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Fakultet Tehničkih nauka

Kneza Miloša br.7, 38220

Mitrovica

Tel/Fax: (+381 28) 425-320 / 425-322

office@ftn.pr.ac.rs



Kosovska

Za izdavača:

Dekan,

Prof. dr Nebojša Arsić

Urednik:

Prof. dr Duško Minić

Kompjuterska obrada:

Asistent Milica Tomović

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Thermal analysis application on the phase equilibria investigation of the alloys in the Bi- Cu_{0.75}Ni_{0.25} section of the Bi-Cu-Ni system

Branislav Marković^{1*}, Dragan Manasijević², Miroslav Sokić¹, Nadežda Talijan³, Nada Štrbac², Vaso Manojlović¹, Zoran Janjušević¹, Mladen Bugarčić¹

¹ *Institute for Technology of Nuclear and Other Mineral Raw Materials, Belgrade, Serbia*

² *University of Belgrade, Technical Faculty, Bor, Serbia*

³ *Institute of Chemistry, Technology and Metallurgy, Belgrade, Serbia*

Abstract

High toxicity of lead and damaging effects on the environment resulted in its prohibited use in electronic materials (RoHS Directive from 1 July 2006 in the EU). Therefore, great effort has been made on the development of new Pb-free soldering and brazing materials [1-5]. The Bi-Cu-Ni ternary system belongs to the group of potential Cu-Ni-based advanced lead-free solder materials for high temperature application [6-8]. The results of phase equilibria investigation of the alloys selected in the Bi-Cu_{0.75}Ni_{0.25} section from bismuth corner with molar ratio Cu:Ni = 3:1, are presented in this paper. The investigations were performed using DTA/DSC experimental methods, while thermodynamic calculation was done according to the CALPHAD method using PANDAT software. The results of the DTA/DSC heating measurements of the chosen samples in the Bi-Cu_{0.75}Ni_{0.25} section, including liquidus temperatures and other phase transition temperatures are presented in graphical abstract. The phase diagram of the investigated Bi-CuNi section has been calculated using PANDAT software and is presented in graphical abstract, together with experimentally determined DTA/DSC points. It could be noticed that calculated phase diagram is in good agreement with DTA/DSC experiments.

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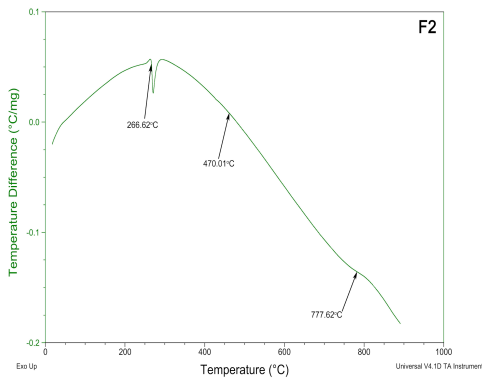
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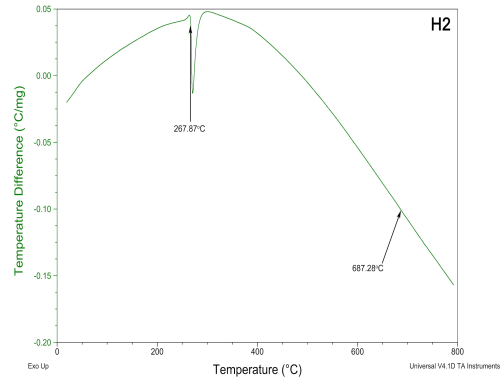
Graphical abstract:

Sample	Sample composition (at.%)	Temperature (°C)	
		Phase transitions	Liquidus
F2	$Bi_{60}Cu_{30}Ni_{10}$	266, 470	777
G2	$Bi_{70}Cu_{22.5}Ni_{7.5}$	267	722
H2	$Bi_{80}Cu_{15}Ni_5$	267	687
J2	$Bi_{90}Cu_{7.5}Ni_{2.5}$	267	-

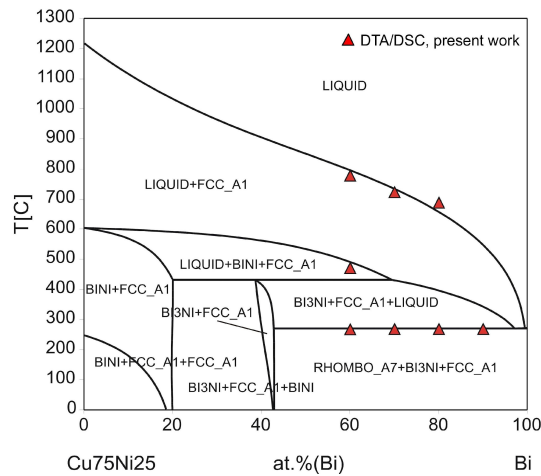
a)



b)



c)



(d)

a) DTA/DSC results for the investigated alloys in the Bi-Cu_{0.75}Ni_{0.25} section (taken from [8]); b) Characteristic DTA curve for the samples F2; c) Characteristic DTA



curve for the samples H2;d) Calculated phase diagram of the Bi-Cu_{0.75}Ni_{0.25} section compared with thermal analysis results from the present study (taken from [8])



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