Fluororganic Derivatives of Elements Ii–Vi Groups: Phase Transitions Thermodynamics and Nanocrystalline Films Deposition

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Fluororganic derivatives metals of II-VI groups are presented the more perspective compounds in semiconductor technology then chlororganic derivatives due to their hydrolysis stability. The data on thermodynamic properties of these compounds are necessary for modeling precipitation processes from gas phase Si and SiC and also for obtaining complex semiconductor compounds A(III) – B(V) and A(II) – B(VI). The aim of this study is to obtain the reliable information on thermodynamic of sublimation, melting and evaporation processes of fluororganic derivatives of Hg, Ga, Si, P, As, Sb, Bi, Te and to grow films by means of CVD.

Samples of investigated compounds ($4\text{-}CF_3C_6F_4(SiCH_3)_3$, $C_6F_5Si(CH_3)_3$, $(C_6F_5)_2Si(CH_3)_2$, $(C_6F_5)_4Si$, $(C_6F_5)_3Ga$, $(C_6F_5)_3P$, $(C_6F_5)_3As$, $(C_6F_5)_3Sb$, $(C_6F_5)_2Te$, $(C_6F_5)_2Hg$) were synthesized and identified in Novosibirsk Institute of Organic Chemistry. Synthesis was realized by method described in [1]. According to this method the impurities content in obtained samples was less than 0.5 per cent.

The pressure of saturated and unsaturated vapors was measured by static method, using quartz membrane zero manometer. The pressure measurement error was less than 0.3 Torr, temperature measurement error was less than 0.5 K [2]. Calorimetry measurements were performed by differential scanning calorimeter Setaram 111 at heating rates 0.5-0.3 K/min; the error in the melting enthalpy measurements was less than 2 per cent
As a result of this study the composition of gas phase of investigated compounds was established and thermal stability ranges, temperature dependences of sublimation and evaporation pressure, temperature and enthalpy of melting, enthalpy and entropy of vaporization were determined.

Using obtained data we built the dependences of thermodynamic properties on molecular weight for phenylsilanes. It allowed us to calculate the enthalpy and entropy of vaporization for other compounds by formula $(C_6F_5)_nSi(CH_3)_m$, where n m=4.

On the base of obtained thermodynamic data the films containing nanocrystalline silicon were grown by CVD in inert (Ar) and reducing (H_2) medium.

[1] Tamborski C. et al. *J. Organomet. Chem.* **4**, 446-454, (1965).
[2] Zelenina L.N. et al. *Russian J. Phys. Chem*. 80, 139-142, (2006).