

Fabrication and Some Properties of Solid Solutions in the $Tl_5Te_3-Tl_9GdTe_6$ System

Imamalieva S.Z.¹, Gasanly T.M.², Mehdiyeva I.F.¹, Sadygov F.M.²

¹*Institute of Catalysis and Inorganic Chemistry of ANAS, Baku, Azerbaijan*

²*Department of General and Inorganic Chemistry, BSU, Baku, Azerbaijan*

Narrow-band gap heavy metal chalcogenides have attracted an increasing level of attention because of their promising thermoelectric properties.

Thallium subtelluride, Tl_5Te_3 owing to features of the crystal structure has a lot of ternary analogs which are thermoelectric with anomaly low thermal conductivity.

In our previous study we reported some new ternary compounds Tl_9LnTe_6 which crystallize in Tl_5Te_3 structure type [1,2]. These compounds might exhibit good thermoelectric properties. Lanthanide elements are lighter than thallium or bismuth elements resulting in significant mass fluctuation between the Tl and Ln atoms, which may further lower the thermal conductivity. On the other hand, the magnetic properties are popular among the f-block metal compounds as all the Ln^{3+} ions contain unpaired electrons.

In present report phase equilibria in $Tl_5Te_3-Tl_9GdTe_6$ system for obtaining of solid solutions with Tl_5Te_3 structure are discussed.

The samples were prepared by heating the high purity elements into graphitized silica ampoules. The ampoules were heated to maximal temperature 1000 K and were kept at this temperature during 4 h. After that they were cooled slowly to 700K and annealed at this temperature during $\square 1000h$.

Investigations were carried out by using DTA, XRD and EMF measurement of concentration cell concerning gadolinium electrode with liquid electrolyte (300-450K). Based on experimental data the T-x phase diagram of $Tl_5Te_3-Tl_9GdTe_6$ system and concentration dependences of crystal lattice parameters are constructed.

It was shown, that system is characterized by formation of continuous fields of solid solutions with Tl_5Te_3 -type structure. The partial molar thermodynamic functions of gadolinium and integral thermodynamic functions of formation and entropy for the Tl_9GdTe_6 and solid solutions $Tl_{10-x}Gd_xTe_6$ are calculated based on the results of the EMF measurements

Moreover, thermoelectric and magnetic properties of Tl_9GdTe_6 compound and solid solutions $Tl_{10-x}Gd_xTe_6$ are discussed.

Reference

1. Babanly M.B., Imamaliyeva S.Z., Babanly D.M. // Azerb. Chem. J., 2009, №2, p.122-125
2. Imamalieva S.Z., Sadygov F.M., Babanly M.B. (2008). // Inorganic Materials, v.44, No.9, pp.935–938