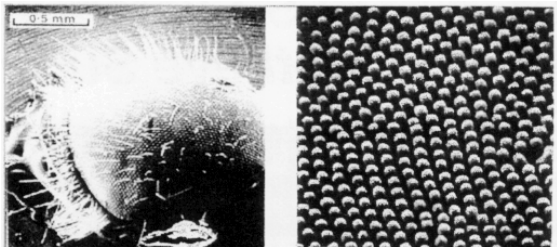
Reflexite® Display Optics

Management of Light®

# Moth-eye Antireflective Microstructures

## Natural "Moth-eye" Structure



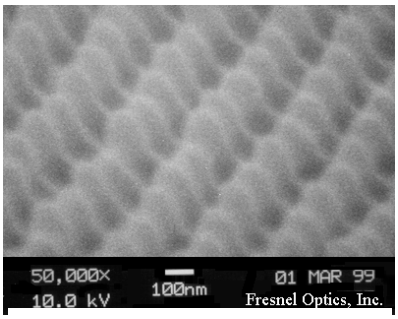

When a moth's eye is examined under an SEM (as seen here), the cornea surface is seen to have microscopic raised protuberances which are roughly 200nm in height and spaced in a hexagonal pattern with centers approximately 300nm apart. This sub-wavelength, surface-relief profile is a low reflectance interface for light. As a result of this surface, the moth's eye is "dead black" and seems to absorb light from any direction. Similar structures of much larger size deaden reflected sound waves in an anechoic chamber.

From a theoretical standpoint, performance can be modeled as a modulated graded-index, which reflects very little light because there are no abrupt index changes.

## Man-Made "Moth-eye" Structure

A holographic lithography process is used to produce master tooling that simulates the moth's eye structure. The nano-surface geometry can be customized somewhat to optimize performance at various wavelengths and viewing angles.

Once the master tool is complete, we accurately replicate this it into a production tool through our precision electroforming process. Production tools can be made to mold high-volume plastic components having an optical microstructure on one side and this antireflective moth-eye structure on the other surface. Production tools can also be made to produce the moth-eye structure in a film form.



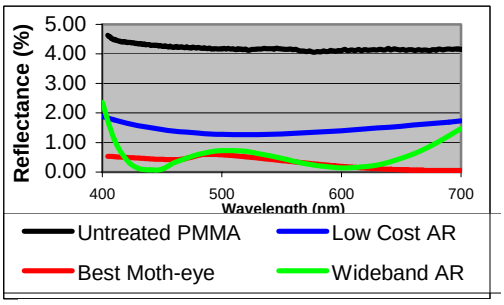

SEM, Moth-eye 4th Generation Replicate (in plastic)

## Advantages of Moth-eye Antireflective Microstructure

- Engineered Performance - Optimized for wavelength and incidence angle
- Advantages in comparison to thin film coatings
  - Durability
  - Cleanability
  - Value

## Moth-eye Performance

As seen in the chart, our "best" moth-eye has an average reflectance of 0.5%. Our typical moth-eye has a 1% reflection.




Single Surface Reflectance vs. Wavelength, Normal Incidence

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