New absorber will lead to better biosensors

October 1 2014, by Amanda Morris

Biological sensors, or biosensors, are like technological canaries in the coalmine. By converting a biological response into an optical or electrical signal, they can alert us to dangers in our external and internal environments. They can sense toxic chemicals and particles in the air and enzymes, molecules, and antibodies in the body that could indicate diabetes, cancer, and other diseases.

An optical biosensor works by absorbing a specific bandwidth of light and shifting the spectrum when it senses minor changes in the environment. The narrower the band of absorbed light is, the more sensitive the biosensor.

"Currently, plasmonic absorbers used in biosensors have a resonant bandwidth of 50 nanometers," said Koray Aydin, assistant professor of electrical engineering and computer science at Northwestern University's McCormick School of Engineering and Applied Science. "It is significantly challenging to design absorbers with narrower bandwidths."

Aydin and his team have created a new nanostructure that absorbs a very narrow spectrum of light—having a bandwidth of just 12 nanometers. This ultranarrow band absorber can be used for a variety of applications, including better biosensors.

"We believe that our unique narrowband absorber design will enhance the sensitivity of biosensors," Aydin said. "It's been a challenge to sense very small particles or very low concentrations of a substance."

This research was described in the paper "Ultranarrow band absorbers based on surface lattice resonances in nanostructured metal surfaces," published in the July 29 issue of *ACS Nano*.

Typical absorber designs use two metal sheets with a non-metallic insulating material in between. By using nanofabrication techniques in the lab, Aydin's team found that removing the insulating layer—leaving only metallic nanostructures—caused the structure to absorb a much narrower band of light. The absorption of light is also high, exceeding 90 percent at visible frequencies.

Aydin said this design can also be used in applications for photothermal therapy, thermo-photovoltaics, heat-assisted magnetic recording, thermal emission, and solar-steam generation.

"The beauty of our design is that we found a way to engineer the material by using a different substrate," Aydin said.

Provided by Northwestern University

Citation: New absorber will lead to better biosensors (2014, October 1) retrieved 26 April 2024 from https://phys.org/news/2014-10-absorber-biosensors.html