FORMATION AND OPTICAL PROPERTIES OF SILVER NANOPARTICLES IN $Li_2B_4O_7$–Gd_2O_3–Ag_2O BORATE GLASS

V.T. Adamiv[1], *I.M. Bolesta*[2], *Ya.V. Burak*[1], *R.V. Gamernyk*[2], *R.M. Dutka*[1], *I.D. Karbovnyk*[2], *M.V. Periv*[2], *I.M. Teslyuk*[1]

[1]Institute of Physical Optics (*23, Dragomanov Str., Lviv 79005, Ukraine*),
[2]Ivan Franko National University of Lviv (*50, Dragomanov Str., Lviv 79005, Ukraine*)

S u m m a r y

The formation of metallic (silver) nanoparticles (AgNPs) in the near-surface layer of $97.0Li_2B_4O_7$–$1.0Gd_2O_3$–$2.0Ag_2O$ ($Li_2B_4O_7$:Gd,Ag)glass at the annealing in vacuum or in air has been reported. The "bottom-up"mechanism of nanoparticle formation is suggested. A conclusion is drawn that the annealing in vacuum does not necessarily require the presence of reducing ions, whereas the formation of nanoparticles at the annealing in air is impossible without reducing agents. Structural defects play a crucial role in the AgNPs nucleation process. The intense plasmon absorption bands peaked at 400.4, 564.2, and 413.7 nm are observed in the absorption spectra of glasses enriched with AgNPs. The average radius of nanoparticles is calculated from the half-width of plasmon bands and falls within the interval of 1.0–1.5 nm. The nonlinear refractive index n_2 related to plasmons in AgNPs is calculated from the normalized transmission and absorption spectra, is positive, and increases approximately 2–4 times as compared to that of $Li_2B_4O_7$:Gd,Ag matrix.