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LAMP Seminars
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ABSTRACTS

(Monday, 13 February 2012)

Preference: oral

Application of Nobel Metals in Dye sensitized Solar Cells: Near field and far field Effects

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Abstract

Dye-sensitized solar cells (DSCs) have been attracting much attention because of their high-energy conversion efficiency and as a low-cost alternative to commercial solar cells[1]. Many methods for improving the conversion efficiency of the DSC have been attempted, including the modifying of photo-anode [2-4], dye molecules modification [5], and optical engineering [6, 7]. The optical properties of molecules situated close to plasmonic materials such as silver and gold have been investigated from two points of view. In this study, silver and gold nano-islands are fabricated on quartz glass using thermal evaporation and sputtering methods, which followed by annealing at 400, and 700 oC, respectively. N719 molecules, common dye which is used in DSC, are utilized to investigate the effect of SPR on dye absorption. N719 dye has three peaks around 310, 380, and 530 nm. The considerable augmentation, 44%, was obtained at around 540 nm in comparison to the absorption of isolated dye. The peak around 500 nm is the characteristic for the presence of Au nanostructures.

Since there is near- field enhancement close to the nano-islands, dye molecules situated in this field, absorbs this high electromagnetic field and their photon absorption increases. Therefore, the photon absorption of dye improves incident photon-to-current conversion efficiency (IPCE), which determines electric energy conversion efficiency in DSCs. For investigating the effect of far field of metals, Ag is selected since it has the highest reflectance among metals. The common particles, which are used in DSC to enhance light harvesting is TiO2. Although Ag is a perfect reflecting material, it has lower effect in light harvesting in comparison with TiO2 particles.

Preference: oral

A multichannel surface plasmon resonance sensor using a new spectral readout system without moving optics

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Abstract

Surface plasmon resonance (SPR) sensors with spectral interrogation provide a high refractive index resolution, a large dynamic range and a fixed optical detection module. In this work, we propose a new multichannel spectral detection unit that uses only one spectrometer to measure the reflection spectrum from multiple sensing spots serially without any mechanical movement. This spectral detection unit is designed based on a spatial light modulator (SLM) configured as a programmable optical aperture for the spectrometer. Refractive index resolution of 1.4×10^{-6} refractive index units (RIU) can be reached using a five-channel prototype.

Preference: oral

Investigations of Photocurrent in Individual Nanowire with Global and Localized Irradiation

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Abstract

In this work, I would like to present the photocurrent studies of isolated nanowire (NW) padded with conducting electrodes at both ends with global irradiation of laser beam and localized irradiation using a focused laser beam. The nanowires (Nb2O5) studied under global laser irradiation of the individual nanowire either in ambient or vacuum reveals photocurrent contributions with different time characteristics (rapid and slow varying components) arising from defect level excitations, thermal heating effect, surface states and NW-conductor contacts. With a spot size of < 1 μm, localized irradiation highlighted the fact that the measured photocurrent in this single NW device (with and without applied bias) depended sensitively on the photoresponse at the NW-conductor contacts.

Preference: oral

Laser Induced Photochemistry for Metallic Nanoparticles and Micro/nanostructures Fabrication

Nicoleta Tosa

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Abstract

My research interests are related to the proper way to implement challenging issues concerning design, optimization and complex characterization of chemical systems based on metallic doped polymers to generate metallic micro-and nanostructures by direct laser irradiation as well as synthesis and spectroscopic characterization of noble metal nanoparticles, bare and functionalized with organic S- and N- derivatives as base for biosensors development. The main difference between this procedure and those classic is that the chemical photoreduction reaction is developed under ambient conditions and is spatially confined in a small volume at the laser focal point. These research directions are supported by the strong background in chemistry and physics and the recent complex instrumentation available in our institute.

Preference: oral

Laser-induced radial birefringence and spin-to-orbital optical angularmomentum conversion in silver-doped glasses

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Abstract

Samples of Ag+/Na+ -exchanged glass that have been subject to ntense laser irradiation may develop novel optical properties, as a consequence of the formation of patterns of silver nanoparticlesand other structures. Here, I report the observation of a laser-induced permanent transverse birefringence, with the optical axis forming a radial pattern, as revealed by the spin-to-orbital angular momentum conversion occurring in a probe light beam. The birefringence pattern can be modeled well as resulting from thermally-induced stresses arising in the silver-doped glass during laser exposure, although the actual mechanism leading to the permanent anisotropy is probably more complex.