Study of some physical properties of the rapidly solidified Sn-Sb-Cu-Zn alloys

Author(s): Lashin, AR (Lashin, A. R.)[1,2] ; Mossa, M (Mossa, M.)[1] ; El-Bediwi, A (El-Bediwi, A.)[1] ; Kamal, M (Kamal, M.)[1]
[1] Univ Mansoura, Dept Phys, Fac Sci, Mansoura 35516, Egypt

[2] Umm Al Qura Univ, Fac Sci Appl, Dept Phys, Mecca 21955, Saudi Arabia

E-mail Addresses: lashingi@uqu.edu.sa

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Abstract

Structure, electrical resistivity, hardness, elastic modulus and roughness of Sn-10%Sb-2%Cu-x%Zn [x = 0.5, 1.0, 1.5, 2.0, 2.5 wt.%] rapidly solidified alloys have been investigated. Investigations have been made by using X-ray diffraction, scanning electron microscope (SEM), double bridge, Vickers hardness tester, the dynamic resonance technique and surface roughness tester. X-ray diffraction showed that, adding different amounts of zinc to the Sn-10%Sb-2%Cu changed its structural properties which affect all measured physical properties. Elastic modulus, hardness and electrical resistivity are increased by increasing the zinc content. Internal friction and roughness are varied. According to our results, the Sn-10%Sb-2%Cu-2.5%Zn alloy has good properties for bearing applications. Published by Elsevier Ltd.

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Reprint Address: Lashin, AR (reprint author)

Univ Mansoura, Dept Phys, Fac Sci, Mansoura 35516, Egypt.

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ODD VALENCY DOPANTS CONVERT BISMUTH INTO SEMICONDUCTOR

Author(s): El Ashram, T (El Ashram, T.)[1] ; Kamal, M (Kamal, M.)[2] ; Raouf, A (Raouf, A.)[1] ; Mosaad, S (Mosaad, S.)[1]
[1] Port Said Univ, Fac Sci, Dept Phys, Port Said, Egypt

[2] Mansoura Univ, Fac Sci, Dept Phys, Mansoura, Egypt

E-mail Addresses: tnelashram@gmail.com

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Abstract

Five alloys Bi-1at.%Ag, Bi-1at.%Zn, Bi-1at.%Al, Bi-1at.%Sn and Bi-1at.%Sb are produced by rapid solidification using the melt-spinning technique. From x-ray diffraction analysis it was found that these alloys are single phase at room temperature. It is also found that all alloys containing odd valency dopants such as Ag (+1), Al (+3) and Sb (+5) have semiconducting behavior and by contrast all alloys containing even valency dopants such as Zn (+2) and Sn (+4) have metallic behavior. The produced semiconductors are narrow band semiconductors. The band gap is decreased by increasing valency from 225.1 meV for Bi-Ag system to 12.7 meV for Bi-Sb system.

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Reprint Address: El Ashram, T (reprint author)

Port Said Univ, Fac Sci, Dept Phys, Port Said, Egypt.

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Research Areas: Materials Science; Physics

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Thermomechanical Analysis of (Cu0.5Tl0.5)-1223 Substituted by Pr and La

Author(s): Abou Aly, AI (Abou Aly, A. I.)[1] ; Awad, R (Awad, R.)[1] ; Ibrahim, IH (Ibrahim, I. H.)[1] ; Kamal, M (Kamal, M.)[2] ; Anas, M (Anas, M.)[1]

[1] Univ Alexandria, Dept Phys, Fac Sci, Alexandria, Egypt

[2] Mansoura Univ, Dept Phys, Fac Sci, Mansoura, Egypt

E-mail Addresses: rawad64@yahoo.com

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Abstract

The thermomechanical analysis (TMA) of Cu0.5Tl0.5Ba2Ca2-xRxCu3O10-delta, where R=Pr and La, with 0.0 <= x <= 0.15, was carried out in temperature range from 450 to 1145 K. The samples were prepared by singlestep solid state reaction technique. The prepared samples were characterized by X-ray diffraction (XRD) and scanning electron microscopy (SEM). The superconductivity of the prepared samples was investigated by electrical resistivity measurement. The results showed that low substitution content enhanced the (Cu0.5Tl0.5)-1223 phase formation, while the higher substitution content degraded this phase. The higher superconducting transition temperatures T-c were found to be 114 K and 109 K at x= 0.025 for Pr- and La-substitutions, respectively. The average linear thermal expansion coefficient increased as x increased, while the shrinkage temperature decreased as x increased. Those results were emphasized by porosity and Vickers microhardness calculations. Debye temperature theta(D) was calculated from the linear thermal expansion coefficient data and correlated to T-c to estimate the electron-phonon coupling lambda(ep).

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Language: English

Author Keywords: (Cu0.5Tl0.5)-1223; Thermomechanical analysis; Thermal expansion coefficient; Debye temperature

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Reprint Address: Awad, R (reprint author)

Univ Alexandria, Dept Phys, Fac Sci, Alexandria, Egypt.

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Research Areas: Materials Science; Metallurgy & Metallurgical Engineering

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Author(s): ZHOU, H; SEAMAN, CL; DALICHAOUCH, Y; et al.
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Copper effects in mechanical properties of rapidly solidified Sn-Pb-Sb Babbitt bearing alloys

Author(s): Kamal, M (Kamal, Mustafa)[1] ; El-Bediwi, A (El-Bediwi, A.)[1] ; Lashin, AR (Lashin, A. R.)[1] ; El-Zarka, AH (El-Zarka, A. H.)[1]
Addresses:

[1] Mansoura Univ, Fac Sci, Met Phys Lab, Dept Phys, Mansoura 35516, Egypt

E-mail Addresses: kamal422002@yahoo.com ; baker_elbediwi@yahoo.com ; lashingi@yahoo.com ; eabdulhameed55@gmail.com

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Abstract

The mechanical behavior of Sn-Pb-Sb Babbitt bearing alloys has been modified with 5 wt% copper and processed by melt spinning technique. Results on the rapid solidification structure and the ribbon indentation creep tests are discussed. The stress exponent values in the range 2.11-2.75 indicate that grain boundary sliding is the possible mechanism during room-temperature creep deformation of melt-spun bearing alloys. (C) 2011 Elsevier B.V. All rights reserved.

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Reprint Address: El-Zarka, AH (reprint author)

Mansoura Univ, Fac Sci, Met Phys Lab, Dept Phys, Mansoura 35516, Egypt.

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Mechanical Properties of (Cu0.5Tl0.5)-1223 Substituted by Pr

Author(s): Awad, R (Awad, R.)[1] ; Abou Aly, AI (Abou Aly, A. I.)[1] ; Kamal, M (Kamal, M.)[2] ; Anas, M (Anas, M.)[1]
[1] Univ Alexandria, Fac Sci, Dept Phys, Alexandria, Egypt
[2] Mansoura Univ, Fac Sci, Dept Phys, Mansoura, Egypt

E-mail Addresses: rawad64@yahoo.com

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Abstract

Cu0.5Tl0.5Ba2Ca2-x Pr (x) Cu3O10-delta superconducting samples, with 0a parts per thousand currency signxa parts per thousand currency sign0.15, were prepared by a single-step solid state reaction on a form of rectangular bar. The prepared samples were characterized using X-ray powder diffraction (XRD) and scanning electron microscope (SEM). The room temperature Vickers microhardness was measured at different loads (0.25-3 N). The experimental results were analyzed using Meyer's law, Hays-Kendall approach, elastic/plastic deformation model, proportional specimen resistance model, and the indentation-induced cracking (IIC) model. Surprising results were obtained and showed that all samples in the form of rectangular bars exhibited reverse indentation size effect in contrary with those in the form of discs. Vickers microhardness values were decreased as Pr-content increased that consisting with the porosity results. Furthermore, the Young's modulus was determined using the dynamic resonance technique. A relation between Young's modulus (E) and Vickers microhardness (H (V)) was obtained.

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KeyWords Plus: POLYCRYSTALLINE SUPERCONDUCTORS; HARDNESS EVALUATION; VICKERS HARDNESS; SINGLE-CRYSTALS; YOUNGS MODULUS; ELASTIC-MODULI; MICROHARDNESS; INDENTATION; LOAD; CERAMICS

Reprint Address: Awad, R (reprint author)

Univ Alexandria, Fac Sci, Dept Phys, Alexandria, Egypt.

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VERIFICATION OF HUME-ROTHERY CONDITION OF PHASE STABILITY IN RAPIDLY SOLIDIFIED Sn-Zn BINARY ALLOYS

Author(s): Kamal, M (Kamal, M.)[2] ; El-Bediwi, AB (El-Bediwi, A. B.)[2] ; El-Ashram, T (El-Ashram, T.)[1] ; Dorgham, ME (Dorgham, M. E.)[2]
[1] Port Said Univ, Fac Sci, Dept Phys, Port Said, Egypt

[2] Mansoura Univ, Fac Sci, Dept Phys, Met Phys Lab, Mansoura, Egypt
E-mail Addresses: tnelashram@gmail.com

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Abstract

A group of binary Sn-xZn alloys (x = 6, 7, 8, 9, 10 and 11wt.%) have been produced by a single copper roller melt-spinning technique. In this study the Hume-Rothery condition of phase stability has been verified. It is found that by increasing valence electron concentration VEC the diameter of Fermi sphere 2k(F) increases which leads to the increase in the diameter of Brillouin zone. Also it has been confirmed that the correlation between Young's modulus and the axial ratio c/a of beta-Sn unit cell, however there is a critical value of c/a about 0.54562 beyond which E decreases. It is found also that the volume and shape of the unit cell affect both electrical and mechanical properties.

Author Keywords: Alloys; Rapid solidification; Valence electron concentration; Resistivity; Young's modulus; Fermi energy; Brillouin zone

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Reprint Address: El-Ashram, T (reprint author)

Port Said Univ, Fac Sci, Dept Phys, Port Said, Egypt.

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