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Optical properties of sandwich structure "$(Ag_3AsS_3)_{0.6}(As_2S_3)_{0.4}$ thin films - gold nanoparticles"prepared by pulse laser deposition

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Among silver-containing chalcogenides Ag-As-S ternary system are take the remarkable place. Glasses and composites of Ag–As–S system are promising materials for creation of solid electrolytes, electrochemical sensors, electrochromic displays etc. In the recent years surface plasmon resonance has been used to enhance photostructural changes due to the laser light. Therefore, it was of a certain interest to obtain and examine such effects in the new investigated Ag-As-S thin films.

Synthesis of $(Ag_3AsS_3)_{0.6}(As_2S_3)_{0.4}$composite was carried out at a temperature of 700 °C for 24 h with subsequent melt homogenization for 72 h. Gold nanoparticles (GNP) were obtained at the silicaglass substrates by annealing of previously deposited by thermal evaporation thin films of gold. Subsequently, the GNP layer were covered with the $(Ag_3AsS_3)_{0.6}(As_2S_3)_{0.4}$ thin film, deposited by pulse laser deposition from the corresponding material. Optical transmission spectra of sandwich structure based on $(Ag_3AsS_3)_{0.6}(As_2S_3)_{0.4}$ thin film and gold nanoparticles were studied in the interval of temperatures 77–300 K by an MDR-3 grating monochromator.

The spectral dependences of the absorption coefficient as well as dispersion dependences of the refractive index were derived from the spectrometric studies of interference transmission spectra. Temperature variation of the transmission spectra as well as the temperature behaviour of the absorption edge spectra in the range of its exponential behaviour were studied. A typical Urbach bundle is observed, temperature dependences of theabsorption edge parameters were obtained. Thus, in the range of the exponential behaviour of the optical absorption edge the energy position of exponential absorption edge E_g^{α} and the Urbach energy E_U in sandwich structurewere determined. The influence of different type of disordering on the Urbach tail was studied and a comparative analysis of the Urbach absorption edge parameters for sandwich structure and $(Ag_3AsS_3)_{0.6}(As_2S_3)_{0.4}$ thin film was performed.