Nanocomposites and nanomaterials; Nanoplasmonics and surface enhanced spectroscopy

Ellipsometric investigation of the interaction of surface and localized plasmons and registration of their splitting.

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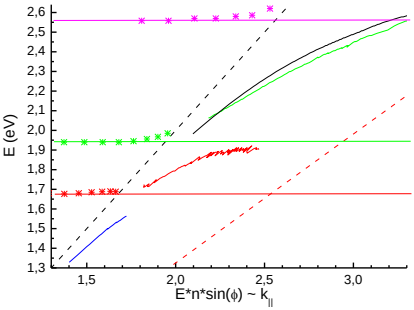
Interaction of two resonances results in their hybridization and splitting what produces the energy gap between two hybridized dispersion curves instead of their intersection. Different parameters of interacting systems define such a splitting [1].

We used ellipsometry to investigate the interaction of surface plasmon with localized resonances of nanoparticles. Measurements were performed as in the standard configuration with external reflection as in Kretschmann geometry with internal reflection. Spherical gold particles of different diameters from "Nanopartz" were deposited from solutions of different concentration on gold films with the thickness of about 40nm on BK-7 slides. For measurements in Kretschmann geometry slides were attached to BK-7 rectangular prism by spectrally matching index liquid from "Cargil".

Modeling shown that resonances demonstrate themselves by dips in spectra of ellipsometric angle Ψ in both measurement geometries. Dispersion curves restored from measured ellipsometric spectra for the system with nanoparticles with the diameter of 50nm are presented in Fig.1.



Presented results clearly demonstrate existence of few plasmon resonances localized on deposited nanoparticles. The third resonance may be multipolar in addition to two (longitudinal and transverse) dipolar ones. Interaction with supporting surface lifts the degeneration of localized plasmon on spherical particle. All localized resonances hybridize with the surface plasmon producing splitting instead of the crossing of initial dispersion dependences. Parts of dispersion curves obtained at external and internal reflection join each other.

1. *Törmä P., Barnes W.L.* // Rep. Prog. Phys.-2015.-**78.**-P.013901.