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SURFACE MORPHOLOGY OF THIN FILMS BASED ON GE-SI-SN MATERIALS AT DIFFERENT GROWTH CONDITIONS

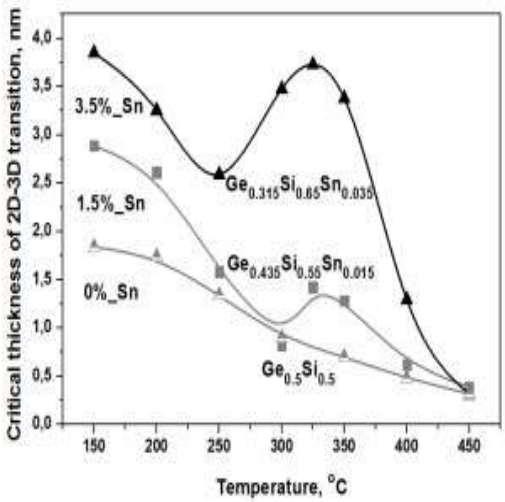
SMC - Semiconductor surfaces

V. Timofeev *, A. Nikiforov, A. Tuktamyshev, V. Mashanov, S. Teys

The Institute of Semiconductor Physics, Siberian Branch of the Russian Academy of Sciences (ISP SB RAS) - Novosibirsk (Russian federation)

Compounds based on Ge-Si-Sn materials have attracted a particular attention due to the possibility of the Ge-Si-Sn application in the photonics, nanoelectronics and photovoltaics [1]. In addition to the changes in the electronic and optical properties, the presence of Sn on the surface increases the surface diffusion of adatoms [2] and also influences on the appearance of a series of superstructures which aren't observed in the GeSi system.

Thin GeSiSn films in the wide range of compositions and thicknesses were obtained by molecular-beam epitaxy. The analysis of spatio-temporal distributions of the intensity of reflection high-energy electron diffraction (RHEED) patterns allows to identify the superstructure and beginning of the nanoisland formation. The mismatch of GeSiSn and Si lattices was varied up to 5%. Figure 1 shows the kinetic diagram of the GeSiSn growth under 2% mismatch. As a result the Sn segregation on the surface the series of superstructures was observed during growth of the Si film on the GeSiSn layer. The decrease of the growth temperature of Si layer contributes the inhibition of the Sn segregation and reduction of the Si film roughness covering the GeSiSn layer. Regularities of the formation of multilayer structures with quantum wells containing pseudomorphic GeSiSn layers have been investigated. Hence the synthesis of superlattices, structures with quantum wells or quantum dots and creation devices based on them can be carried out.



References

[1] B. Vincent et al. MicroElect. Eng., 88, 342 (2011).

[2] A.E. Dolbak et al. Cent. Europ. Journal of Physics, 6, 634 (2008).