THERMOELECTRIC PROPERTIES OF Sm_2SnSe_4 CRYSTAL: ENERGY CONVERSION SYSTEMS

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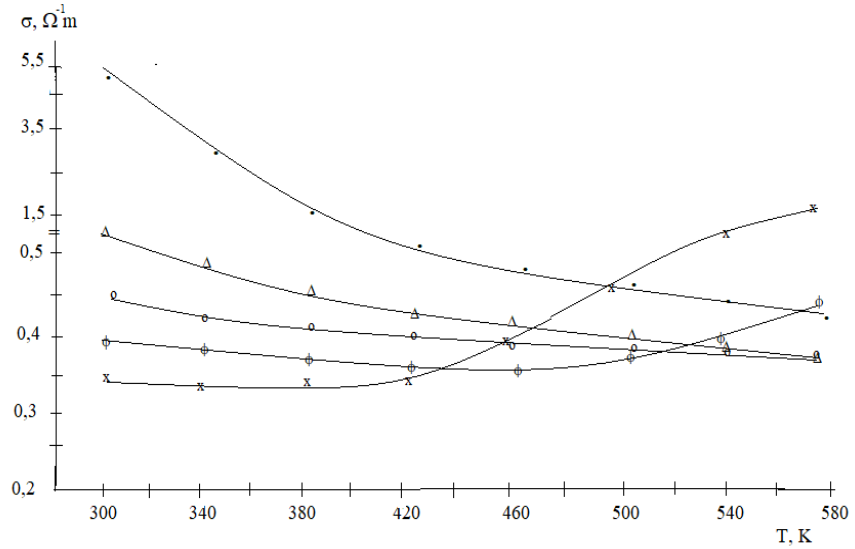
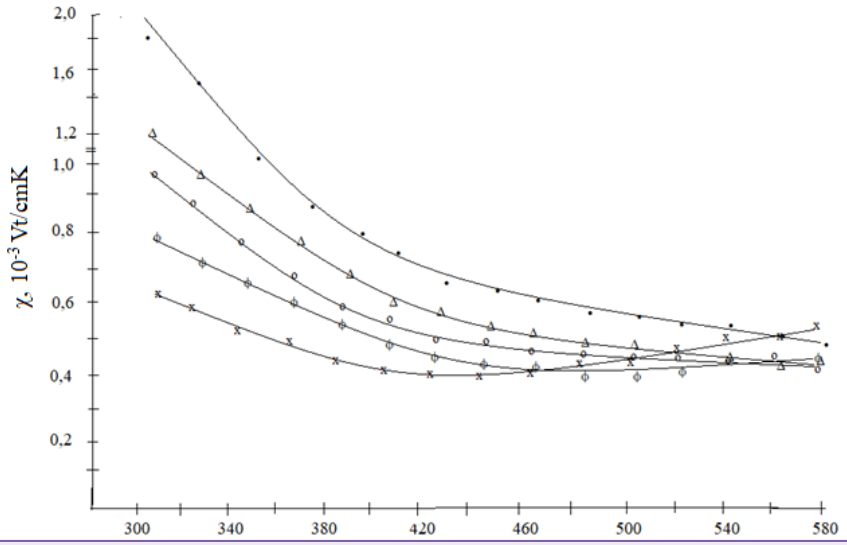
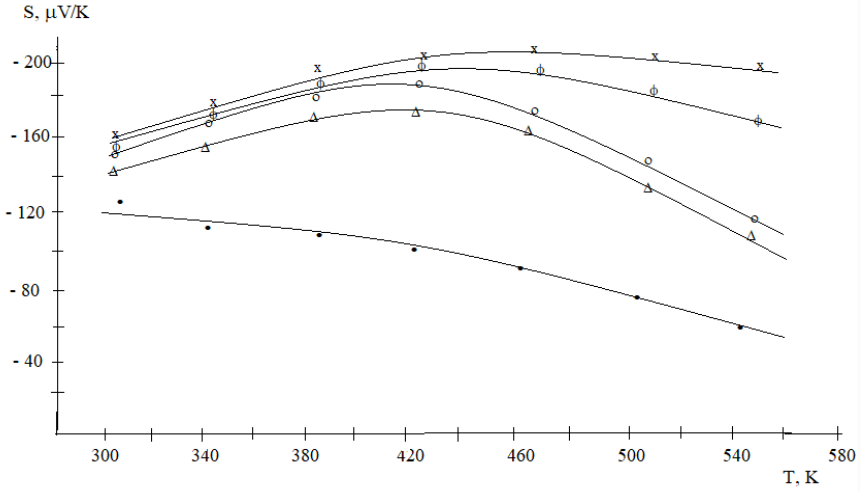
Detail of EXPERİMENT

For the synthesis of the Sm_2SnSe_4 energy conversion compound to be studied, high-grade pure Sn-000 tin, B4 brand selenium and samarium with 99.98% purity were used. A 10 gram substance was filled into a pre-prepared ampoule and sealed with a 0.133 Pa vacuum. The mixture was heated to 1100^0 C, cooled to 750^0 C after one hour and kept at this temperature for 170 hours to create homogeneity. The interaction of the components is very complex. The energy transformation compound Sm_2SnSe_4 is formed as a result of liquid + $Sm_2Se_3 \leftrightarrow Sm_2SnSe_4$ and crystallizes at 845^0C. The resulting mixture was infused at a temperature of 620^0C for t = 142 hours. This was followed by differential thermal analysis (DTA) and X-ray phase analysis (RFA) of the sample. Density has been studied. The compound was found to conform to the stoichiometric composition. The thermoelectric parameters of the Sm_2SnSe_4 compound were measured at a temperature of T = 300-580K, the temperature dependence graphs were plotted and analyzed.

Temperature dependences of of electrical conductivity, thermal e.d.f., thermal conductivity .







In this work, the electrical conductivity (σ), thermal e.d.f. (S) and thermal conductivity (χ) of the Sm_2SnSe_4 compound were measured and calculated. The electrical conductivity of the sample can be divided into two parts: 300-380 K and T> 420K. In the first part, σ (T) increases weakly and a partial decrease is observed at T = 380 K. At T> 420 K, σ (T) is weak at first and intensifies at T> 570K. In other words, it increases with the law $\sigma \sim T^{0,14}$ in the first part and with the law $\sigma \sim T^{0,37}$ in the second part.

Experimental results for Sm_2SnSe_4 for before and after thermal treatments

The Sm_2SnSe_4 compound is an n-type conductor. The concentration of the carriers is in the order $n = 1.4.10^{16}$ cm^{-3} at T=300 K, Hall's mobility u=1.5 $cm^2/V \cdot san$. Thermal treatment of the Sm_2SnSe_4 compound: thermo e.d.f. The values of S and χ before and after thermal treatments were compared to determine the effect of (S) and the heat transfer coefficient (χ) on the change in values. Heat treatment was carried out at temperatures T = 573 K and T = 673 K. The thermal treatment time was maintained at these temperatures at t = 120 h and the parameters were measured repeatedly.

Table 1. Some kinetics parameters for of Sm_2SnSe_4 for before thermal treatment.

T, K	σ, $Om^{-1}cm^{-1}$	S, mkV/k	10^{-3}, χ, Vt/cmK
90	2,43	-131	57.6
180	2,79	-327	41,2
305	3,92	-319	14,4

Table 2. Some kinetics parameters for of Sm_2SnSe_4 for after thermal treatments at 573 and 673 K temperatures.

T, K	(T = 573K)			(T=673K)		
	σ, $Om^{-1}cm^{-1}$	S, mkV/k	10^{-3}, χ, Vt/cmK	σ, $Om^{-1}cm^{-1}$	S, mkV/k	10^{-3}, χ, Vt/cmK
90	2,96	-166	62,7	1,97	-160	68,0
180	2,92	-351	51,5	2,33	-382	47,8
305	4.29	-347	15,9	3,14	-370	17,0

CONCLUSİONS

- The high value of thermo e.d.f. and the low value of electrical conductivity are due to the high ionicity of the Sm_2SnSe_4 crystal.
- According to the results of the experiment, we can say that the thermal treatment of Sm_2SnSe_4 improves the kinetic parameters of the crystal.
- In other words, heat treatment compensates for some of the vacancy centers in the crystal (formed by the excess of Se - element atoms) and improves the transport of charges.

THANKS FOR YOUR ATTENTION !