

# **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)

## **DVANAESTI SIMPOZIJUM O TERMODINAMICI I FAZNIM DIJAGRAMIMA**

*sa međunarodnim učešćem*



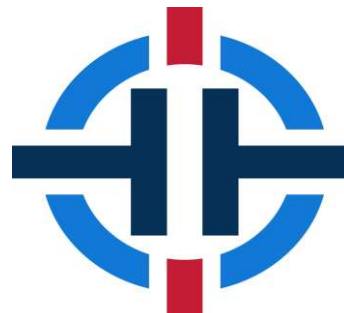
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# Dvanaesti simpozijum o termodinamici i faznim dijagramima

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# Dvanaesti simpozijum o termodinamici i faznim dijagramima

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# Sadržaj

	Dragan Manasijević, Duško Minić, Milena Zečević	
1.	<i>O aktivnostima Komiteta za termodinamiku i fazne dijagrame Srbije u proteklom periodu</i>	1
2.	<i>Trenutni članovi Komiteta za termodinamiku i fazne dijagrame Srbije</i>	4
3.	<i>Spisak objavljenih radova u časopisima međunarodnog značaja članova Komiteta za termodinamiku i fazne dijagrame Srbije u periodu 2024-2025. godina</i>	5

## Plenarno predavanje:

Dragan Manasijević, Ljubiša Balanović, Ivana Marković, Milan Gorgievski, Uroš Stamenković, Avram Kovačević

1.	<i>Al-Sn alloys as composite phase change materials for thermal energy storage: microstructural and thermal characterization</i>	11
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## Izvodi radova:

	Dragan Manasijević, Ljubiša Balanović, Nicanor Cimpoesu, Ivana Marković, Milan Gorgievski, Uroš Stamenković, Aleksandra Stepanović	
1.	<i>Microstructural and thermal properties of the Al-Cu eutectic alloy</i>	15
	Kristina Božinović, Dragan Manasijević, Ljubiša Balanović, Ivana Marković, Milan Gorgievski, Uroš Stamenković, Miljan Marković	
2.	<i>Microstructural and thermal characterization of some alloys from the ternary Ag-In-Sn system</i>	17
	Milan Nedeljković, Srba Mladenović, Vladan Čosović, Ivana Marković, Jasmina Petrović, Uroš Stamenković, Milijana Mitrović, Avram Kovačević	
3.	<i>Thermal properties of eutectic Sn-0.7Cu alloy reinforced with graphene nanosheets produced by powder metallurgy technique</i>	19
	Milan Gorgievski, Miljan Marković, Nada Štrbac, Dragan Manasijević, Vesna Grekulović, Dalibor Jovanović, Marina Marković	
4.	<i>Kinetic and DTA-TGA analysis of Cu<sup>2+</sup> biosorption on hazelnut shells</i>	21
	Marina Marković, Milan Gorgievski, Miljan Marković, Nada Štrbac, Vesna Grekulović, Milica Zdravković, Nemanja Milošević	
5.	<i>DTA-TGA and thermodynamic studies of walnut shells used for the biosorption of Cu<sup>2+</sup> ions from synthetic solutions</i>	23
	Uroš Stamenković, Ivana Marković, Dragan Manasijević, Vladan Čosović, Milan Gorgievski, Avram Kovačević, Milan Nedeljković	
6.	<i>Melting temperatures and thermal properties of Sn-Bi alloys and composites</i>	25

7.	Uroš Stamenković, Ivana Marković, Milan Nedeljković, Kristina Božinović <b><i>Wetting behavior of Sn-Bi solder alloy and composites obtained by powder metallurgy</i></b>	27
8.	Ivana Marković, Milica Volojanović, Uroš Stamenković, Dragan Manasijević, Milan Nedeljković, Ljubiša Balanović <b><i>Microstructure of Sn-Ag-Cu Composites: Sintered State and Post-Soldering Analysis</i></b>	29
9.	Milijana Mitrović, Saša Marjanović, Biserka Trumić, Vesna Krstić, Milan Nedeljković, Jasmina Petrović <b><i>Influence of extrusion process on the comminution of the microalloyed Cu-Fe-P alloy structure</i></b>	31
10.	Jasmina Petrović, Srba Mladenović, Milan Nedeljković, Ivana Marković, Uroš Stamenković, Milijana Mitrović <b><i>Microstructure and potential of hybrid aluminum composites based on EN AW-6061 reinforced with Al<sub>2</sub>O<sub>3</sub> and walnut shell ash</i></b>	33
11.	Jasmina Petrović, Srba Mladenović, Milan Nedeljković, Ivana Marković, Milijana Mitrović, Aleksandra Ivanović <b><i>Protective role of gelatin in corrosion resistance of cold-formed copper wire</i></b>	35
12.	Avram Kovačević, Uroš Stamenković, Milan Nedeljković <b><i>Review of material and process parameters in the production of drawn SnPb wire</i></b>	37
13.	Milan T. Đorđević, Aleksandar Todić, Aleksandar Đorđević <b><i>Experimental device for investigations of tribological influences in sheet metal forming</i></b>	39
14.	Aleksandar Todić, Milan T. Đorđević, Dušan Arsić, Aleksandar Đorđević <b><i>The influence of vanadium on the microstructure and electrochemical properties of carbides in chromium-molybdenum steels</i></b>	41
15.	Veljko Minić, Miljana Popović, Milena Zečević, Jelena Miladinović, Aleksandar Đorđević <b><i>Experimental results of phase transition temperatures of the Al-Bi-Ge ternary alloys</i></b>	43
16.	Aleksandar Đorđević, Duško Minić, Yong Du, Milena Zečević <b><i>Electrical conductivity of the Al-Bi-Ge alloys</i></b>	45
17.	Duško Minić, Dejan Gurešić, Yuling Liu, Milena Zečević <b><i>Brinell hardness of the Al-Bi-Ge alloys</i></b>	47
18.	Milena Zečević, Duško Minić, Aleksandar Đorđević, Veljko Minić <b><i>Experimental test of as-cast samples from the Al-Bi-Ge ternary system</i></b>	49
19.	Veljko Minić, Aleksandar Đorđević, Yuling Liu, Duško Minić, Milena Zečević <b><i>Experimental test of phase equilibria of the Al-Bi-Ge ternary system at 400 °C</i></b>	51
20.	Jovana Galjak, Miljana Krstić, Ivan Bogavac, Svetomir Milojević, Gordana Milentijević <b><i>Characterization of coal fly ash for the production of coagulant for usage in wastewater treatment</i></b>	53

21.	Miljana Krstić, Svetomir Milojević, Jelena Avramović, Ana Veličković, Jovana Galjak, Vlada Veljković <b><i>Temporal Fractionation and Modeling of Juniper Berry Oil Composition During Hydrodistillation</i></b>	55
22.	Irma Dervišević, Jelena Đokić <b><i>Bioremediation of plastic by microbiomes and its conversion into biopolymers</i></b>	57
23.	Mladen Šljivić, Miljojka Mijailović, Svetomir Milojević, Jovana Galjak, Miljana Krstić <b><i>Obtaining distillate from the Leskovac quince variety</i></b>	59
24.	Ljiljana Babincev, Jovana Kulizić, Anđela Babincev <b><i>Thermodynamic Analysis of Diastase Enzyme Degradation in Different Types of Honey</i></b>	61
25.	Jelena Đokić, Jasmina Dedić, Irma Dervišević <b><i>Environmental Impact Assessment of the REE at the area Contaminated with Lead Metallurgy Waste Deposit</i></b>	63
26.	Jelena Đokić, Jasmina Dedić, Irma Dervišević <b><i>The impact of gauge minerals Feldspar and Diopside Ferroan on heavy metals and REE penetration to the soil</i></b>	65
27.	Dimitrije Anđić, Miroslav Sokić, Aleksandar Jovanović, Branislav Marković, Vaso Manojlović, Željko Kamberović <b><i>Thermal decomposition of cerussite</i></b>	67
28.	Gvozden Jovanović, Dimitrije Anđić, Dragana Randelović, Danijela Smiljanić, Branislav Marković, Miroslav Sokić <b><i>Application of Thermogravimetric analysis on combustion study of biomass for Zn extraction</i></b>	69
29.	Gordana Marković, Vaso Manojlović, Francisco Javier Dominguez Gutierrez, Karol Frydrych <b><i>Phase Diagram Analysis of Ti-Mo-Sn System for <math>\beta</math>-Titanium Alloy Development</i></b>	71



## **Thermal properties of eutectic Sn-0.7Cu alloy reinforced with graphene nanosheets produced by powder metallurgy technique**

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### **Abstract**

In this research, the effect of graphene nanosheets (GNS) on the thermal conductivity of Sn-0.7Cu-xGNS (x= 0, 0.02, 0.04, 0.06, 0.08 and 0.1 wt.%) nanocomposite materials was investigated. The GNS were successfully incorporated into the matrix alloy using the powder metallurgy technique, which includes mixing and mechanical alloying, cold compacting and sintering. Thermal diffusivity was measured at room temperature in an inert protective atmosphere using the xenon-flash method. The Sn-0.7Cu matrix alloy has a thermal conductivity of 53 Wm<sup>-1</sup>K<sup>-1</sup> [1], while GNS exhibit a significantly higher value of 5000 Wm<sup>-1</sup>K<sup>-1</sup> [2]. Therefore, it can be predicted that adding GNS will enhance thermal conductivity. However, the situation becomes more complex with composite materials [3]. The obtained value for thermal conductivity of the matrix alloy is 28.42 Wm<sup>-1</sup>K<sup>-1</sup>, while the composite with a 0.08 %GNS has the highest thermal conductivity of 35.29 Wm<sup>-1</sup>K<sup>-1</sup>. However, as the GNS content further increases, the thermal conductivity decreases. The decrease in thermal conductivity can be attributed to the agglomeration of GNS along the grain boundaries. This agglomeration leads to the accumulation of dislocations, which distort the matrix lattice, increasing the probability of electron scattering. As a result, the number of effective electrons (as heat carriers) in the crystal is reduced, which raises resistance and decreases thermal conductivity. The results indicated that the incorporated GNS enhanced the thermal conductivity of the matrix alloy to a certain extent.

**Type of work:** original research paper.

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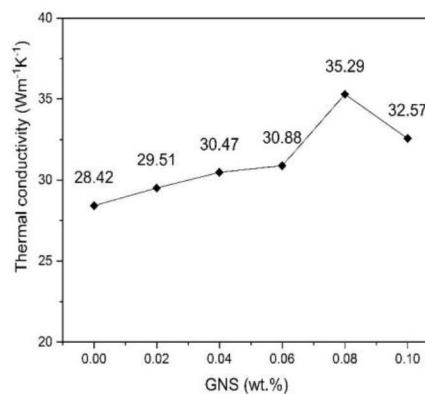
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3. A. Skwarek, B. Illés, P. Górecki, A. Pietruszka, J. Tarasiuk, T. Hurtony: *Journal of Materials Research and Technology*, 22 (2023) 403-412.

### Graphical abstract:

*Thermal diffusivity, specific heat capacity, and thermal conductivity of the Sn-0.7Cu-xGNS nanocomposite materials.*

Nanocomposite materials	Thermal diffusivity (mm <sup>2</sup> s <sup>-1</sup> )	Specific heat capacity (Jg <sup>-1</sup> K <sup>-1</sup> )	Thermal conductivity (Wm <sup>-1</sup> K <sup>-1</sup> )
Sn-0.7Cu	15.69	0.254	28.42
Sn-0.7Cu/0.02GNS	17.03	0.244	29.51
Sn-0.7Cu/0.04GNS	17.27	0.250	30.47
Sn-0.7Cu/0.06GNS	17.93	0.245	30.88
Sn-0.7Cu/0.08GNS	20.03	0.251	35.29
Sn-0.7Cu/0.10GNS	19.35	0.245	32.57



*Thermal conductivity of Sn-0.7Cu-xGNS nanocomposite materials.*