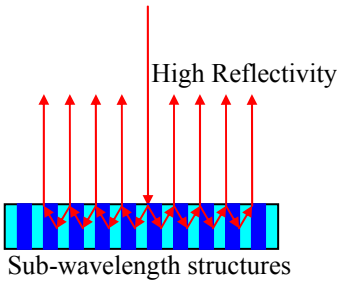
OAK RIDGE NATIONAL LABORATORY FACT SHEET
MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

Highly Reflective Sub-Wavelength Structures For Homeland Security Initiatives

New and Exciting Smart Optical Technology

Through a newly founded Photonics program, Oak Ridge National Laboratory (ORNL) researchers are developing, smart optical sensors to respond reliably, accurately, and quickly in harsh conditions. These discrete sensors can be fabricated on a scale so small, that they are undetectable by the human eye and can be optically detected from distances over several km away in adverse environmental conditions.



Applications

- Remote tracking, tagging locating and identification
- Versatile sensors with scalable properties
- Customized optical surfaces with wavelength selectivity
- Bio-terrorism sensor

Description

Sub-wavelength structures are customized optical surfaces, which, when illuminated with light of a specific wavelength become highly reflective. Unlike other retro-reflectors, mirrors, and reflective paints, these sub-wavelength structures, if designed correctly, can offer high reflectivity, without limited wavelength selectivity, polarization selectivity, and angular sensitivity. The structures are essentially located in microscopic optical waveguides, with imprinted features, having dimensions smaller than the wavelength of the incident light. Sub-wavelength optical structures can be created with high reflection coefficients in the infrared (IR) where long-range propagation (>5km) of light in the atmosphere is possible, and where environmental conditions such as fog, smoke and dust do not impede the penetration. Thus applications of tags include remote identification, tracking and locating at distances. Furthermore, at different wavelengths, changes in the reflected intensity can indicate the presence of gases commensurate with a bio-terrorism sensor.

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"Biological weapons are potentially the most dangerous weapons in the world…We must be better prepared to prevent, identify and respond."
George W. Bush-Signing of Public Health Security and Bio-terrorism Bill, 6.12.02.

Advanced Lasers, Optics, and Diagnostics Group:
http://www.ornl.gov/lod