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PROPERTIES OF ELECTROPHYSICAL PARAMETERS OF SOLID ALLOYS BASED ON Sb-Bi-Te

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Abstract: This article presents thermoelectric properties of hard alloys, quantities, crystallization of Sb_2Te_3 and Bi_2 Te_3, their state diagrams.
Keywords: solid alloy, solid solution, stoichiometric composition, thermoelectric material, thermoelectric driving force, electrical conductivity, state diagram, concentration.

Introduction

Searching for new thermoelectric materials exhibiting high-performance thermoelectric, tensoelectric and optical properties and researching their physical properties, use in high-tech fields of science and technology, makes it possible to create new generation devices with significantly higher characteristics compared to existing ones. For this reason, the demand for studying materials based on bismuth, antimony telluride and selenide is increasing.

The thermoelectric properties of solid solution Bi2Te3-Sb2Te3 were first studied by Shmelev in 1949, and the creation of the alloy was a big step in the creation of a low-temperature thermoelectric energy converter.

If the crystallization rate of the solid solution increases to 0.25mm/hour, Bi2Te3-Sb2Te3 is in a metastable state. The amount of telluride in trivalent Sb-Bi-Te was studied from 43 to 100% by the state of the diagram (Fig. 1).

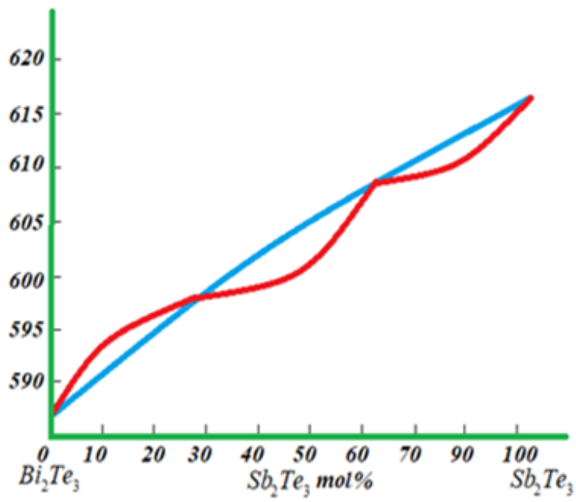

Figure 1. State diagram of Bi2Te3-Sb2Te3

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2:1 when polythermal shears of Sb:Bi are studied; In 1:1 and 1:3, it was noticed that the Sb2Te3-Bi2Te3 stoichiometric composition shifts to the σ-phase side in the Sb:Bi system with a decrease in temperature.

When studying isothermal shearing at 4000C, a narrow zone is observed between two continuous solid solutions: σ phase Sb2Te3 and Bi2Te3.

The deviation in double Sb-Te corresponded to 50% Te of the stoichiometric composition. The phase with an excess of antimony was in the double phase range of the solid solution.

Studying the characteristics of pressed and annealed alloys G.V. Checked by Kokosh. The following figure (Figure 2) shows the samples pressed and heated at t=350 0C for 24 hours and heated for 15 days. It was determined that the crystals were arranged in an orderly manner when the electric conductivity was heated for 15 days at a ratio of 2:1 Bi2Te3:Sb2Te3. During the crystallization of Sb2Te3 and Bi2Te3, tellurium and tellurium solution were formed, and it was found that Sb and Bi elements are in excess in the crystal lattice. During pressing and heating, electrons are placed in the tellurium crystal lattice.

In this case, the concentration of holes in the alloy decreases, and the hole (p-type) thermoelectric power increases.

In the Bi2Te3 alloy, tellurium enters the full composition, the increase of electrons is felt, and the electronic thermoelectric driving force increases. Therefore, when heated, the thermoelectric conductivity of Bi2Te3 increases compared to the thermoelectric conductivity of Sb2Te3.

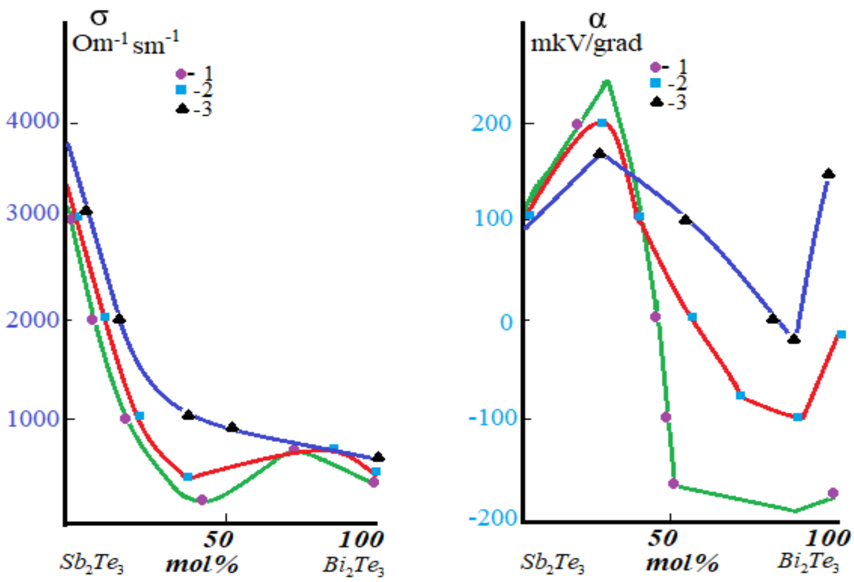

Figure 2. Effect of combustion on electrical conductivity and thermoelectric driving force.

The Bi2Te3 -Sb2Te3 alloy pressed, calcined for 24 hours, and calcined for 15 days was studied by Shmelev in 1949. It continuously forms an alloy and crystallizes in the form of SbBiTe3 in the alloy solution. In its state diagram, the liquidus and solidus lines are close to each other. Its extreme values of Sb2Te3 and Bi2Te3 correspond to 33.3 and 66.7 mol %. In the equilibrium diagram, the liquidus and solidus lines intersect at 2:1 and 1:2. For all other cases, the distribution balance of the coefficient is less than one. If the crystallization coefficient is less than one for the composition Bi2Te3 -Sb2Te3. If we increase the rate of crystallization, the space between the liquidus and solidus lines increases.

If the crystallization rate is 0.25 mm/hour, Bi2Te3-Sb2Te3 is in a motostable state. It was observed that Sb-Bi shifted towards the σ-phase state and that the stoichiometric cross section of Sb2Te3-Bi2Te3 shifted towards the temperature decrease. As the amount of bismuth in the alloy

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increases, the σ -phase decreases. The Sb-Bi-Te melting diagram occurs at high temperature, and it shifts from Sb2Te3 to Bi2Te3, where two equilibrium monovariants are formed, which forms the Bi-Te system from the Sb-Te system. Depending on the service of the obtained material, it is possible to obtain binary, ternary and complex compounds based on bismuth telluride by various methods. At this time, it is necessary to observe the following conditions: the melting of the crucible material should not be reversed: it should be protected from oxidation; Falling foreign atoms should not wet the crucible wall.

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