NANO HIGHLIGHT
Low-Cost Plasmonic Crystal Sensors

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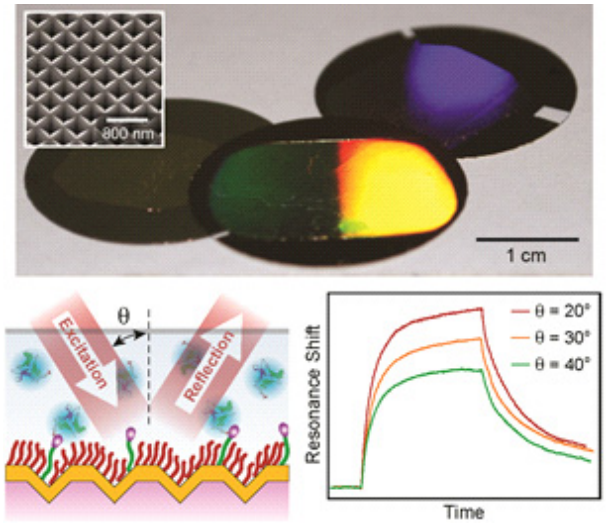
NU-NSEC researchers have developed an easy, inexpensive sensing platform ideal for multiplexed sensing applications. This platform uses molded, disposable plasmonic crystals to take advantage of the interaction of light with electrons oscillations on a metal surface. The sensing step is based on a technique called surface plasmon resonance (SPR), which measures light reflected off a sensor surface that changes when the surface molecules interact with the sensor target. SPR has typically been used for sensing applications with prism-based sensors, but these are not ideal for developing high-throughput sensors that could be used for drug screening or environmental monitoring. In contrast, these NU-NSEC researchers have developed grating-based sensors which can be made as small as a few micrometers and provide the characteristics necessary for high-fidelity multiplexed sensing.



Clockwise from top left: Silicon template; polyurethane-molded plasmonic crystals on glass coverslips coated with 150 nm of gold; comparison of resonance shifts for various angles of SPR excitation; and a model of the SPR technique applied to a plasmonic sensor.

Credit: Teri W. Odom, Northwestern University

The plasmonic crystal nanofabrication procedure can create large-area (greater than 1 cm2) sensing surfaces with high uniformity. The procedure requires three steps: (1) fabricating a silicon template master made up of a two-dimensional array of nano-pyramidal pits, (2) using the template as a mold to generate polyurethane replicas, and (3) depositing a thin film of gold onto the polyurethane substrates to form the gold plasmonic crystals. The gold surface can then be treated with a layer of sensor molecules that will interact with target molecules and give rise to the sensor's signal output. The researchers also discovered that optimizing the angle of light used for SPR detection provides a general approach to increase the signal-to-noise ratio in real-time measurements, thus increasing accuracy.

Overall, this research has led to new capabilities for low-cost nanofabrication of grating-based sensors, while improving the performance of these sensors by increasing detection sensitivity and accuracy. Long term, this discovery, coupled with the many advances achieved by NU-NSEC researchers, is leading to quick and inexpensive point-of-care diagnostics able to detect multiple disease targets within a single patient sample, and high-throughput drug screenings able to reduce drug discovery and development time.

[1] H. Gao, J.-C. Yang, J.Y. Lin, A. Stuparu, M.H. Lee, M. Mrksich, T.W. Odom. *Nano Lett.* **10** (2549), 2010.