

Scattering of surface waves by gold film with variable roughness

V. Sterligov (1), I. Gritsaenko (1), and Ya. Men (2)

(1) Institute of Semiconductor Physics, Kiev, Ukraine (vaster04@yahoo.com), (2) Institut für EBS, Universität Ulm, Ulm, Germany

Scattering of surface waves by surface roughness is one of the most important mechanisms that transfer energy of surface waves into volume ones that propagate in free space. Such transfer of energy is origin of losses that determine quality of optical devices exploiting surface waves. Change of polarization state of light scattered by surface roughness reveals different mechanisms of electromagnetic wave transfer, including excitation of surface waves, their interaction with surface roughness and emission into free space.

Samples with variable along its surface roughness were created by pulsed laser deposition of gold nanoparticles and covering obtained structure by gold film of fixed thickness. Scattering of volume waves enables calculation of r.m.s. surface roughness δ , which was varied in the range 1...7 nm. Than surface waves, both evanescent and surface plasmon-polaritons, were excited in Kretschmann layout for the same area of the sample for which δ was calculated, and scattered radiation of different polarization was measured. It was calculated Total Integrated Scattered (TIS) intensity for the scattering of surface waves, integrated along the plane of incidence. It was found that co-polarized TIS_{pp} and TIS_{ss} values are mainly proportional δ , while for cross-polarized TIS_{ps} and TIS_{sp} these dependencies are more complicated.

Power Spectral Density (PSD) data of studied sample's areas were calculated and compared according data of volume and surface waves scattering. Difference of obtained PSD data for surface and volume wave scattering is presented and discussed.