ELECTROPHYSICAL PARAMETERS OF COMPLEX SOLID COMPOUNDS

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ABSTRACT

This article presents the thermoelectric properties of ternary hard alloys, their quantities, their crystallinity, their state diagrams, their thermoelectric conductivity coefficients, and their specific conductivities.

Key words: *solid alloy, solid solution, stoichiometric composition, thermoelectric material, thermoelectric driving force, electrical conductivity, state diagram, concentration.*

ANNOTATSIYA

Ushbu maqolada uchlamchi qattiq qotishmalarning termoelektrik xossalari, miqdorlari, ularning kristallanishi, ularning holat diagrammalari bilan birga termoelektr yurituvchi kuch koeffitsiyenti va solishtirma elektr o'tkazuvchanligi keltirilgan.

Kalit so'zlar: *qattiq qotishma, qattiq eritma, stexiometrik tarkib, termoelektrik material, termoelektrik harakatlantiruvchi kuch, elektr o'tkazuvchanlik, holat diagrammasi, konsentratsiya.*

АННОТАЦИЯ

В статье представлены термоэлектрические свойства тройных твердых сплавов, их количество, кристалличность, диаграммы состояния, коэффициенты термоэлектрической проводимости и удельная проводимость.

Ключевые слова: *твердый сплав, твердый раствор, стехиометрический состав, термоэлектрический материал, термоэлектрическая движущая сила, электропроводность, диаграмма состояния, концентрация.*

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.

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DISCUSSION AND RESULTS

The thermoelectric properties of solid solution Bi_2Te_3-Sb_2Te_3 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, Bi_2Te_3-Sb_2Te_3 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).

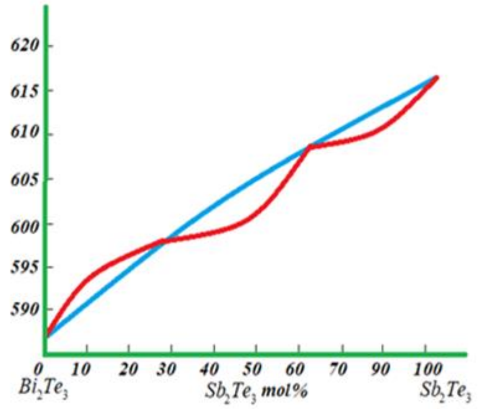

Figure 1. State diagram of Bi2Te3-Sb2Te3

2:1 when polythermal shears of *Sb:Bi* are studied; In *1:1* and *1:3*, it was noticed that the Sb_2Te_3-Bi_2Te_3 stoichiometric composition shifts to the σ-phase side in the *Sb:Bi* system with a decrease in temperature.

When studying isothermal shearing at 400^0C, a narrow zone is observed between two continuous solid solutions: σ phase Sb_2Te_3 and Bi_2Te_3.

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 ^{0}C 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* Bi_2Te_3:Sb_2Te_3. During the crystallization of Sb_2Te_3 and Bi_2Te_3, 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.

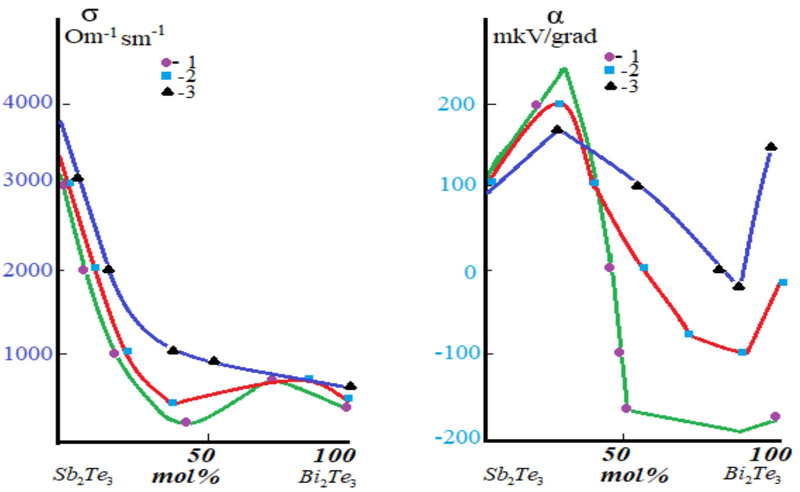

Figure 2. Effect of combustion on electrical conductivity and thermoelectric driving force.

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

In the Bi_2Te_3 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 Bi_2Te_3 increases compared to the thermoelectric conductivity of Sb_2Te_3.

The Bi_2Te_3 -Sb_2Te_3 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 $SbBiTe_3$ in the alloy solution. In its state diagram, the liquidus and solidus lines are close to each other. Its extreme values of Sb_2Te_3 and Bi_2Te_3 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 Bi_2Te_3 -Sb_2Te_3. If we increase the rate of crystallization, the space between the liquidus and solidus lines increases.

CONCLUSION

If the crystallization rate is 0,25 mm/hour, Bi_2Te_3-Sb_2Te_3 is in a motostable state. It was observed that *Sb-Bi* shifted towards the σ-phase state and that the stoichiometric cross section of Sb_2Te_3-Bi_2Te_3 shifted towards the temperature decrease. As the amount of bismuth in the alloy increases, the σ -phase decreases. The *Sb-Bi-Te* melting diagram occurs at high temperature, and it shifts from Sb_2Te_3 to Bi_2Te_3, 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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