

OR0809

Preparation of nanostructured silver layer and tuning of its optical behavior

Jiri Bulir¹, Michal Novotny¹, Jan Lancok¹, Ladislav Fekete¹, Marek Skeren²

¹Institute of Physics, ASCR, Prague, Czech Republic ²Czech Technical University in Prague, Prague, Czech Republic

bulir@fzu.cz

Silver exhibits a great potential for a fabrication of metal-dielectric and plasmonic optical devices due to its unique optical constants and excellent electrical properties. In this work, we show preparation of nano-structured ultra-thin silver layer possessing a plasmon resonant behavior. The silver layers were deposited by RF magnetron sputtering. Typically, the growth noble metals such as Ag is governed by Volmer-Weber mechanism, which is characterized by the isolated islands formation at the initial stage of the silver nucleation on a substrate. However, such nano-islands possess an irregular shape and wide size distribution. We show that the growth mode of the silver can be controlled by the deposition conditions and the plasma parameters. Thus an ultra-thin, continuous and smooth silver layer can be prepared using this method. The prepared ultra-thin continuous layers were thermally annealed exploiting the effect of Rayleigh instability for transformation of the continuous layer to semi-spherical silver nano-particles with a regular shape and a narrow size distribution. The optical behavior was tuned by alloying with others noble metals such as Au and Pd. Both, the deposition process and the thermal annealing was monitored by means of the spectral ellipsometry. The nano-granular character of the nano-structured layer is revealed by resonant features in the extinction coefficient spectra. The surface morphology of the completed layer was analyzed by scanning electron microscopy (SEM), and atomic force microscopy (AFM).

Keywords

silver

nano-particles

magnetron sputtering

spectral ellipsometry