

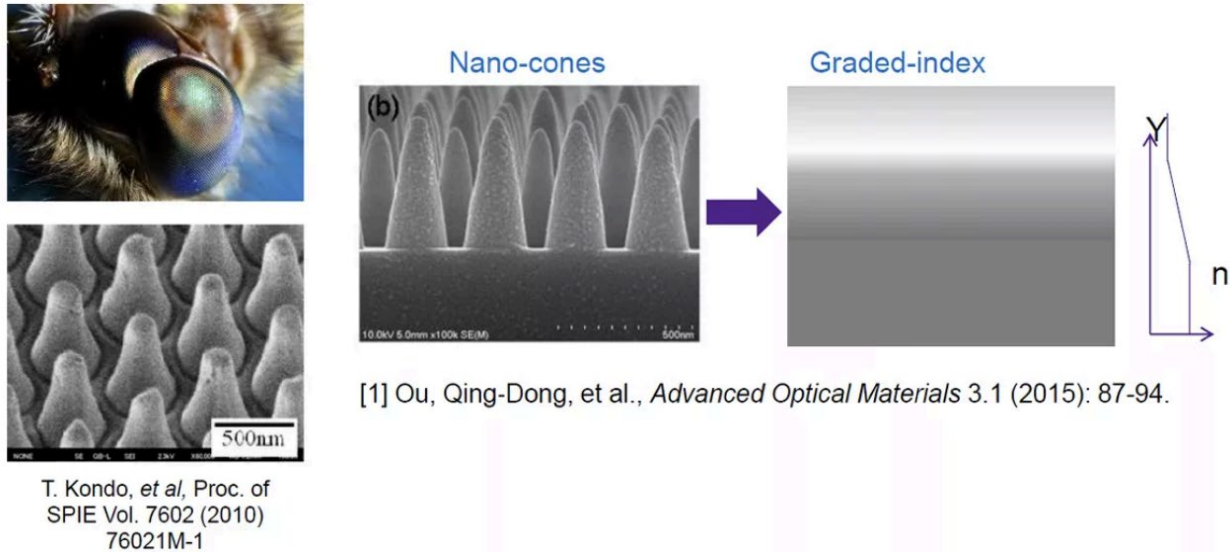
Nanostructured Moth-Eye Anti-Reflective Coating

Products: MOST, DiffractMOD

Applications: Nanophotonics and Nanostructures

Introduction

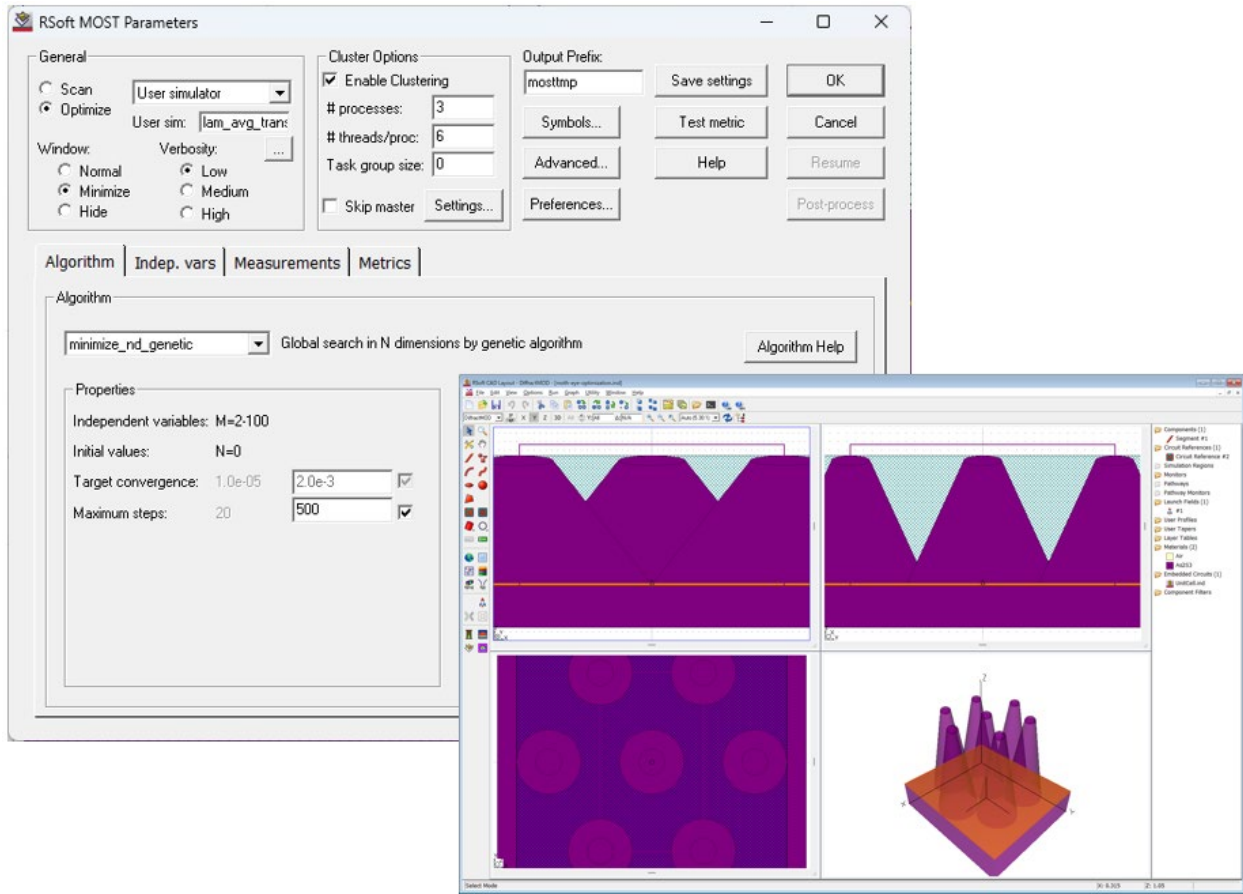
Microscale structures on the surface of optical interfaces have been known for over a century as an effective method of reducing Fresnel reflections. The eyes of a moth are covered with a natural anti-reflective nanostructured film.



- The moth-eye pattern is a pattern of subwavelength “bumps” reduces reflection by creating an effective refractive index gradient between the air and the medium
- The moth-eye structure is one of the most effective nanostructures to reduce reflection
- Moth-eye nanostructures can be patterned on surfaces to give them antireflection properties
- Moth-eye structures have several advantages over traditional thin-film AR coatings
 - Environmental tolerance
 - Surface adhesion
 - Single-material fabrication
 - Minimal surface preparation
 - Higher laser-induced damage threshold
 - Self cleaning (lotus effect)
- Moth-eye structures are especially useful for reducing reflections from and increasing transmission between materials with a large refractive index contrast
 - Particularly important in high-power & low-loss applications
- Moth-eye AR structures have found uses in a number of applications, including laser systems, photovoltaics, LEDs, electronic displays, and fiber optics

The Challenge

In this work, we optimize the shape and dimensions of moth-eye structures for maximum output coupling through the endfaces of As_2S_3 ($n=2.45$) chalcogenide optical fibers.



The Solution

Rigorous computational EM propagation methods, like FDTD and RCWA, can be used to accurately simulate the transmission/reflection from the moth-eye surface.

- For this particular moth-eye structure, RSoft's DiffractMOD RCWA tool is utilized due to RCWA's speed advantages over FDTD
- RSoft's MOST Optimization and Scanning Utility is used in conjunction with DiffractMOD to optimize the reflection/transmission for the moth-eye AR pattern

Example files

Supporting files [Nanostructured Moth-Eye Anti-Reflective Coating](#)

References

- [1] Ou, Qing-Dong, et al., Advanced Optical Materials 3.1 (2015): 87-94.
- [2] T. Kondo, et al, Proc. of SPIE Vol. 7602 (2010) 76021M-1