## Effect of Ag impurity on the optical properties of GST225 thin films

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Intensive research is currently underway to develop materials for the optical recording of information based on a glass-crystal phase transition. Promising materials for this direction are thin films of chalcogenide semiconductors based on the Ge-Sb-Te system. To improve the parameters of recording and rewriting information, the speed of the phase transition, the number of write-erase cycles used the impurity modification with metals such as Ag, In and Bi. It was found that Ag atoms act as nucleation centers that can reduce the activation energy of crystallization and increase the crystallization rate of the film, thereby erasing the PCRAM erasure rate [1].

The report presents the results of the influence of silver impurity and size effect on the optical properties of $Ge_2Sb_2Te_5$ (GST225) films.

Nanosized films GST225 modified by Ag were obtained by ion-plasma RF magnetron sputtering of a combined target from GST225 and Ag in an Ar atmosphere. The used power of the RF generator was selected in such a way as to produce GST225 films with an amorphous structure. Crystallization was performed by thermal annealing at 300°C. The films' thickness range ~50-150 nm and was determined on the Quanta 3D 200i SEM. The concentration of silver impurities in the films was 5.0 and 9.7 at. %.

The optical properties of studied films deposited on glass substrates were investigated using Shimadzu UV2000. It was found that the spectral dependences of the transmission coefficients $T(\lambda)$, absorption $\alpha(h\nu)$, and the optical band gap $E_g$ depend both on the concentration of Ag in the films and on their thickness. It was found that for amorphous and crystalline GST225<Ag> films in the range of the studied Ag impurity concentrations and their thicknesses, the quadratic law of light absorption is observed, which indicates the realization of indirect allowed optical transitions. Modification of amorphous and crystalline GST225 films with silver impurities leads to a substantial decrease in the optical band gap. At a fixed concentration of Ag impurity in GST225<Ag> films in the amorphous and crystalline state, with a decrease in their thickness to 50 nm, a significant decrease in $E_g$ is also observed.

Thus, the modification of GST225 films with an Ag impurity leads to significant changes in their structure and optical properties.

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**References**

[1] K.H. Song, S.W. Kim, J.H. Seo, H.Y. Lee, J. Appl. Phys. 104 (2008) 103516.