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

ZBORNIK IZVODA RADOVA

Kosovska Mitrovica,
20-21. jun 2025. god.

Dvanaesti simpozijum o termodinamici i faznim dijagramima

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Dvanaesti simpozijum o termodinamici i faznim dijagramima

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Sadržaj

Plenarno predavanje:

Izvodi radova:

Al-Sn alloys as composite phase change materials for thermal energy storage: microstructural and thermal characterization

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Abstract

Al–Sn alloys are well known for their excellent resistance to wear and corrosion, as well as their solid mechanical performance, making them popular choices for bearing applications [1,2]. More recently, however, they have attracted attention as potential composite phase change materials (C-PCMs) for thermal energy storage (TES) systems. To determine their suitability for such applications, a thorough investigation of their thermal characteristics is essential. In this study, Al–Sn alloys containing 11.7, 22.4, 32.8, 41.1, and 53.4 atomic percent Sn were prepared by melting high-purity metals. Continuous stirring of the melt was employed to prevent segregation, followed by casting into stainless steel molds. The resulting ingots displayed uniform microstructures, free of cracks and pores. Thermal diffusivity of the solid Al–Sn samples was measured between 25°C and 150°C using the light flash method. Density at room temperature was determined via the Archimedes principle, while specific heat capacities across different temperatures were calculated using the CALPHAD (Calculation of Phase Diagrams) approach. Thermal conductivity values were then derived using an appropriate conversion relationship. Additionally, phase transition temperatures and the associated thermal effects were analyzed by differential scanning calorimetry (DSC).

The study mapped how thermal conductivity changes with both alloy composition and temperature, and also assessed how latent heat of fusion varies across the compositions. Microstructural and phase composition analyses were performed using scanning electron microscopy (SEM) coupled with energy-dispersive spectroscopy (EDS). The findings offer valuable insights into the thermal behavior and microstructural characteristics of Al–Sn alloys, contributing to the development of advanced PCMs for thermal energy storage applications.

Type of work: original research paper.

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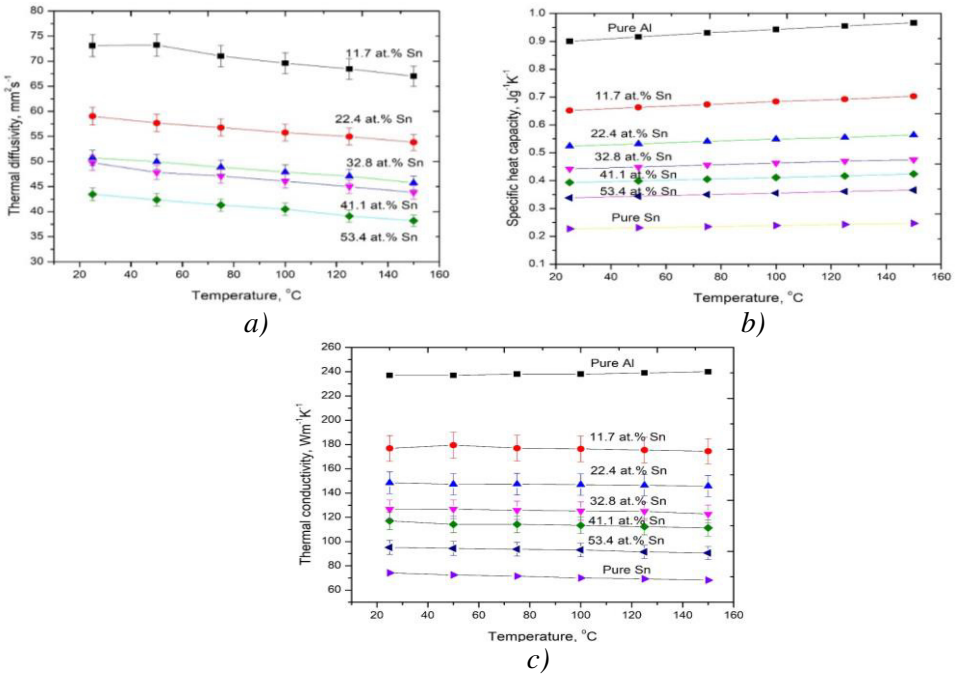
2. T. Tamura, M. Li, K. Takahashi, E. Inoue, Improved solidification structures and mechanical properties of Al–20 wt% Sn alloys processed by an electromagnetic vibration technique, Mater. Sci. Eng. A. 862 (2023) 144416.

Graphical abstract:



a) Thermal diffusivity variations with temperature for the studied Al–Sn alloys.

b) The specific heat capacity variations with temperature for the studied Al–Sn alloys and pure Al and Sn.

c) Thermal conductivity dependences on temperature for the investigated Al–Sn alloys.