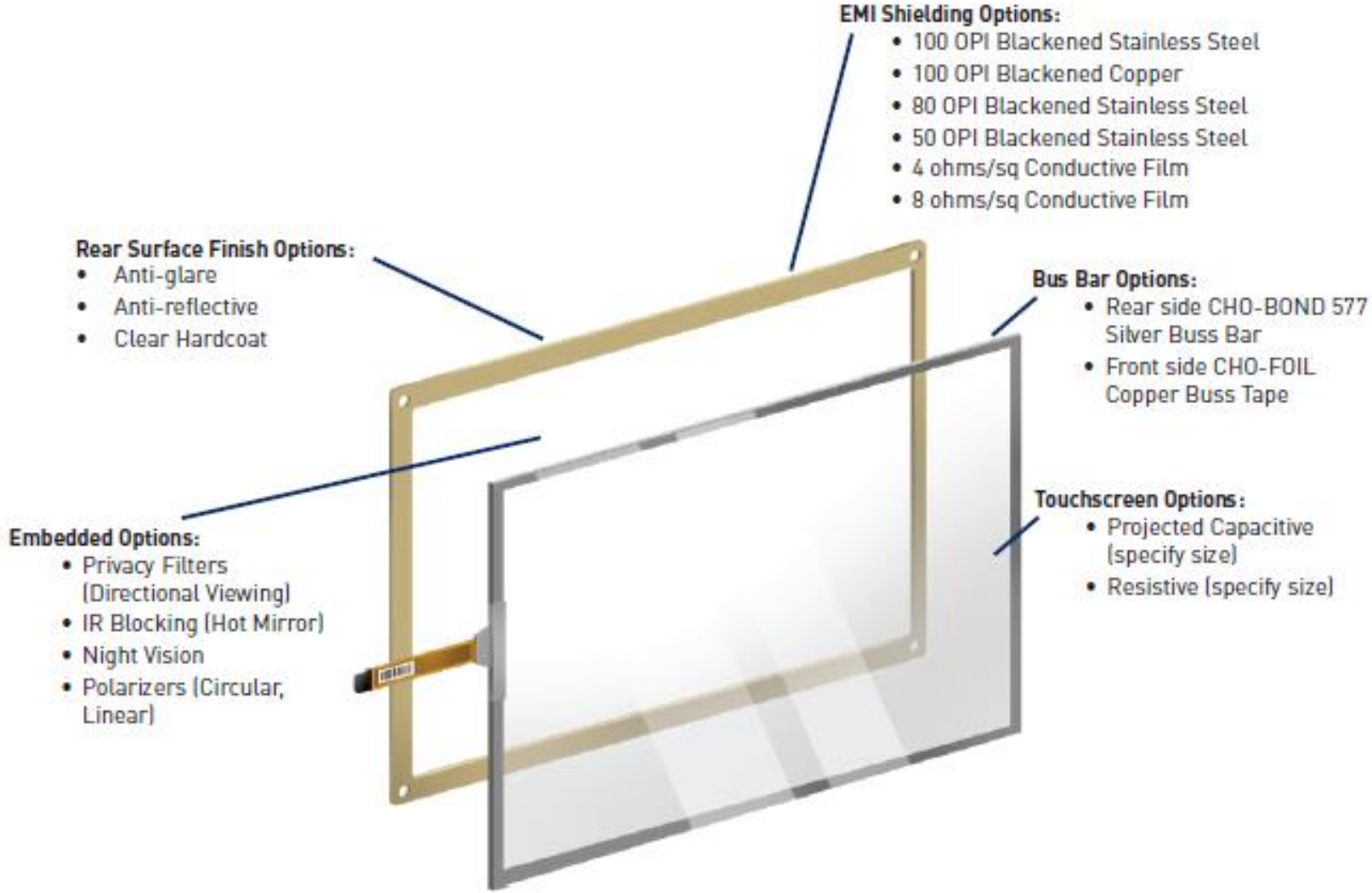
Front of Screen (FOS) – these are enhancements that are literally placed in front of the display; they can be either placed on the cover lens or the touch sensor.

Filters – these are enhancements that come generally in precut sheets and are applied directly to the front of the display or between the touchscreen and display.

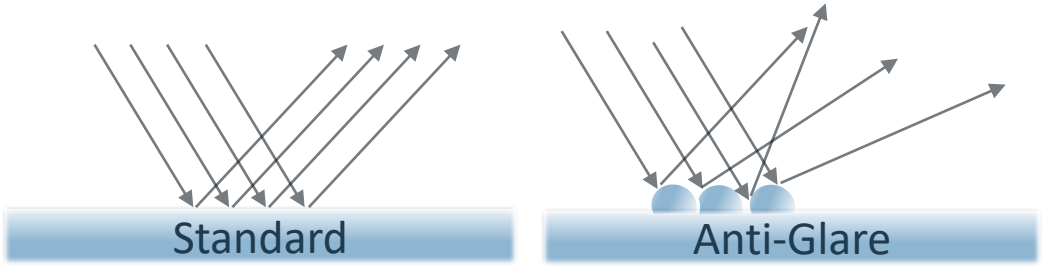
Screen Optical Coatings/Enhancements – these are a variety of enhancements that are directly applied to the touch screen or cover lens and usually affect the viewing / optical qualities of the touch panel. They can be applied by sputtering, thin coating, dip coating, etching, etc.

Embedded Enhancements – these are enhancements that are included during the production process, usually by the addition of various materials to provide enhanced performance for the final product.

Screen Enhancements – Overview



Screen Enhancements - Glare Reduction



Gloss	Haze
50°±10	11%±2%
60°±10	7%±2%
70°±10	5.5%±2%
90°±10	5%±3%
100°±10	3%±2%
115°±10	2%±1%

The lower the gloss, the less the level of glare

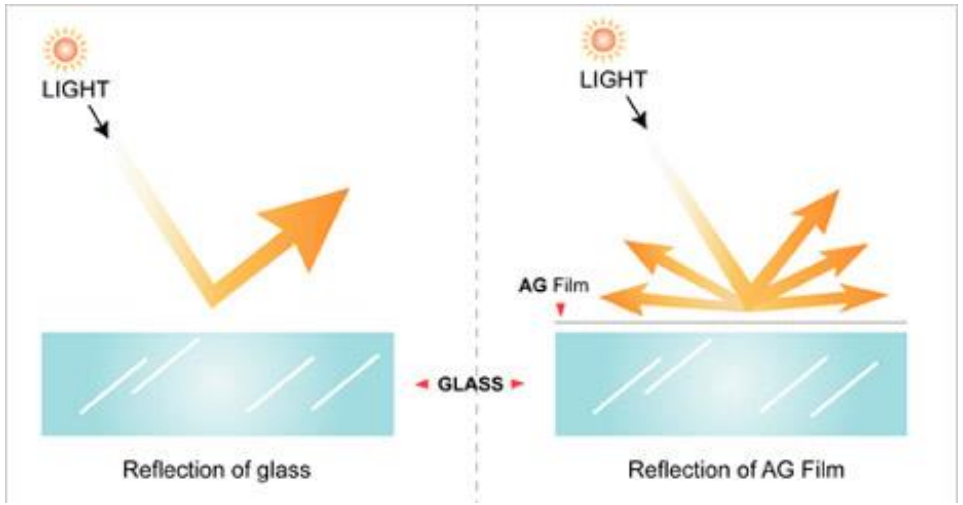
The lower the gloss, the greater the haze, the lower the resolution

Background

Works by changing specular reflection into diffuse reflection. Untreated or uncoated glass surfaces will reflect approximately 4% or more, depending upon the angle of incidence and index of refraction of the light hitting each surface (front & back). Applying glare reduction methods to untreated glass can significantly reduce this reflected light. Varying levels of diffusion (gloss) yield different levels of reduced glare. The lower the gloss, the more glare reduction it provides. However, the lower the gloss, the lower the screen resolution. Factors to determine the type of non-glare glass to specify :

- Level of Gloss desired
- Finished resolution of glass
- Haze and light transmission desired
- Anti-Newton effects desired
- Single or double sided etching
- Choice of coatings
- Cost trade-offs.

Screen Enhancements – Anti-Glare (AG) - Coated



Background

When surrounding glare makes display readability an issue, anti-glare coatings utilize diffusive properties to fragment ambient light off of the screen's surface, utilizing constructive interference.

Applications

Used widely in any applications where there will be strong sources of light that may cause glare, anything from POS monitors used in retail or restaurant environments to outdoor touch applications.

Working Principles

Varying levels of diffusion specified as gloss yield different levels of reduced glare. A lower gloss reading denotes a more diffuse panel. The more diffuse the panel surface, the more glare reduction it provides. Diffusion works by scattering specular reflections into a wide viewing cone (basically scattering the light into many different directions), reducing the resolution and thus the visibility of reflected images and glare. This results in an increase in haze and decrease in resolution.

Application Method

The AG layer is coated in a layer on the surface of the cover lens or display, and creates a series of silica "bumps" that act to diffuse the light.

Screen Enhancements – Anti-Glare (AG) - Coated

Advantages

- Improved readability
- Improved contrast
- Cheaper than etching (20-30%)
- Shorter lead times

Disadvantages

- Reduces transmittance and screen resolution / increases haze
- Low level of durability - tends to wear off after 2 or more years (depending on use)

Testing / Evaluation / Specifications

- What's generally measured is the level of gloss
- Standard range: 60 - 130 (US Gloss, measured at 60° by a BYK Gardner Glossmeter, model 4501)
- Thickness: 0.7mm - 4.75mm

Screen Enhancements – Anti-Glare (AG) - Etched

Background

Anti-glare glass breaks up incident light reflected images, allowing the user to focus on the display image versus the reflected images. Unlike anti-reflection coated or untreated surfaces, anti-glare etched glass does not become highly reflective as a result of oily finger prints.

Applications

Used widely in any applications where there will be strong sources of light that may cause glare, anything from POS monitors used in retail or restaurant environments to outdoor touch applications. Etched is often emphasized in applications that receive a lot of wear and tear due to its superior life span.

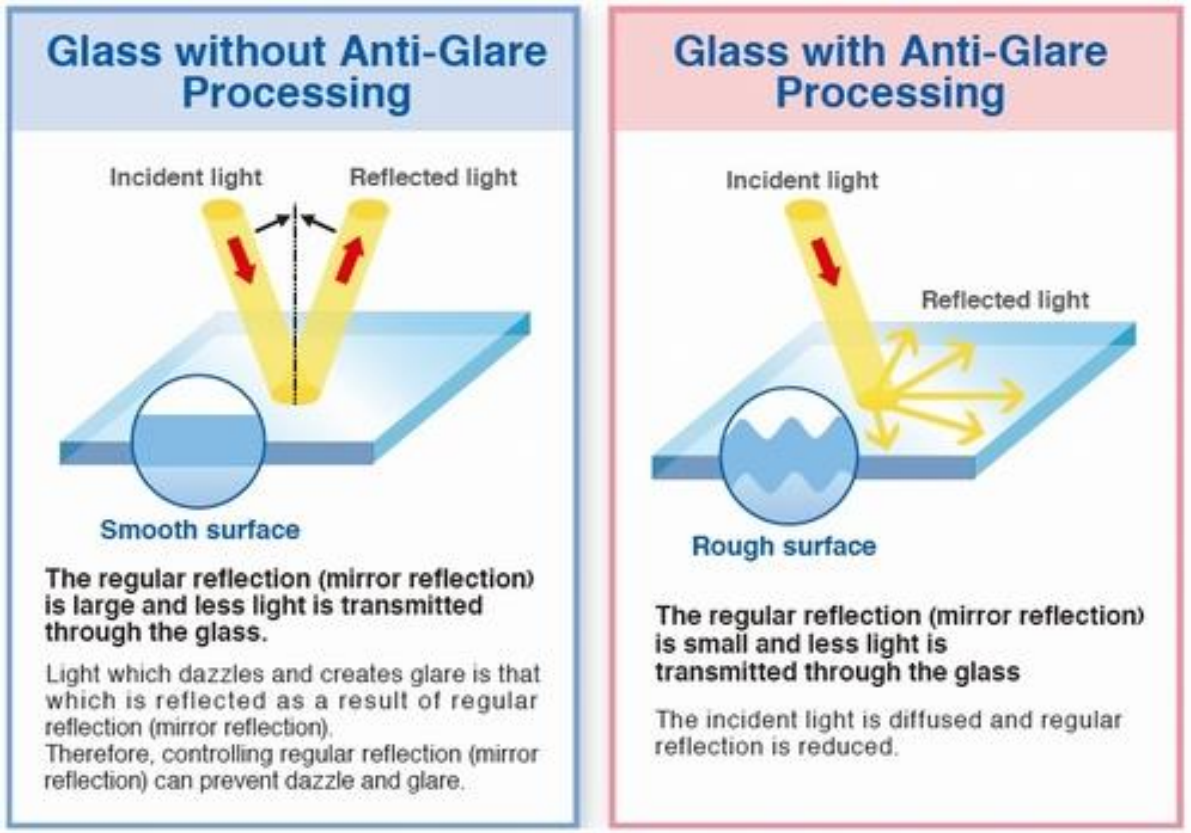
Working Principles

Non-glare glass is produced by chemically etching the surface(s) of the glass to produce a “bumpy” surface pattern that scatters reflected light. Various processing techniques and parameters result in different levels of scattering.

Application Method

Anti-glare glass is manufactured by acontrolled acid etch process yielding uniform diffused surfaces for anti-glare, high resolution, anti-Newton ring applications.

Screen Enhancements – Anti-Glare (AG) - Etched



Advantages

- Improved readability
- Improved contrast
- Longer lifespan than coated applications

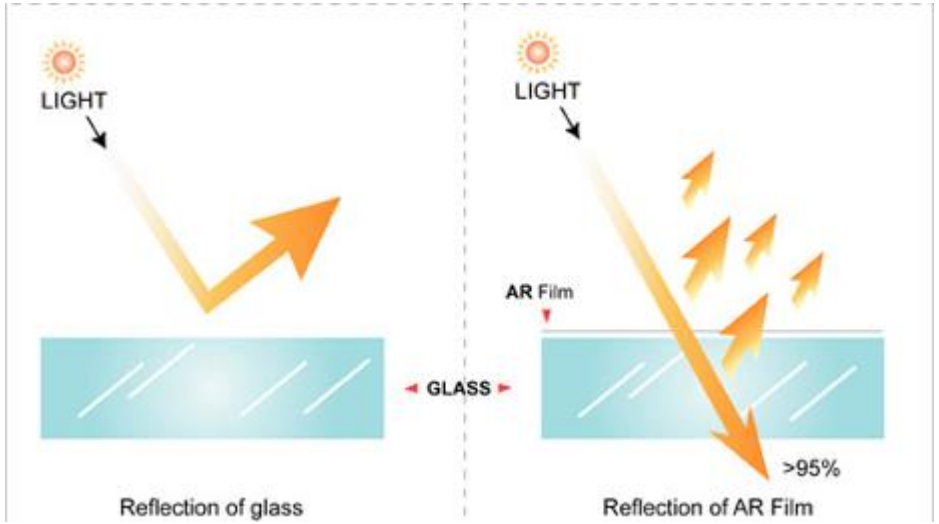
Disadvantages

- Significantly higher cost (30%+ depending on size)
- Utilizes environmentally unfriendly chemicals
- Longer lead times

Testing / Evaluation / Specifications

- What's generally measured is the level of gloss
- Standard range: 60 - 130 (US Gloss, measured at 60° by a BYK Gardner Glossmeter, model 4501)

Screen Enhancements – Anti-Reflection (AR)



Background

Anti-reflection tends to be more rarely used than AG, but is essential for outdoor viewing applications. It is a type of optical coating applied to the surface of lenses and other optical elements to reduce reflection. In typical imaging systems this vastly improves optics and stackup efficiency

(AR) coatings may be placed on flat, concave, convex, or complex shaped transparent substrates. Substrates may include but are not limited to commercial soda-lime glass, borosilicate glass, special index optical glasses and filters, quartz, and fused silica.

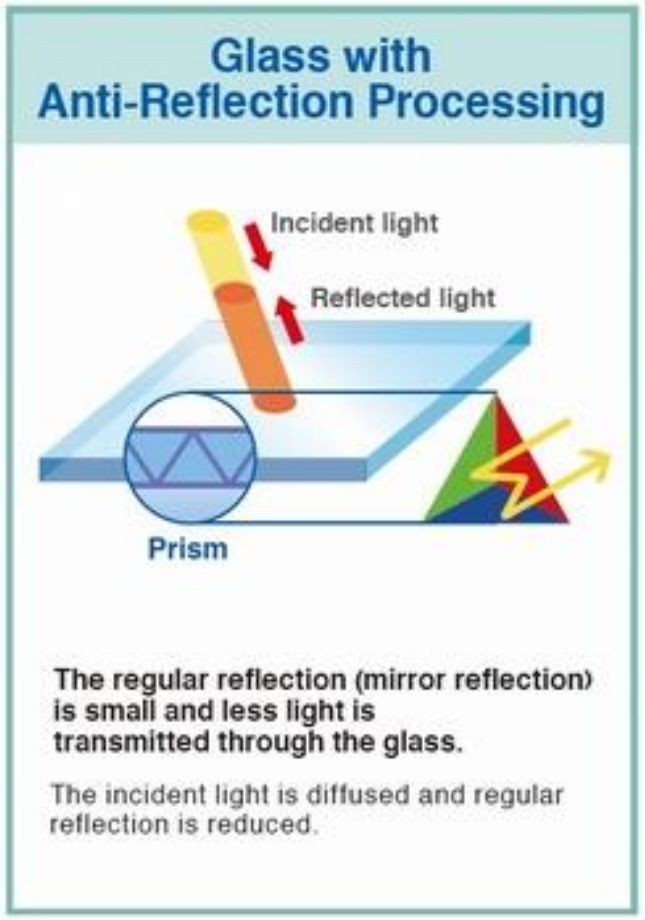
Working Principles

AR glass is created by bonding specially selected materials to the surface(s) of the glass. AR uses destructive interference of multiple layers to reduce the amount of light that is reflected back to the viewer. While uncoated glass has a surface reflectivity of approximately 4% per surface, (AR) glass will have a reflection value less than uncoated, ranging down to 0.1% in some cases.

Applications

it is widely used in outdoor applications and any application that requires high contrast, brightness, sunlight readability, etc. Thanks to its ability to increase brightness without increase the display's backlight power consumption, it is often used in applications that require lower power usage or longer battery life.

Screen Enhancements – Anti-Reflection (AR)



Application Method

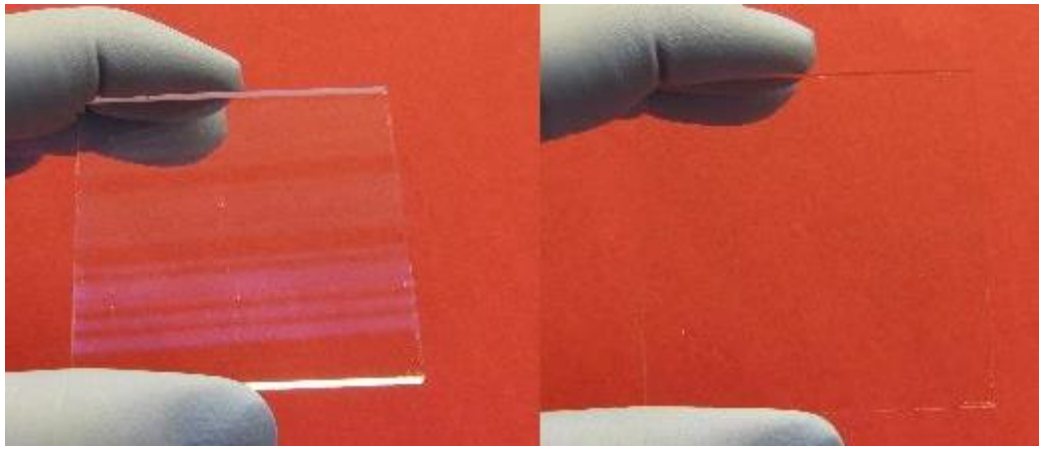
AR works by coating / sputtering multiple layers of films on the cover lens surface with different refractive indexes. This will reduce reflections based on the principle of optical interference.

- Dip coating
- Thin film coating
  - Evaporative coatings
  - Sputter coatings

Dip Coating - on glass is accomplished by dipping the glass into tanks containing proprietary materials and bonding agents and then "firing" the coating onto the surface to create a bond. Dip coating may be performed on small parts and lot sizes as well as large sheets and lot sizes. Most dip-coated products do not have anti-reflective performance below 1% surface reflectivity and 1-3% is average. In addition, dip coating may not be as durable as either pyrolytic or thin film coated products

Thin Film Coatings - Both methods may produce precisely controlled layering and high performance coatings with many material choices available. The major difference between sputtering and evaporation coatings is with the sputtering methods, the AC or DC electrical/magnetic charges, depending on the equipment design, increase the energy of the vapor. This produces a more uniform and denser layering of the coating deposition. The majority of high efficiency broadband anit-reflective (AR) product are sputtered.

Screen Enhancements – Anti-Reflection (AR)



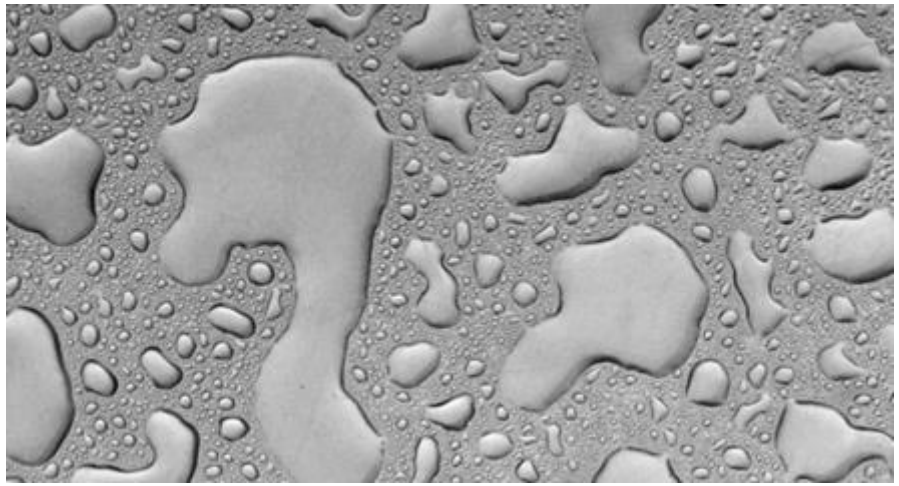
Advantages

- Improves the contrast of an image (signal-to-noise ratio of a beam).
- Improves sunlight readability
- Reduces reflections & glare
- Increases transmittance
- improve the brightness (signal strength) of transmitted images or light beams
- Can improve power consumption by allowing a lower LED brightness

Disadvantages

- High cost (double that of AG) ~$34.5/m²
- Highly vulnerable to fingerprints, so an extra layer of AF (with additional cost) is often required when AR is used

Screen Enhancements – Anti-Fingerprint (AF)



Anti-fingerprint (AF) coating, also known as anti-smudge (AS), utilizes a nano material with excellent water and oil-repelling properties to increase the smoothness of the glass surface, reduce the visibility of fingerprints, make it resistant to smudging and staining and easy to clean.

Advantages

- Resistant to fingerprints
- Resistant to dirt and grime
- Easy to clean

Disadvantages

- Cost is still higher than that of AG
- Tends to have a shorter lifespan than most coatings due to the thin layer deposited (5 – 25nm); anywhere from 1-3 years for high use items

Applications

it is widely used in high-traffic products that require good readability (kiosks, POS, medical, aeronautics, etc.), and is often paired with AR coatings, due to AR's vulnerability to fingerprints.

Screen Enhancements – Anti-Crack or Anti-Shatter Film

Background

Anti-crack or anti-shatter films (ASF)are added to the front of the cover lens in order to prevent glass from shattering or breaking and emerging from display.

Applications

Deadfront panels are most commonly found on automotive in-cabin dashboards and high-end home appliances, and are becoming increasingly popular for consumer, information display, and industrial interface panels.

Working Principles

The shatter proof film generally consists of an outer cover with a pressure adhesive that adheres directly to the cover lens. In case the cover lens breaks, the adhesive holds the glass fragments together and prevents them from coming out of the display.

Application Method

The anti-crack film comes in rolls and is die cut into sheets which can be directly applied to the front of the cover lens by an adhesive build into the film.

Screen Enhancements – Dead Front

Background

"Dynamic" Deadfront panels are often used by equipment designers to create a sleek and uncluttered appearance for user interface panels, drawing attention to the "hidden" light up indicators only as required. When backlit, panel features, icons or other alpha-numeric indicators are visible and when unlit, a monochromatic streamlined look is achieved. It is available in a variety of colors and transmittance values.

Applications

Deadfront panels are most commonly found on automotive in-cabin dashboards and high-end home appliances, and are becoming increasingly popular for consumer, information display, and industrial interface panels.

Working Principles

Deadfront works by utilizing a semi-translucent cover lens, film or other material to block most of the light emitted by the display or LED.

Application Method

Deadfront can be applied either through the use of plastic films which are mass produced and die cut into the required size, or through the use of a silk screening effect over the glass with a semi-translucent paint/color.

Screen Enhancements – Dead Front

Advantages

- Reduces the brightness of LEDs or displays that might be jarring to users
- Presents a clean, modern, unobtrusive interface when dead front effect is active

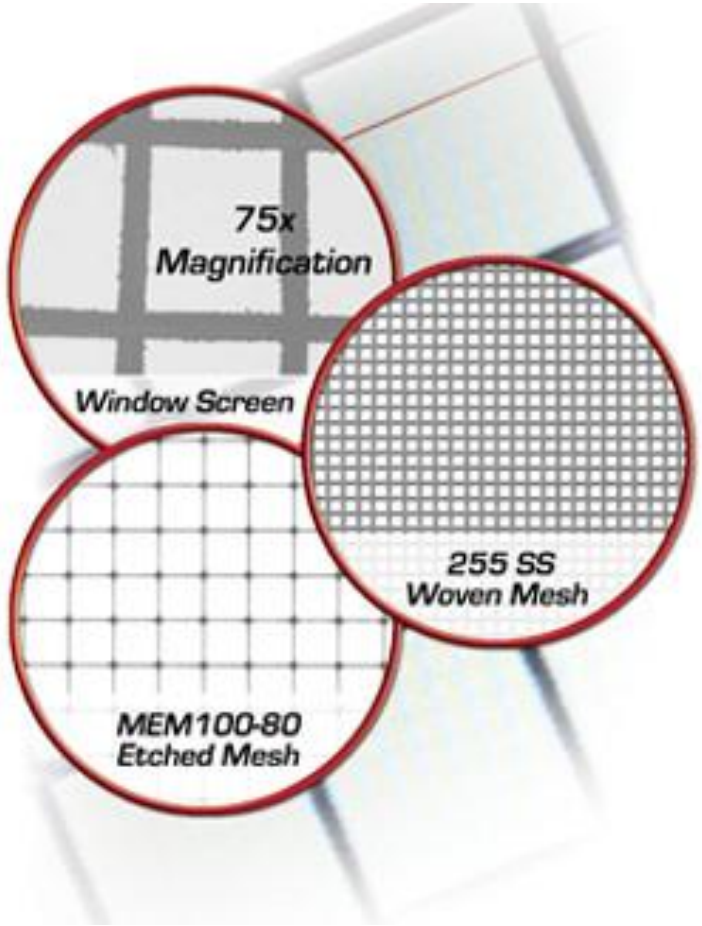
Disadvantages

- By definition, dead front will reduce transmittance and the brightness of the area effected
- Deadfront films are precise and even in application, but tend to be more expensive
- Deadfront silk screening effects tend to be cheaper, but uneven in application and effect

Testing / Evaluation / Specifications

- Dead front is measure by the its transmittance, how much light is let through
- Typical values include: 5%, 10, 15%, 20% transmittance

Screen Enhancements – EMI/RFI Resistance



Background

Defending against co-existing electrical systems or rogue RF signals, Low Ohm Indium Tin Oxide (ITO) and blackened mesh EMI/RFI shielding protects displays while providing high electrical isolation to eliminate signal interference. Ideal for medical equipment and military applications, these filters can be tuned to specific frequencies and allow flat panel displays to satisfy FCC and MIL-STD-461 requirements.

Applications

Often utilized in environments and applications where there is a high level of electronic noise or it is essential that panels work 100% of the time regardless of environmental interference. This includes military, industrial, aeronautic, in-vehicle and medical uses.

Working Principles

Applying a filter or mesh between the touch screen and the LCD allows the electronic noise or interference emitted by the LCD to be blocked from interfering with touch panel sensitivity and function.

Application Method

Fine metal mesh can be applied to the front of the LCD with the use of conductive tape, it can be embedded in an acrylic cover lens, or a layer of low resistance ITO glass can be added to the display stack. The key is to encase the LCD or physically interpose between the system that is to be shielded, a la a Faraday cage, which will serve to block out electronic noise.

Screen Enhancements – EMI/RFI Resistance

EMI Shielding	Transm (%)	Reflection (%)	Shielding
10-Ω/sq. Metal	80%	7 – 8%	Low
10-Ω/sq. ITO	88%	7 – 8%	Low
10-Ω/sq. IMITO	≥ 96%	< 0.5%	Low
2-Ω/sq. ITO	78%	10%	Fair
2-Ω/sq. IMITO	≥ 87%	< 1.0%	Fair
50 Mesh	80-85%	0.15 - 0.35%	Good
80 Mesh	77-83%	0.15 - 0.35%	Good
MEM 100-80	81-86%	< 0.6%	Fair-Good
100 Mesh	66-69%	0.15 - 0.35%	Good
255 Mesh	40-44%	0.15 - 0.35%	Superior

Advantages

- Increases the sensitivity range of the touch screen by eliminating LCD noise
- By adding filters to the front of the touch panel, it can also screen out other sources of electronic noise or interference.

Disadvantages

- Tends to be a high cost solution both due to added processing and material costs
- Most of the available solutions can affect screen transmittance and optical quality

Testing / Evaluation / Specifications

- Measured by the decibel level of electronic noise it can filter out

Screen Enhancements – Privacy Filters

Background

Privacy filters guard the security of on screen data and stop off-axis viewing of the display by blocking the light on either side, blacking out the screen to any viewing angle greater than 30 degrees so the image cannot be read.

Applications

Used most commonly for applications that require password use, financial transactions, sensitive information to be displayed (ATM, medical, etc.).

Working Principles

Manufactured by creating chemical louvers that let the light come straight through, this film allows only those placed directly in front of the filter to see the screen clearly.

Application Method

The privacy filter is generally applied as a film with an adhesive base layer that is directly applied to the top of the screen (as per 3M’s privacy products).

Screen Enhancements – Transparent Heaters

Background

Transparent heaters expand the operating temperatures of flat panel displays and backlights, improving the display performance, especially at low operating temperatures. Transparent heaters are optically clear (ITO) allowing them to be easily combined with other coatings and filters

Applications

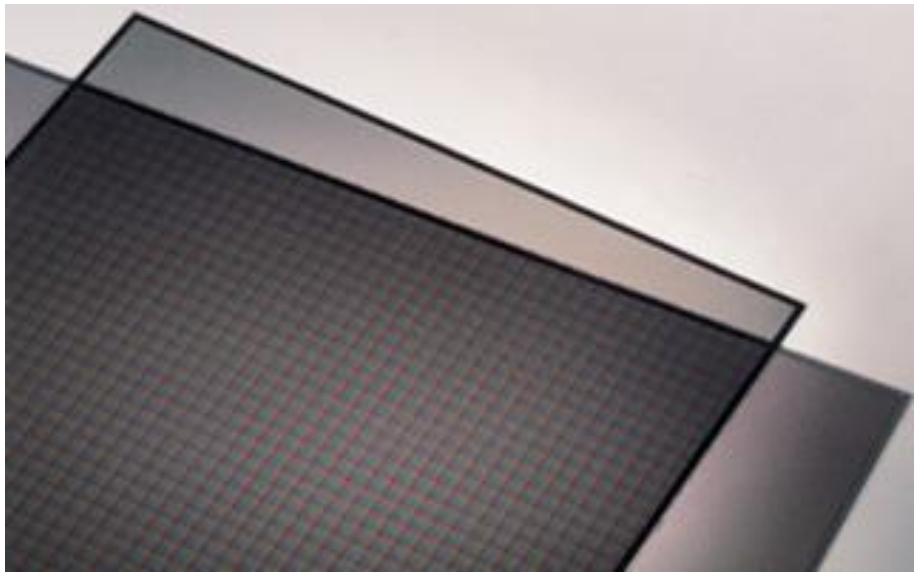
Largely aimed at outdoor use or those applications which require reliable operation in temperature extremes (military for example).

Working Principles

Application Method

AR works

Screen Enhancements – Colored Filters



Background

A variety of colored filters can provide contrast enhancements composed of optical substrates including acrylic, polycarbonate, and glass. Colored Optical Filters provide contrast enhancement for monochrome displays utilizing a color selective band pass. Long Pass filters are used to improve the overall contrast and performance of optical scanners, red, yellow and amber LEDs. Triple Notch filters and polarizers are used to improve contrast LCDs by assuaging internal reflections and yielding a greater difference between the display's output and Background

Applications

Deadfront

Working Principles

Application Method

AR

Screen Enhancements - Other

- **Anti-Corruption** – Sharpie ink or other typically corrosive, permanent materials can be wiped off
- **Anti-Microbial (AM/AB)** – typically used for healthcare applications, it is a material that inhibits bacterial growth which can be incorporated in the product housing and on a filter applied to the surface of the touch screen.
- **Hard Coating (HC)** – applied to plastic cover lens to achieve up to 9H hardness for anti-scratch purposes. Extremely expensive – cost will exceed that of Gorilla Glass or equivalent HIE glass. Cast/extruded acrylic can be up to 17 times stronger and only half the weight of glass. Acrylic sheet used in touch screen is strong, moisture resistant & is oftentimes clearer than glass/optically clear.
- **Anti-stiction** – reduces finger-sticking friction