

Solid-Phase Interaction in the Bilayer Eutectic Nanofilms

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Low-temperature solid-phase interaction in the simple eutectic pairs of metal- semiconductor thin films is one of the ways to create new materials for engineering of nanoplasmonic and nanophotonic structures. Such eutectic pairs of films can be used for recording media, in the optical sensors and photonic crystals. In present report bilayer systems of semiconductor and metals that are forming simple eutectic pairs Ge-Au, Ag, Al were investigated. The aim was to study the changes of structural and optical properties of bilayer eutectic nanofilms during the laser and thermal annealing. Bilayer eutectic nanofilms systems were prepared by thermal evaporation in vacuum with computer control technique.

The nanostructure with total thickness 45 - 50 nm and width of pits 0,5mkm was obtained via laser beam treatment of two-layer eutectic system Ge-Au, Ag, Al. The annealing was performed by laser radiation with a wavelength of 530 mkm. The laser annealing power of this structures on glass substrates is represented in Table 1.

Table 1. The annealing power of two-layers structures on glass substrates

| Systems | Layers thickness, nm | Pulse length, ns | Recording power for local interaction, mW | Recording power for perforation, mW |
|---------|----------------------|------------------|---|-------------------------------------|
| Ge-Al | 45 | 150 | 4,2 | 11 |
| Ge-Ag | 50 | 150 | 11 | 19 |
| Ge-Au | 45 | 150 | 5,7 | 11 |

The results of bilayer eutectic nanofilms thermal annealing demonstrate the changing of transmission and reflection index. At the same time AFM images of samples before and after the thermal annealing show the same structure. The temperatures of solid-phase interaction of investigating samples was 1,5-3 times less then eutectic temperatures. Spectra of binary mixtures Ge-metals were measured in situ during the thermal annealing. They show the changes of transmission as a function of the annealing temperature. Also be noted that reflection index spectra of the systems Ge-Au,Ag,Al before and after annealing are different. All features of the investigated systems described above were used by us for creation photonic crystals.

One of the most sensitive modern optical sensors are devices based on SPR. System Ge-Au make it possible to extend the range of the studied biological objects. Annealing this bilayer systems shows the shifts of curves of surface plasmon resonance and give the possibility to obtain the required curves.

Such advantages of these materials as low-energy interactions, long lifetime and environmental make them promising for neoteric technology.