THE INFLUENCE OF THE MAGNETIC FIELDS ON THE THERMAL DIFFUSIVITY OF Ni DOPED TGS CRYSTALS

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It has been shown recently that the crystal growth conditions have a great influence on the physical properties of crystals. The thermal diffusivity of TGS crystals is different for crystal grown in the ferroelectric and paraelectric phases [1]. Similarly the influence of the magnetic field on the crystallization process of crystals grown from a water solution [2] has been studied. The aim of our work is to complement [3], where the influence of the magnetic and electromagnetic fields on the crystallization process of the TGS crystals grown from a water solution was studied. In [3] pure TGS crystals were used, for our purpose 2 mól% Ni doped TGS crystals were used. The crystals were similar to those in [3], grown in the following way: group A was grown in the usual way, in group B the crystals were influenced during their growth by a direct magnetic field of a 35 Oe intensity, in group C a shield for shielding electromagnetic waves was used.

The pulse method [4] for thermal diffusivity measurements was used. The dimensions of samples were $2-3 \times 10 \times 10$ mm-, the heat was propagated in the "b" direction.

The influence of the magnetic and electromagnetic fields is shown in Fig. 1. The highest absolute thermal diffusivity values are in group A. The influence of the magnetic field (group B) is below the critical point seen, above the critical point there is no difference between the thermal diffusivity values of groups B and A. The influence of the shielding of the electromagnetic waves (group C) is the most prominent. The thermal diffusivity values of group C are the lowest. Below the critical point the curve of thermal diffusivity is very smooth with an untypically small decrease.

From the dynamic scaling law theory [5] it follows that thermal diffsivity near the critical point typically falls according to the exponential law

$$k = A(T - T_c)^n,$$

where A is a constant, n the critical index, T_c the critical temperature. The critical indices calculated by the least square method below the critical point (42–49 °C) are as follows:

From Table 1 it follows that the critical index "n" depends considerably on the growth conditions. The greatest change of "n' is in group C.

In [3], where the number of dislocations in pure TGS crystals was studied it was found that the greatest influence was that of the electromagnetic shielding, when the number of dislocations in the crystal of group C was the lowest.

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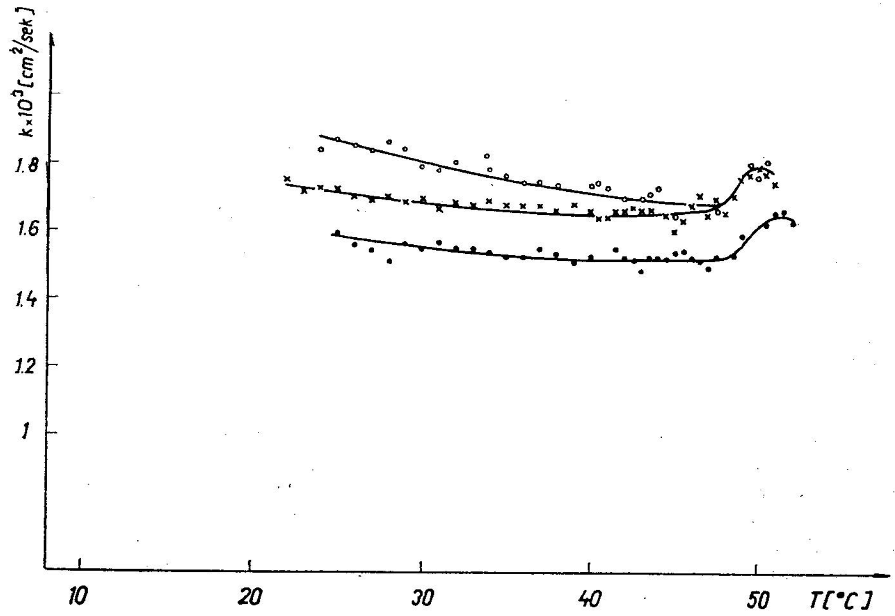

Fig. 1. Thermal diffusivity of the 2% Ni doped TGS crystals, o — crystal grown in the usual way, x — crystals grown in the direct magnetic field of 35 Oe, ● — crystals grown with the shielding of electromagnetic waves.

Table 1

	group A	group B	group C
n	0.179	0.052	0.0027
A	1.654	1.578	1.517

From our results it follows that thermal diffusivity depends considerably on the growth conditions. However at the present stage of the theoretical and experimental knowledge it would be premature to explain the mechanism of the dependence. From this point of view it would be necessary to continue a systematic summarization of the theoretical and experimental knowledge.

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