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Nano-plasmonic biosensors and photodetectors

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In this talk, the author will present the recent work on nanoplasmonic based biosensors and photodetectors. He will present a label-free, optical nano-biosensor based on the Localized Surface Plasmon Resonance (LSPR) effect that is observed at the metal-dielectric interface of silver nano-cylinder arrays located periodically on a sapphire substrate. The sensing mechanism is based on the detection of refractive index change, due to the binding of biotin that is immobilized on the silver nano-cylinders to the avidin in the target solution, by observing the shifts in the LSPR wavelength. Our results show that such a plasmonic structure can be successfully applied to bio-sensing applications and extended to the detection of specific bacteria species. A highly tunable design for obtaining double resonance substrates to be used in Surface Enhanced Raman Spectroscopy will also be presented. Tandem truncated nano-cones composed of Au-SiO₂-Au layers are designed, simulated and fabricated to obtain resonances at laser excitation and Stokes frequencies. Surface Enhanced Raman Scattering experiments are conducted to compare the enhancements obtained from double resonance substrates to those obtained from single resonance gold truncated nano-cones. The integration of plasmonic structures with solid state devices has many potential applications. It allows the coupling of more light into or out of the device while decreasing the size of the device itself. The author will present a UV plasmonic antenna integrated metal semiconductor metal (MSM) photodetector based on GaN. Al grating structures were designed and fabricated. Well defined plasmonic resonances were measured in the reflectance spectra. Optimized grating structure integrated photodetectors exhibited more than eight-fold photocurrent enhancement.

Biography

Ekmel Ozbay received his PhD degree from Stanford University in Electrical Engineering in 1992. He worked as a Postdoctoral Research Associate in Stanford University, and later worked as a scientist in DOE Ames National Laboratory in Iowa State University. He joined Bilkent University (Ankara, Turkey) in 1995, where he is currently a full Professor in Department of Electrical and Electronics Engineering, and also in physics department. His current research topics involve nanophotonics, nanometamaterials, nanoelectronics, nanoplasmonics, nanodevices, photonic crystals, GaN/AlGaIn MOCVD growth, fabrication and characterization of GaN based devices, and high speed optoelectronics.

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