

# Metallic Writing Surface

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# Project Aim

- We wish to make a metallic surface that can be electronically written.
- Such a surface could form part of a keyboard deck, or be used on the back of a laptop display, for taking notes while the device is closed.
- Existing pens use capacitive sensing to determine position.
- However it is physically impossible to make a capacitive sensor that works through metal.
- Contradictory requirements like this are a fertile ground for innovation.

# What makes a surface look metallic?

- A metal surface is typically created by shot blasting and anodizing, or by painting.
- Unlike a mirror, where the angle of incidence and reflection are equal, and paper, where the angle of reflection totally random, “metallic” surfaces have a limited degree of diffusion and some absorption.
- Absorption usually results in 30%-70% reflectivity, depending on the metal and external protective lacquer or paint.

# Surface scatter

- A laser is shone on the surface and the scattered light distribution compared for paper, painted and anodized metal surfaces.

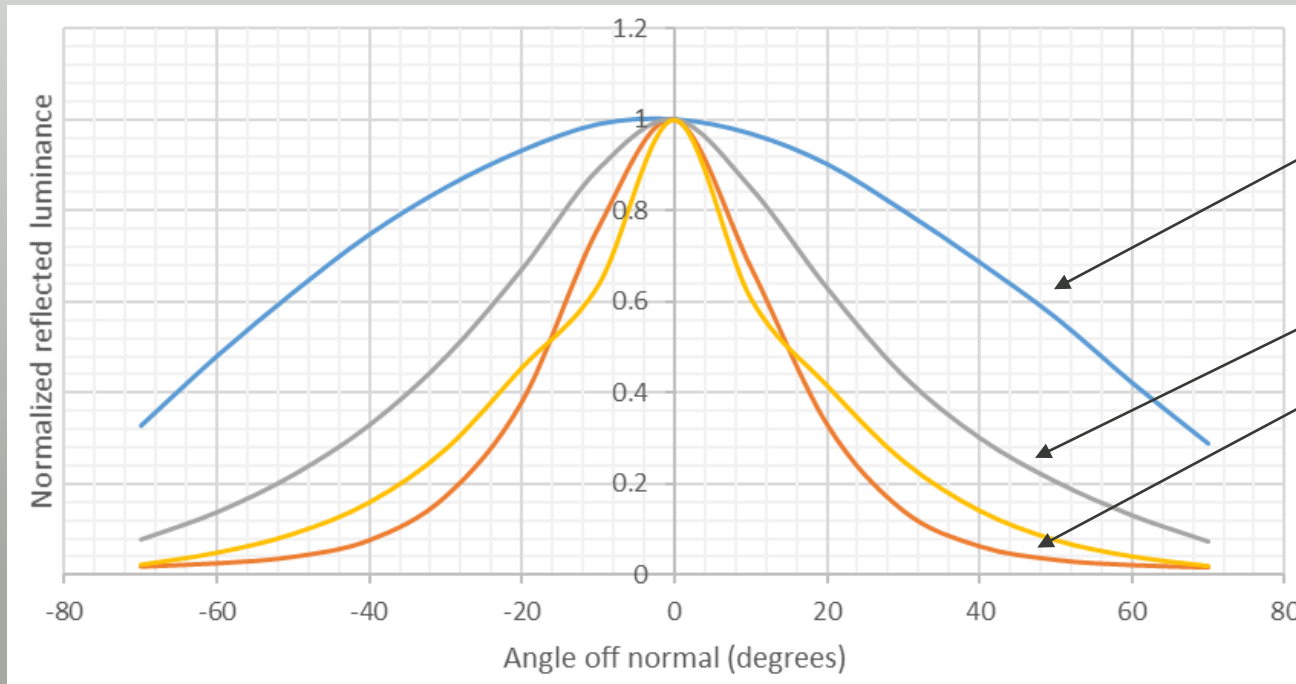


Photo paper (blue curve)

Silver paint (grey curve)

Shot hammered and anodized (yellow and orange curves)

The full-width half maximum of the scatter distribution for metal surfaces is in the range 40-70 degree

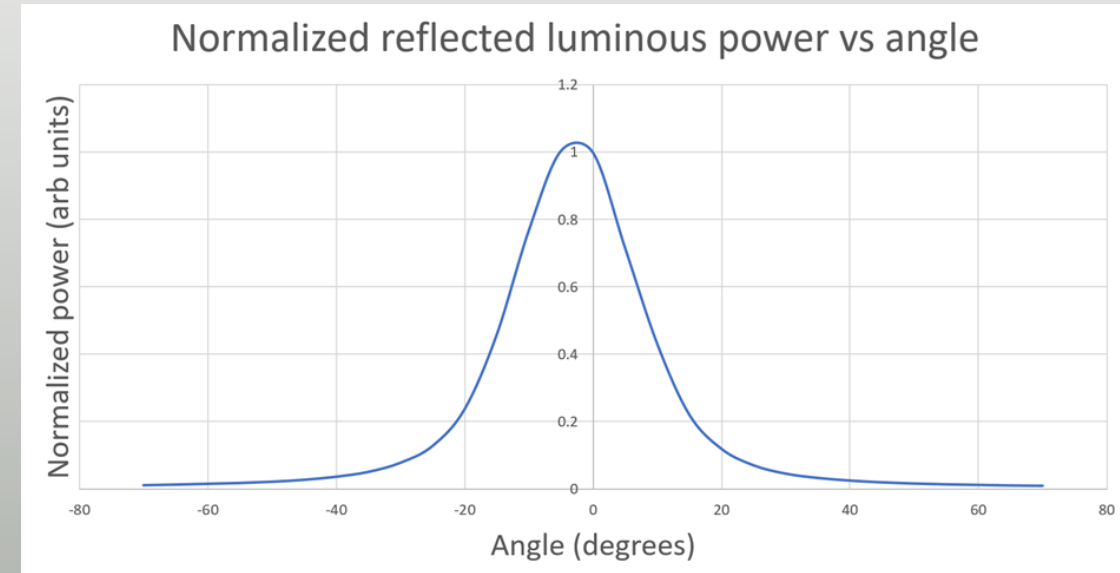
# Advanced Polarizer Film

- Polarizer film is used in LCD backlights exhibit high reflectivity for one polarization.
- The film acts as planar mirrored surface for the reflected polarization.
- These are made using polymer dielectric stacks (like fish scales). They have no metal content.
- The polymers are stretched to make the stack reflect one polarization and transmit the other.
- Light from a polarized display underneath passes through with low loss.



# How can we mimic a metallic surface?

- Adding a diffuser creates an effect visually like a metal.
- The diffusion is tunable with the strength of the diffuser.
- Additional surface relief adds a paper like texture to the surface (helps improve pen feel and reduces effect of fingerprints).
- The diffuser may be etched glass, sol-gel coated glass, or polymer.

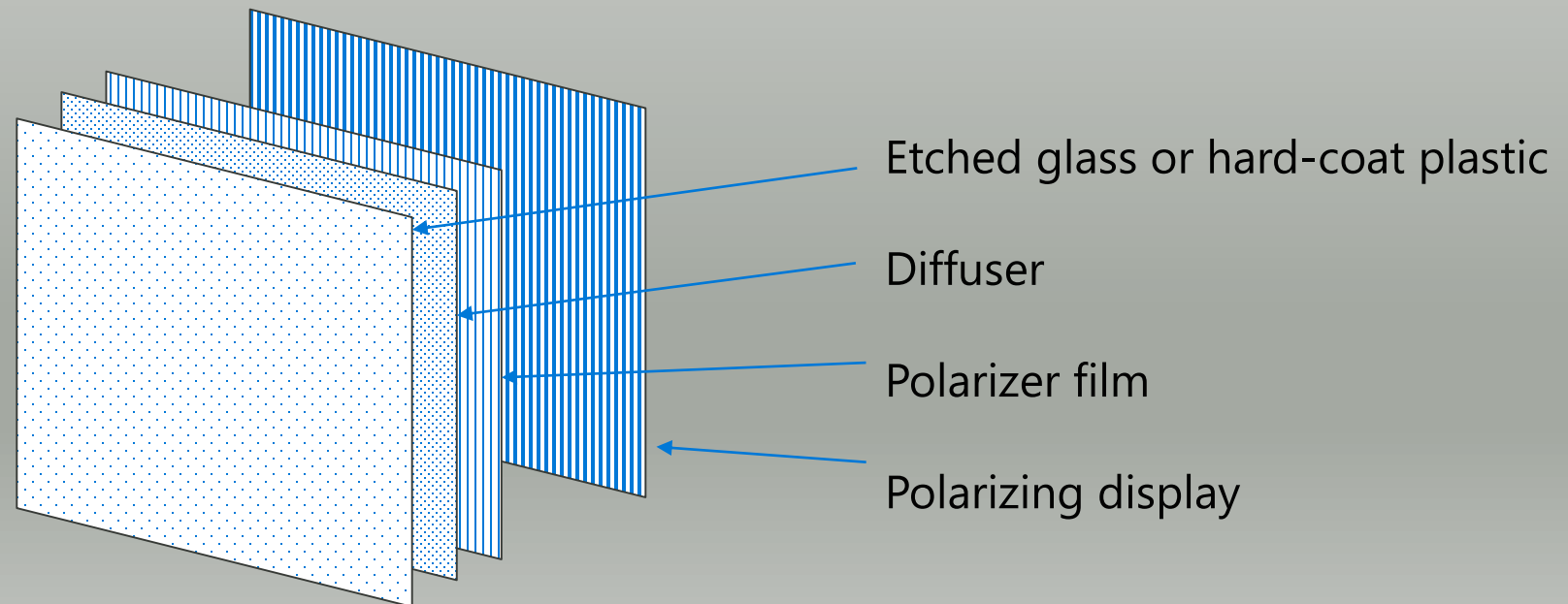


A volume diffuser is bonded to an advanced polarizer film with a thin layer of transfer adhesive.

The effect is similar to the “metallic” diffusion characteristics shown in Slide 4.

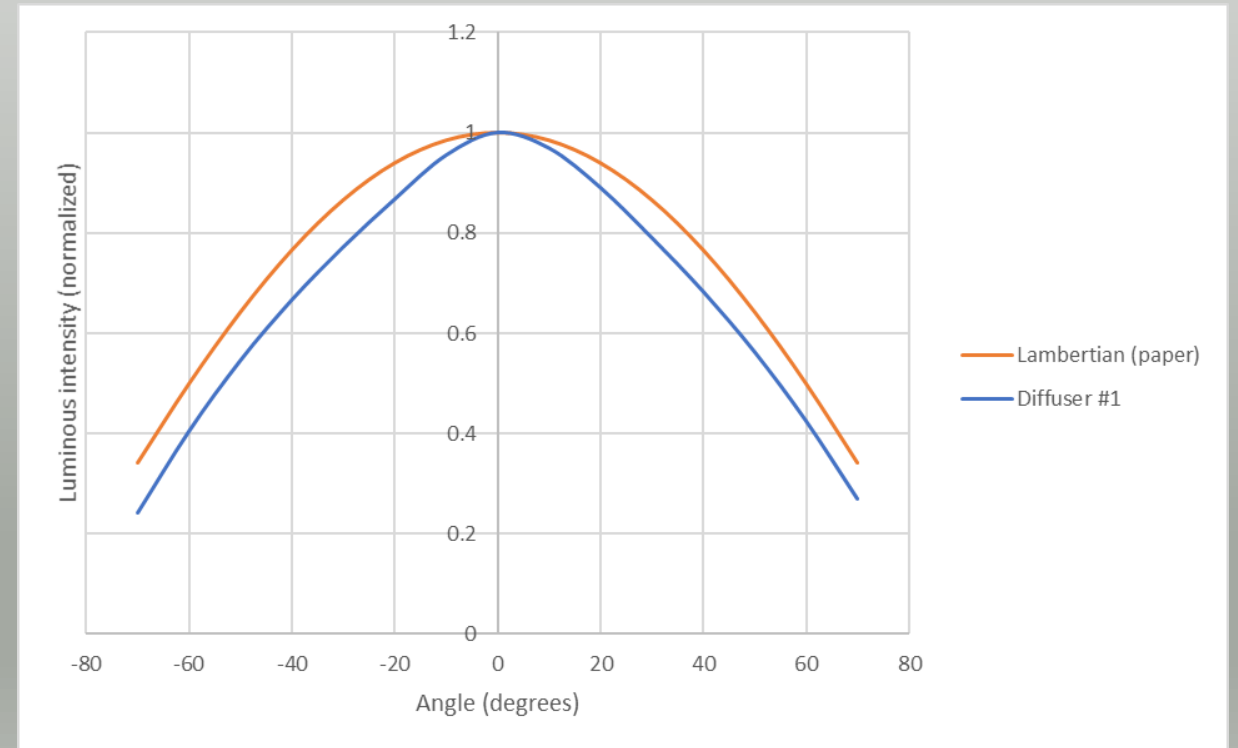
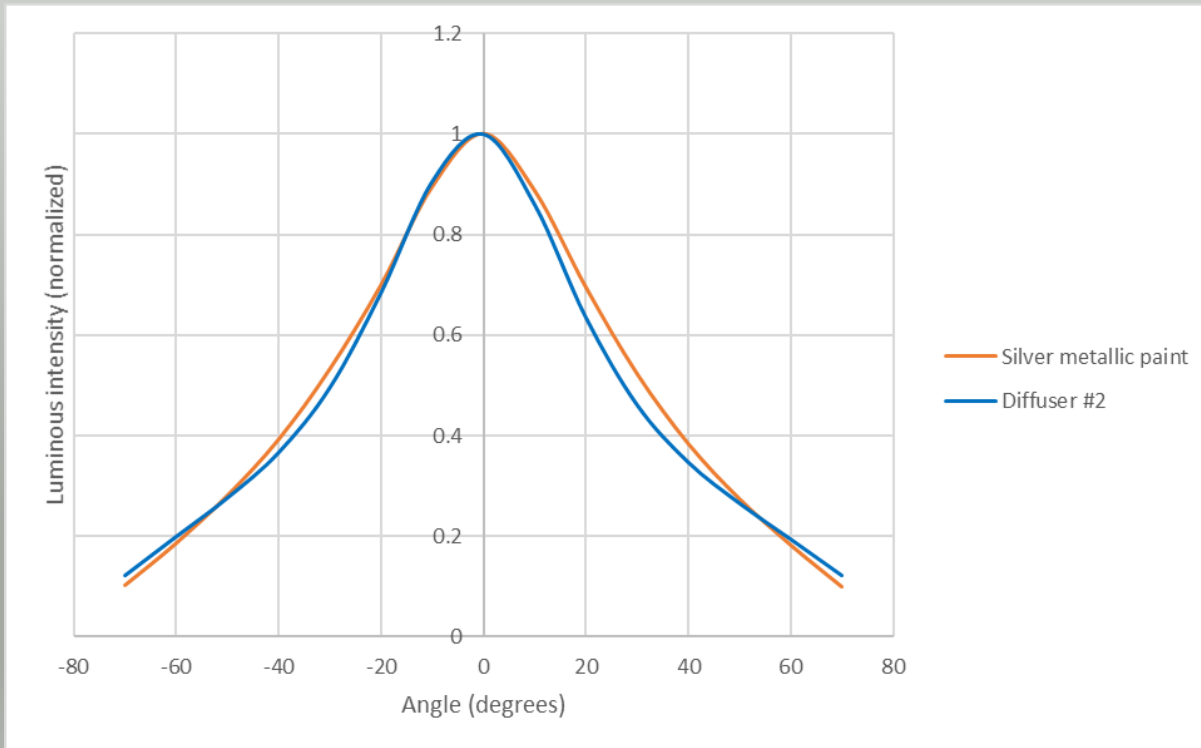
# Adding a Display

- Now we have a diffuser that works for only one polarization.
- We can add a polarized display underneath such as an LCD or OLED that can be seen through the surface with low loss.
- The display luminance should be matched to the ambient lighting conditions to maintain the illusion that the surface is metallic.



# Mimic a specific surface

- Changing the diffuser creates different surface characteristics. On the left side is a paper-like surface and on the right, a surface like silver metallic paint.





# Demonstrations

- The all-dielectric, polarizing structure allows touch and pen operation and high display transmission.
- In the following videos a mirror and metallic paint surface are shown.

