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Research Highlights

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Subject Categories: Imaging and sensing | Plasmonics

Plasmonics: Sensors tune in

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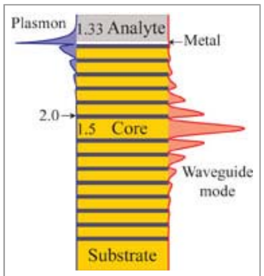
Coupling a photonic crystal waveguide to a propagating surface plasmon allows biosensors to get smaller and cheaper



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Over recent years, researchers in biosensing applications have seized on the possibilities presented by surface plasmon resonances. As light couples with the oscillations of electrons at metal–dielectric interfaces, enticing opportunities arise to detect both tiny variations in biological film thickness and binding events between a target analyte and its receptor. Yet commercial sensor systems remain bulky and expensive, limiting their use to the laboratory. To reduce the size and cost, waveguide-based sensor systems have been suggested instead of the gold-covered glass prisms in current use. However, the sensitivity of these devices has so far been blighted by mismatches in the effective refractive index between plasmon mode and core, and the shallow effective angle of incidence onto the metal layer. Now Skorobogatiy and Kabashin propose a solution[1].

They consider a photonic-crystal waveguide with 27 layers alternating in refractive index, the 12th of which acts as the core. This is topped by a thin layer of gold, which supports surface plasmons, followed by a water 'analyte' for cladding. According to theory, the effective refractive index of the photonic-crystal waveguide depends on the alternating layer thicknesses so it can be tuned to match that of the plasmon mode in the metal film. If this effective refractive index differs greatly from the core, the effective angle of incidence is also greatly reduced. They calculated a 10% change in the transmitted intensity when a 1-nm-thick biolayer was deposited on a tuned photonic crystal waveguide – a sensitivity comparable to existing surface plasmon resonance biosensing configurations, thereby opening the way to smaller, cheaper sensors. With instrumental implementation already in progress, surface plasmon resonance biosensing may soon be liberated from the bulky lab-bound systems.

References

1. Skorobogatiy, M. & Kabashin, A. V. Photon crystal waveguide-based surface plasmon resonance biosensor. *Appl. Phys. Lett.* **89**, 143518 (2006).10.1063/1.2360186

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