## Nanocomposites and nanomaterials

# Physico-chemical interaction in $CuSbSe_2$-"$P_2Se_4$" system

**M.V. Potoriy[1], P.M. Milyan[2], S.F. Motrya[2]**

[1] *Department of Chemistry, Uzhgorod National University, Pidgirna street, 46, Uzhgorod 88000, Ukraine.*

[2] *Research Institute for Physics and Chemistry of Solids, Uzhgorod National University, Pidgirna street 46, Uzhgorod 88000, Ukraine,*
*E-mail: pet-milyan@yandex.ru*

Modern device engineering needs the devices with different semiconductor materials. Among them quaternary compounds $Me^{I}Me^{III}P_2X_6$ ($Me^{I}$-Cu, Ag; $Me^{III}$-In, Sb, Bi, Cr, V; X-S, Se) which were intensively studied recent years can be interesting as ferroelectrics and thermoelectrics.

$CuSbP_2Se_6$ is one of such compounds. This report describes physico-chemical interaction in $CuSbSe_2$-"$P_2Se_4$" system where this compound is formed.

Samples of $CuSbSe_2$-"$P_2Se_4$" system were obtained from elementary components in evacuated silica ampoules. Weight of the sample was 5 g. Temperature of synthesis was controlled by Chromel-Alumel thermocouple. During the synthesis of the alloys firstly we stopped the heating for 24 hours at 450-500 K. Next stop was at 670 K also for 24 hours. At the maximum temperature of synthesis which was 950-1000 K the samples were endured for 1 week. In order to homogenize the alloys they were annealed at 550 K during 2 weeks.

Obtained compounds were investigated by differential thermal analysis. On the base of DTA phase diagram of $CuSbSe_2$-"$P_2Se_4$" system has been built till 50 mol. % "$P_2Se_4$". We established that quaternary compound $CuSbP_2Se_6$ is forming by peritectic reaction at 713±5 K. Composition of the peritectic point is 91 mol. % $CuSbSe_2$ – 9 mol. % "$P_2Se_4$". Eutectic point in this system (683±5 K) has a composition 94 mol. % $CuSbSe_2$ – 6 mol. % "$P_2Se_4$".

X-ray diffraction pattern of $CuSbP_2Se_6$ was obtained by DRON-3 diffractometer. It was established that $CuSbP_2Se_6$ crystallizes in trigonal lattice (P-31c) with unit cell parameters: a=6,507(1) Å; c=13,272(5) Å; Z=4; $\rho_{calc.}$=4,92 g/cm$^3$, unit cell volume V=486,578 Å$^3$.

The density of $CuSbP_2Se_6$ determined by picnometry is $\rho_{exp.}$=4,74 g/cm$^3$.

Enthalpy of melting of $CuSbP_2Se_6$ was calculated using quantitative thermography method ($\Delta H$=41,18 kJ/mol).

Obtained data of this compound may be added to a database of new quaternary compounds. Its crystallochemical characterictics can be used for identification of related compounds.