cavity or channel, the given method is preferable to the Monte Carlo method.

**NOTATION**

$L$, initial contour; $L^*$, contour approximating contour $L$; $z(M), f(M), \gamma(M)$, arbitrary functions of the point $M$; $z^*(m), f^*(m), \gamma^*(m)$, step functions approximating the functions $z(M), f(M), \gamma(M)$; $\mu$, number of zones; $\varphi(m, n)$, mean angular coefficient; $l$, contour length; $\alpha$, molecular-capture coefficient; $\delta$, relative error.

**LITERATURE CITED**


**HEAT TRANSFER OF THERMISTORS IN A NONUNIFORM ELECTRIC FIELD**

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The results of an investigation of the action of dc and ac electric fields on the heat transfer of thermistors are described.

In recent years both in the Soviet Union and abroad increased attention has been given to finding new methods of improving heat transfer based on the use of electric fields. The basic principle of this method is the fact that under the action of intense electric forces in liquids and gases additional disturbances arise which under certain conditions can be localized in a narrow region of the boundary layer which has the highest thermal resistance and is therefore essentially a controllable heat transfer. The electroconvection disturbances that arise lead to a considerable increase in heat transfer.

However, despite the promising possibilities of the new method it has not been investigated to any great extent either theoretically or in practice. The theoretical assumptions and experimental results of different investigators are often questionable and even contradictory. This relates, first of all, to the nature of the action on the heat transfer of dc, ac, and mixed electric fields, and also to the quantitative estimates of the increase in heat transfer as a function of the field strength, the temperature difference, the configuration, the diameter of the heat-transfer and high-voltage electrodes, their mutual position, the temperature of the surrounding medium, etc. [6]. The methods for the experimental investigation of the effect are also far from ideal. Thus, in all the publications known to us [1-7] the heat transfer of the heated conductor has been investigated. The high-voltage was applied either to a coaxially situated conducting cylinder or to a plate placed parallel to the conductor. Hence, in all these cases the heat transfer of a conductor in a nonuniform electric field was
investigated. The effect of an increase in the heat transfer was found from the amount of additional energy consumed in heating the wire in the field as compared with the energy consumed in heating to the same temperature when there is no field. For this purpose the conductor, as a rule, was connected in a bridge circuit which enabled one to maintain its temperature constant and to make all the measurements necessary to determine the average heat-transfer coefficient along the length. The main drawback of such a method of determining the energy consumed and the temperature of the heated wire is its comparatively low temperature coefficient of resistance which determines the low temperature sensitivity of such a thermal probe and, consequently, makes these measurements of low accuracy.

In the present article we attempt to extend the heat-transfer intensification effect in electric fields to semiconductors, and primarily to semiconductor thermistors which have a high sensitivity to changes in the heat-transfer conditions. We have two aims in mind: first, to study how the main parameters and characteristics of the heated semiconductor devices change when acted upon by electric fields, and, second, from the results obtained to determine the possibility of using thermistors as sensitive probes for studying heat-transfer intensification processes.

As is well known, the main characteristics of any thermistor when it is heated by the current passing through it is the static volt-ampere characteristic, i.e., the relation

\[ U_T = F(I_T) \quad \text{or} \quad I_T = F(U_T) \]

when the parameters of the surrounding medium remain unchanged. The nature of this relationship is governed by many factors and mainly by the conditions under which heat transfer occurs to the surrounding medium. Consequently, the application of an electric field and the resulting intensification of heat transfer should lead to a change in the volt-ampere characteristics of the thermistor, other conditions being equal.

To check this suggestion and to make quantitative estimates we carried out a series of experiments with KMT-10, MMT-1, and KMT-4 thermistors, RIIZhT test high-power resistors, and ST5-1 posistors. Preliminary investigations enabled us to draw the following interesting conclusion: intensification of the heat transfer in an electric field is not possible in any heated body but only occurs from a metal or when there is direct thermal contact with a metal. Hence, for the further investigations, we used KMT-4 thermistors which have a metal body in combination with hollow cylinders of different diameter made from copper, brass, and aluminum. One of the cylinders had a continuous highly polished surface. In the others a large number of holes were drilled in the side surface to improve the heat transfer.

Figure 1a shows a sketch of the test model. A hollow cylinder 2 is fastened to the coordinate 1; inside the cylinder along its axis there is a thermistor 3 which is stretched by means of a spring between two electrically insulated supports 4. A high-voltage lead 5 is connected to the cylinder through a special terminal. The second terminal of the high-voltage source is connected to the current-carrying thermistor 6 which is connected to its metal body.

The coordinate with the cylinder and thermistor is connected to the base 7 which is made of an electrically insulating heat-resistant material.