Nanooptics and nanophotonics

Study of Spectral and Nonlinear Optical properties of Nanostructured Gold Films

M. Brodyn[1], A. Borshch[1],V. Liakhovetskyi[1], V. Rudenko[1], V. Styopkin[1], V. Volkov[1]

[1] Nonlinear Optics Department, Institute of Physics Natl. Acad. of Sci. of Ukraine. Prospect Nauki, 46, Kiev-03039, Ukraine.
E-mail: email.of. lyakh@iop.kiev.ua

Regular nanostructured Au films with different topography and enhanced surface density of nanoparticles as well as random nanostructures are synthesized by means of nanosphere technology and thermal deposition on glass substrates.

Plasmonic spectra of the structures under study are measured depending on their topography features. The third order optical susceptibility $\chi^{(3)}$ of the samples is measured in resonant and nonresonant respective to plasmonic band conditions. Maximum value of the $\chi^{(3)}$ was measured to be $8 \cdot 10^{-5}$ esu.

The nonlinear optical response dynamics is measured under femtosecond laser excitation at λ=400nm and 800 nm. It was shown that the nonlinear optical response is induced during less than 200 fs and is due to free electron generation and the following electron-electron scattering resulting in electron gas heating. The relaxation of the nonlinearity goes with two different times "fast" $\tau_1 \sim 2 \div 5$ ps and "slow" $\tau_2 \sim 200$ ps. It was shown that the "fast" relaxation corresponds to the time of hot electros thermalisation, meanwhile the "slow" one corresponds to Au nanoparticle lattice cooling down.