Oriental Renaissance: Innovative, educational, natural and social sciences
SJIF 2024 = 7.404 / ASI Factor = 1.7
(E)ISSN: 2181-1784
4 (5), May, 2024
www.oriens.uz

OBSERVATION OF TEMPERATURE DEPENDENCE OF HALL COEFFICIENT IN SEMICONDUCTORS

Kholmatova Rukhshona Musinjon kizi
3rd year student of Physics, Fergana State University,
Gaynazarova Kizlarxon Isroilovna,
Doctor of Philosophy (PhD) in Physical and Mathematical Sciences

ABSTRACT

In this thesis, it is shown that the Hall coefficient and cavity Hall mobility for the Bi2Te3 alloy are temperature dependent, that the Hall coefficient also changes as the temperature increases, and that it is possible to determine the second phase carriers of R_x at high temperatures.

Key words: *Hall coefficient, cavities, Hall mobility, concentration*

АННОТАЦИЯ

В данном тезисе показано, что коэффициент Холла и холловская подвижность полости сплава Bi2Te3 зависят от температуры, что коэффициент Холла также изменяется с ростом температуры и что можно определить носители второй фазы R_x при высоких температурах.

Ключевые слова: *коэффициент Холла, полости, холловская подвижность, концентрация.*

ANNOTATSIYA

Ushbu tezusda Bi_2Te_3 qotishmasi uchun Xoll koeffitsiyenti va kovaklar Xoll harakatchanligining haroratga bog`liqligi, harorat ortishi bilan Xoll koeffitsiyenti ham o'zgarishi, yuqori haroratlarda R_x kattalik ikkinchi tagzona tashuvchilari bilan aniqlash mumkinlgi ko'rsatib berilgan.

Kalit so'zlar: *Xoll koeffitsiyenti, kovaklar, Xoll harakatchanligi, konsentratsiya*

INTRODUCTION

In recent years, the widespread use of fossil fuels has caused a number of environmental problems such as air pollution, water pollution and the greenhouse effect. Solving environmental and energy problems is relevant [1, 2]. Thermoelectric materials can realize the mutual conversion of thermal energy and electrical energy with the advantages of environmental friendliness, long service life and noiseless operation. They are also expected to be one of the most promising materials for solving current environmental and energy problems. Of course, low energy conversion efficiency affects the field of application of thermoelectric materials. However, they still need to improve their thermoelectric performance to achieve relatively stable and high thermoelectric values. The zonal structure of bismuth antimony and tellurium chalcogenide compounds obtained in the 1970s is still a matter of debate. This is due to the fact that the temperature dependence of the conductivity σ (T) and the heat capacity α(T) does not have any specific properties, and the participation of one type of charge carriers in kinetic phenomena (a single-band model) has a characteristic form for Therefore, experimental data on kinetic phenomena (σ(T), α(T)) allow their qualitative and quantitative description within the one-point model of the valence band.

DISCUSSION AND RESULTS

As a result of the low temperature T and the large concentration r, in the spin state of charge carriers, with increasing temperature, a part of the "light" holes moves to the second zone - the zone of heavy cavities, which has a higher effective mass of the density of states and less mobility. . Also, the temperature correlations of the Hall coefficient and mobility confirm that the structure of the valence zone of the base has an unusual character (Figures 1a and b). For the Hall coefficient, when the scattering mechanism of spherical zones and holes is assumed to be the same

$$R_x = \frac{r}{e}\frac{p_1\mu_1^2+p_2\mu_2^2}{(p_1\mu_1+p_2\mu_2)^2}, \qquad (1)$$

the expression is appropriate, where p_1, μ_1, p_2, μ_2 are the concentration and mobility of holes in the 1st and 2nd zones, respectively.

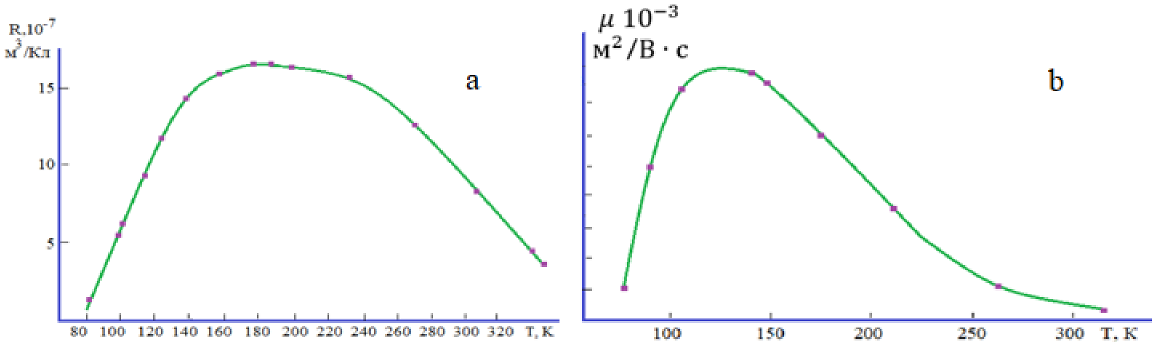

Fig 1. Temperature dependence of Hall coefficient (a) and hole Hall mobility (b) for Bi2Te3 alloy.

As the temperature increases, the Hall coefficient also initially increases, the maximum R_{max} value is reached at equal values of electrical conductivity in the zones $\sigma_1 = \sigma_2$. At high temperatures, the value of R_x determined by the carriers of the second domain, like the rest of the kinetic coefficients, and depending on the temperature, they increase in concentration

$$R_x = \frac{r}{pe} \qquad (2)$$

causes the value of R_x to decrease according to the expression (see Fig. 1a).

CONCLUSION

For complex zone semiconductors, at the temperature at which R_x reaches its maximum, the zone parameters such as $b = \frac{\mu_2}{\mu_1}, \frac{p_2}{p_1}, \Delta\varepsilon$ can be determined by the combination o R_x, α_{um} and σ_{um} parameters.

REFERENCES

1. Karimberdi, O., Usmanov, Y., & Toolanboy, A. Semiconductor sensor for detecting volume changes at low temperatures. *European Journal of Molecular & Clinical Medicine*, (2020). *7*(2), 2353-2358.
2. Onarkulov, K., Gaynazarova, K., & Tashlanova, D. Termoelektrik samaradorlikni qotishmalardagi elektronlar va teshiklarning harakatchanligiga bog‘lanishi. *Science and innovation*, (2022). *1*(A4), 56-59.
3. Gaynazarova Kizlarxon Isroilovna, Turg’unboyeva Madina Salimjon qizi. PROPERTIES OF ELECTROPHYSICAL PARAMETERS OF SOLID ALLOYS BASED ON Sb-Bi-Te. STUDY OF STOCHIOMETRICAL COMPOSITION IN OBTAINING TERTIARY COMPOUNDS. Scientific aspects and trends in the field of scientific research International scientific-online conference Part 9 APRIL 30th colletions of scientific works Warsaw 2023. P. 67-69.
4. G’aynazarova Kizlarxon Isroilovna. CHARACTERISTICS OF MOBILITY IN TERTIARY SOLID SOLUTIONS. Материалы международной конференции «Оптические и фотоэлектрические явления в полупроводниковых микро- и наноструктурах» Фергана-2023.с.112-114.
5. Q.I.Gaynazarova. CRYSTAL STRUCTURE OF CHALCOGENIDES OF THERMOELECTRIC ALLOYS BASED ON $Bi_2(B^{VI})_3$ and $Sb_2(B^{VI})_3$, (B^{VI}–Se, Te). Материалы международной конференции «Оптические и фотоэлектрические явления в полупроводниковых микро- и наноструктурах» Фергана-2023.с.110-112.
6. K.Onarqulov, K.G’aynazarova. THERMAL CONDUCTIVITY OF THERMOELECTRIC COMPOUNDS BASED ON $Bi_2(BVI)_3$ va $Sb_2(BVI)_3$, (B^{VI}–Se, Te). Материалы международной конференции «Оптические и фотоэлектрические явления в полупроводниковых микро- и наноструктурах» Фергана-2023.с.26-27.
7. Onarkulov, M., & Gaynazarova, K. (2024, March). Effect of chalcogens on Bi-Sb (Se-Te) based alloys made under inert gas pressure. In AIP Conference Proceedings (Vol. 3045, No. 1). AIP Publishing.