Nanocomposite CdS:Au NPs

V.V. Kusnezh, H.A. Il'chuk, R.Yu. Petrus', F.I. Tsyupko[2]

Lviv Polytechnic National University, [1]Physics Department, [2]Analytical chemistry Department, 12 S. Bandery Str., 79013 Lviv, Ukraine

The nanoparticles (NPs) of Au and Ag noble metals can be used as light scattering elements for enhancing the solar cell energy conversion efficiencies. It is known that light can induce a localized surface plasmon resonance (i.e. a collective oscillation of the conduction electrons) in the metal particles of sub-wavelength size. These plasmonic nanoparticles have very strong interaction with light near the resonance frequency. Incident light can be either absorbed or scattered and the contribution from each mechanism depends on the size and shape of the particle. The inclusion of metallic nanoparticles in solar cells (SC) can enhance the absorption of the light by two mechanisms: an increasing of the forward scattering crossection and a near-field enhancement.

Cadmium sulfide thin films were deposited on the glass and ITO surfaces with geometry 16×8×0.7 mm by magnetron RF-sputtering method. The Au NPs array was chemically deposited from a mixture of $AuCl_3$, CH_2O and Na_2CO_3 aqueous solutions on the cadmium sulfide thin films. The substrate was covered by 300 µl of working solution for 0.5–2 min and rinsed in distilled water to prevent precipitation of NP growth in solution volume. Post deposition (400°C, 1 h) annealing was performed to evaporate water residuals and improve NPs adhesion.

The surface morphology was investigated by atomic force microscope XE-70 Park System (Park, South Korea). Transmission T(λ) and reflectivity R(λ) spectra of the samples in the wavelength range from 300 to 1100 nm with 5 nm step were measured by the spectrophotometer Bentham PVE 300 (Bentham, UK).

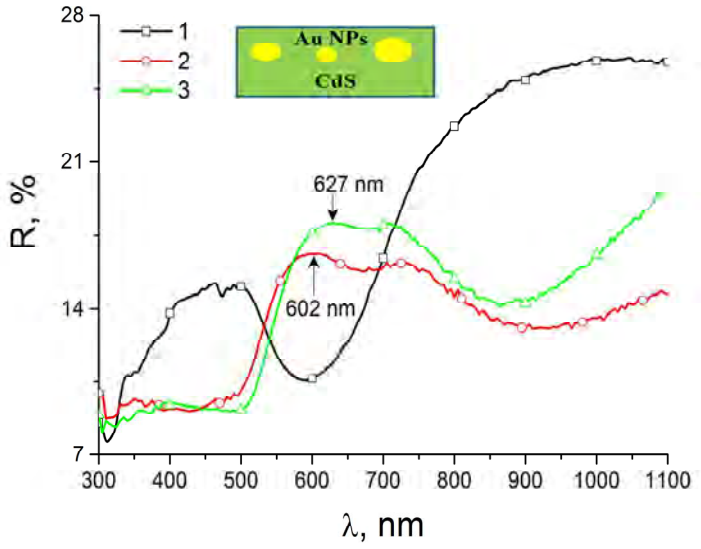

Fig. Reflectivity spectra of the as deposited CdS thin film (1) and with Au NPs array decorated on top (a) and inside (b) the CdS thin films with 60 (2) and 90 s (3) deposition time