Characterization of the ternary Ag-Ge-Sn alloys

Milena Premović[1], Duško Minić[1], Tamara Holjevac Grgurić[2], Zdenka Zovko Brodarac[3], Milan Kolarevič[4]

[1] *University of Priština, Faculty of Technical Science, Kosovska Mitrovica, Serbia*
[2] *Faculty of Metallurgy, University of Zagreb, Croatia*
[3] *University of Zagreb, Faculty of Metallurgy Sisak, Croatia*
[4] *University of Kragujevac, Faculty of Mechanical and Civil Engineering in Kraljevo*

Abstract

Up to now in our group few ternary systems based on Ag-Ge-X (X=Sb, Bi, Ga and In) [1,2] were examined. The phase diagram of Ag-Ge-Sn ternary system has not been investigated up to now. Focure on those alloys is due to the technical importance of the Ge-based alloys [3,4] and their special application as a phase change memory materials (PCM materials) [5-8].

Selected alloys for experimental tests were from three vertical sections and two isothermal sections. As-cast samples from Ag-GeSn, Ge-AgSn, and Sn-AgGe vertical sections were experimentally study by using differential thermal analysis (DTA) and differential scanning calorimetry (DSC). Annealed samples at 200 and 300 °C were experimentally study by using scanning electron microscopy (SEM) with energy dispersive spectrometry (EDS) and X-ray powder diffraction (XRD). Experimentally determined results were used for thermodynamic modeling of the ternary system. New ternary parameters for Liquid phase are introduced and good agreement between calculated phase diagrams and experimental results has been reached. Thermodynamic data for three sub-binary systems are taken from literature.

Acknowledgements

This work has been supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (Grant No. OI172037).

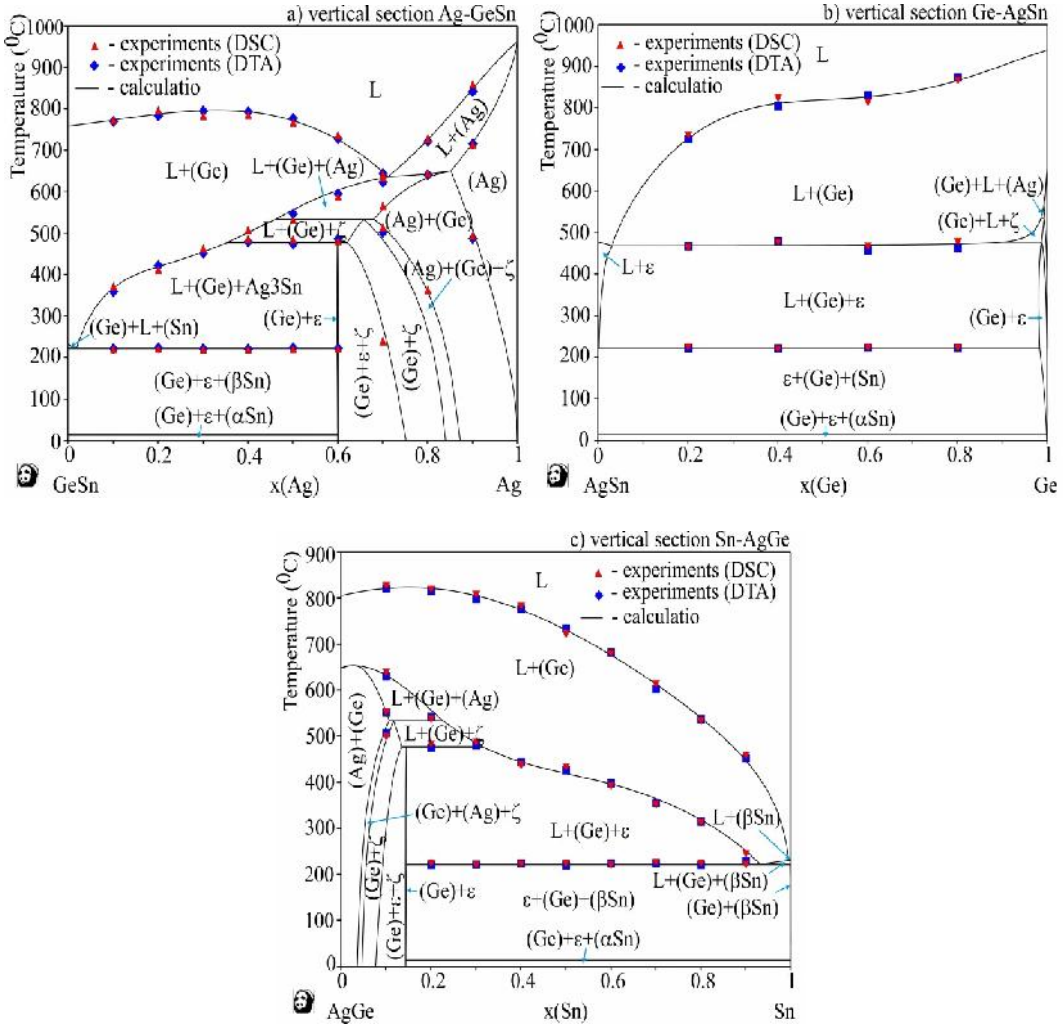
References

[1] M. Premovic, D. Manasijevic, D. Minic, D. Zivkovic, J Alloys Compd. 610 (2014) 161–168.
[2] D. Milisavljević, D. Minić, M. Premović, D. Manasijević, N. Košanin, Thermochim. Acta. 665 (2018) 1–10.
[3] N. Agrawal, M. Sarkar, M. Chawda, V. Ganesan, Mater. Chem. Phys. 143 (2013) 330-335.
[4] Y. Zeng, H. Li, Y. Du, Y. Pan, Y.Peng, P. Zhou, M. Premovic, J. Phase Equilib. Diffus. 38(5) (2017) 843–852.
[5] S.L. Ou, C. P. Cheng, C.Y. Yeh, C.J. Chung, K.S. Kao, R.C. Lin, Adv. Mater. Res. 189-193 (2011) 4430-4433
[6] D. Ielmini, A. L. Lacaita, Mater. Today. 14 (12) (2011) 600-607

[7] E.M. Vinod, R. Naik, R. Ganesan, K.S. Sangunni, J. Non-Cryst. Solids. 358 (2012) 2927-2930.

8. P. Nemec, V. Nazabal, A. Moreac, J. Gutwirth, L. Benes, M. Frumar, Mater. Chem. Phys. 136 (2012) 935-941.

Graphical abstract:



Comparison between experimental DTA results and calculated vertical sections of the Ag-Ge-Sn ternary system: a) vertical section Ag-GeSn, b) vertical section Ge-AgSn and c) vertical section Sn-AgGe.