are shown by points, which, as seen from Fig. 1, cluster near the dashed line, with accuracy ±10%.

From the fact that the straight lines in the plot of $\zeta = F(T)$ (Fig. 2) have equal slopes both at $T < 6°K$, where $\theta_1 = -1.3°K$, and at $T > 9°K$, where $\theta_2 \simeq 2°K$, we see that the constants C in the Curie-Weiss law (2), and hence the product $N\mu^2$, remain the same in both temperature intervals.

As is well known, the temperature dependence of the susceptibility, in the form $\chi = C/(T - \theta)$, is related to the action of the internal fields. In particular, a positive value of θ corresponds to ferromagnets and a negative one to antiferromagnets. In our case the change of the sign of θ corresponds to the temperature region in which delocalization of the electrons sets in - the smeared "dielectric - metal" transition [4].

Further investigations should show whether this transition is accompanied by a Wigner correlation of the electrons [5].

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PLASMA-JET CO_2 LASER

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Submitted 26 April 1972
ZhETF Pis. Red. 15, No. 11, 665 - 668 (5 June 1972)

We report in this article the first case of plasmotron excitation of a CO_2 laser by injecting into the laser volume plasma jets produced in capillary plasmotrons.

It is known that pre-ionization of all or part of the working volume of the laser is an important factor in the production of a high-pressure active medium for a gas-discharge CO_2 laser. For pre-ionization of the entire working volume, it turned out to be convenient to use ionizing-radiation sources [1 - 2], which increase the extent to which the energy of the current flowing through the gas is utilized, and prevent formation of an arc discharge. If part of the active laser volume is pre-ionized by introducing into the laser a third electron that produces a local overvoltage, then plasma cathodes are produced and contribute to a relatively homogeneous breakdown of large gas volumes at high pressures [4]. An important factor here is that main discharge is initiated in the presence of plasma-filled cathode regions.

A further development of this method is to force plasma formations not into the cathode region, but into the entire laser volume. This can be done with plasmotrons.

The experiment was performed in a transversely-excited laser system similar to that described earlier in [5]. The separate cathodes of the system were replaced by a row of 25 capillary plasmotrons simultaneously injecting plasma jets into the laser volume. We investigated mainly the mixture CO_2-N_2-He with a component ratio 1:2:3 at a pressure of 30 Torr. The supply of interelectrode gap of the working volume was different from that of the capillaries. The gap was 2 cm long, the capillary diameter 1 mm, the length 5 mm, and the distance

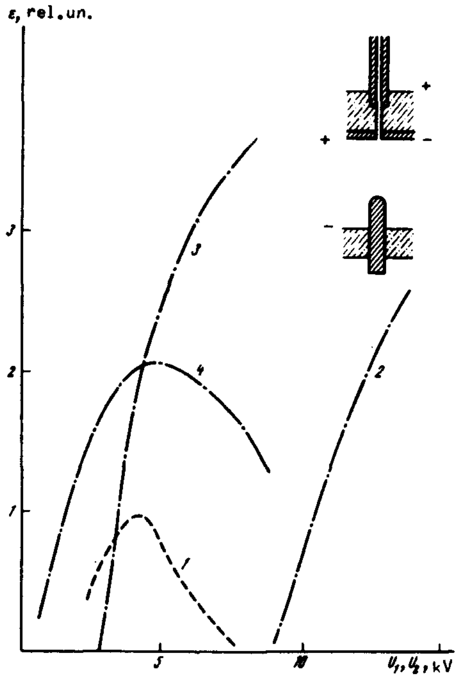

Fig. 1

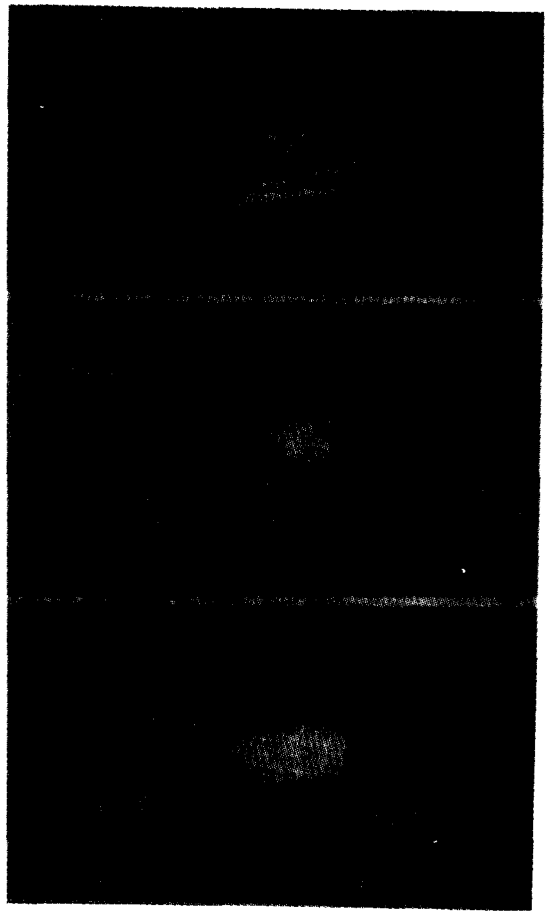

Fig. 2

Fig. 1. Generation energy (relative units) vs. voltages U_1 on the capillaries and U_2 on the working-volume electrodes. The diagram shows also schematically the plasmotron connection. 1) $U_1 = 0$, 2) $U_2 = 1$ kV, 3) $U_2 = 2$ kV, 4) $U_2 = 2.5$ kV.

Fig. 2. Photographs of discharge in the working volume of the laser: a - no voltage applied to the capillaries (the photograph was taken at a small angle to the discharge-chamber axis); b - voltage applied to the capillaries only, c - voltage applied both to capillaries and to the working-volume electrodes.

between capillaries 1 cm. The voltage on the capillaries ranged from 0 to 15 kV, the current reached 250 A, and a voltage up to 10 kV was applied to the discharge gap of the working volume.

The laser resonator was made up of a plane-parallel germanium plate (output mirror) and a solidly gold-coated spherical mirror of 500 cm radius. The distance between mirrors was 100 cm. The laser radiation was registered with a receiver based on Ge:Zn:Sb.

The experimental results show that it is possible to produce an active medium with the aid of plasma jets. When no voltage is applied to the capillaries, the usual streamer breakdown is produced in the laser volume. The dependence of the generation energy on the voltage across the laser electrodes is shown dashed in Fig. 1. Figure 2a shows the structure of the breakdown in this case. Application of voltage on the capillaries changes the picture appreciably. In the absence of voltage on the working-volume electrodes, the plasma jets extend to approximately the middle of the laser volume (Fig. 2b). There is no lasing in this case.

Intense lasing is produced when voltages are applied simultaneously to the capillaries and to the electrodes. The dependence of the generation energy for this case on the electrode voltages is shown by the solid lines in Fig. 1. As shown by the photograph in Fig. 2c, the plasma jet becomes much longer in this case. The field of the working volume draws out the plasma cloud without changing its cross section. The generation energy reaches 0.1 J. The laser pulse has an intense spike on the leading front, with approximate duration 0.1 μsec. It is important that under optimal conditions the voltage on the working-chamber electrodes is 2 kV, not enough to break down the gas in the working volume in the laser and to obtain lasing in the absence of gas jets in the volume. The sharp increase of the generation energy as shown in Fig. 1, when the plasma jets and the accelerating voltage in the working volume act simultaneously, takes place if the pulses feeding the working volume and the capillaries are carefully synchronized.

No lasing takes place when the working volume is filled with pure CO_2 and nitrogen is fed through the capillaries under pressure. On the other hand, intense lasing takes place if helium is fed through the capillaries. For the plasma-jet CO_2 laser to operate it is apparently important to have plasma formations come out of the capillaries. Practically no vibrationally-excited molecules come out of the capillaries.

Our experiments have thus demonstrated the promising prospects of the new plasmotron method of exciting gas-discharge CO_2 lasers. An increase of the energy input to the capillaries will apparently make it possible to use higher pressures.

The authors thank N.A. Karpov and Yu.N. Petrov for numerous discussions.

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SUPERCONDUCTING TRANSITION TEMPERATURE, ELECTRIC RESISTANCE, AND OPTICAL ABSORPTION SPECTRA OF Be AND Zn FILMS EVAPORATED TOGETHER ON CERTAIN DIELECTRICS

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Submitted 27 April 1972
ZhETF Pis. Red. 15, No. 11, 668 - 673 (5 June 1972)

According to contemporary theoretical notions, the realization of the electron-electron superconductivity mechanism would raise considerably the superconducting transition temperature [1]. The electron-electron mechanism might be realized, for example, in thin layers consisting of a metal and of a suitable organic compound [2]. One of the possible variants is the use of a porphyrin complex as the nonmetallic component.

The results of an investigation of the superconducting transition temperature T_c of beryllium films evaporated simultaneously with zinc etioprophyrin