Komitet za termodinamiku i fazne dijagrame Srbije

u saradnji sa:

Fakultetom tehničkih nauka u Kosovskoj Mitrovici,
Tehničkim fakultetom u Boru i
Associated Phase Diagram and Thermodynamics Committee
(Poland, Czech Republic, Hungary, Bulgaria, Slovenia, Serbia, Montenegro, Romania, Croatia, Bosnia and Herzegovina)

JEDANAESTI SIMPOZIJUM O TERMODINAMICI I FAZNIM DIJAGRAMIMA

sa međunarodnim učešćem

ZBORNIK IZVODA RADOVA

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Jedanaesti simpozijum o termodinamici i faznim dijagramima

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Sadržaj

Plenarno predavanje:

Izvodi radova:

Bi–In–Sn Lead-free solders: Microstructure and thermal conductivity

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Abstract

In the paper, the focus was on the microstructure and thermal conductivity of three-component lead-free solder alloys of Bi-In-Sn system. Microstructural characterization involved the examination of the microstructure of the alloys using scanning electron microscopy (TESCAN VEGA 3 LMU) and the compositions of the coexisting phases, as well as the total composition of the prepared alloys with energy-dispersive X-ray spectrometry (Oxford Instruments X-act). The microstructural analysis helped to determine the presence of intermetallic compounds, grain boundaries, and other features that influence the material's properties and performance. Furthermore, the thermal characterization of the Bi-In-Sn alloys involved the evaluation of their thermal properties, including thermal diffusivity, thermal conductivity, and heat capacity. These properties are essential for understanding the alloys' heat transfer behavior, their ability to dissipate heat, and their suitability for specific applications in which thermal management is crucial. Thermal diffusivity was measured using a flash method using Discovery Xenon Flash (DXF) 500 instrument (TA Instruments, Germany). Other thermal properties like thermal conductivity and heat capacity are evaluated to provide a comprehensive understanding of the alloys' thermal behavior. These properties determine the alloys' ability to conduct heat and store thermal energy. The microstructural and thermal characterization combination provides valuable information about the Bi-In-Sn lead-free solder alloys. The results of this study contribute to the knowledge base on Bi-In-Sn lead-free solder alloys and can guide future research and development efforts in this field.

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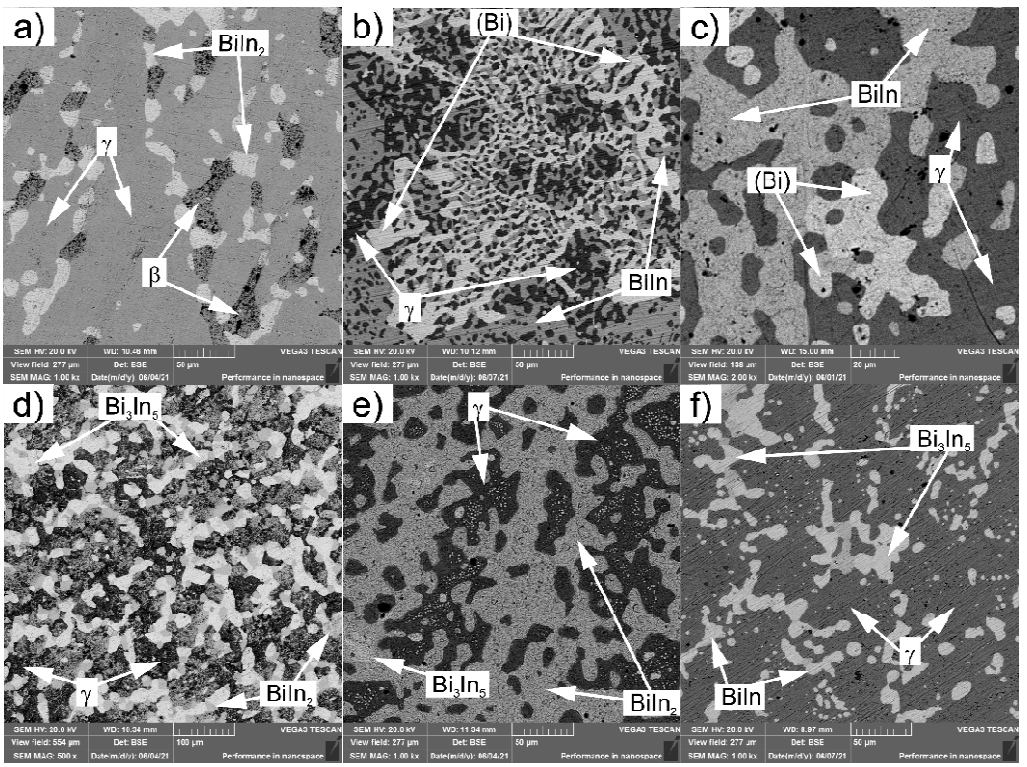
Graphical abstract:



Characteristic SEM microphotographs of the tested alloys with marked experimentally determined phases: a) B-2, b) B-4, c) I-3, d) I-4, e) S-2 and f) S-3.

Obtained results of thermal diffusivity, specific heat and thermal conductivity.

Sample	Bi* In** Sn***	Thermal diffusivity	Specific heat capacity	Thermal conductivity	Thermal diffusivity	Specific heat capacity	Thermal conductivity
	mass. %	(cm^2/s)	(J/(kg·K)	(W/m·k)	(cm^2/s)	(J/(kg·K)	(W/m·k)
		25 (°C)			50 (°C)		
B-2	20*	0.159	344.917	41.108	0.146	361.803	39.624
B-4	60*	0.068	257.903	15.790	0.067	260.006	15.645
I-3	40**	0.142	239.467	25.651	0.121	249.629	22.770
I-4	60**	0.152	235.975	26.914	0.134	249.047	25.093
S-2	20***	0.106	231.925	19.344	0.095	241.741	18.157
S-3	40***	0.139	248.649	26.584	0.126	265.578	25.804

Mass fraction of Bi, In** and Sn*** with ratios In/Sn=1, Bi/Sn=1, and Bi/In=1, respectively.*