Nanooptics and photonics

Modulation-polarization spectroscopy of the glass surface functionalized by Au nanoparticles

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Gold nanoparticles (Au NPs) are extensively studied due to their unique optical properties that are manifested in the localized surface plasmon resonance (LSPR). Wide applications as a material for sensor, photovoltaic, medical tools, etc., make them important. The synthesis of Au NPs with the average diameter of 17±2 nm was achieved following the Turkevich method [1]. The glass slides were coated with (3-aminopropyl)-triethoxysilane with further immersion into aqueous solution of Au NPs to achieve they random chemical attachment to the surface [2]. The SEM and AFM study of the slides revealed formation of NPs monolayer with the separation to the distance exciding one NP diameter.

The aim of this work is to study the optical polarization properties for randomly distributed Au NPs arrays using the modulation-polarization spectroscopy (MPS) technique [3]. Angular and spectral dependencies of polarization difference $(,) = R_s^2 - R_p^2$ of reflection coefficients of *s*- and *p*-polarized radiation in the wavelength range λ = 0.4–1 μm were measured. Two mechanisms of resonant interaction of electromagnetic radiation with an array of Au NPs were detected. The excitations of LSPR on isolated non-interacting nanoparticles in a short-wavelength range around 505 nm and between them due to dipole fields' interaction in a long-wavelength range around 620 nm, respectively. Dispersion characteristics *(k)* of surface plasmons were obtained. Radiative and non-radiative modes of surface plasmons were studied. The frequencies and relaxation parameters of LSPR s and the plasma frequencies for Au NPs were obtained. The correlation between structural and morphological features of the films with arrays of Au NPs and their resonant-optical polarization properties is discussed.

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