[3]. For Sb, however, the accommodation region can reach 10 μ [4][3]), so that an estimate of the reflection coefficient is difficult. Furthermore, K may greatly increase because of the appearance of bound charges on the twin boundaries, in analogy with what occurs in semiconductors [5].

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CW CHEMICAL LASER USING $DF-CO_2$

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We report here realization of continuous laser emission in subsonic gas streams. The generation was produced by CO_2 molecules excited by energy transfer from vibrationally-excited DF^* molecules obtained by a purely chemically initiated chain reaction between deuterium and fluorine.

These processes correspond to the scheme:

$$F + D_2 \rightarrow DF^* + D, \quad \Delta H = -31{,}7 \text{ kcal/mole}, \tag{1}$$

$$D + F_2 \rightarrow DF^* + F, \quad \Delta H = -98 \text{ kcal/mole} \tag{2}$$

$$DF^* + CO_2(00^\circ 0) \rightarrow CO_2(00^\circ 1) + DF. \tag{3}$$

In our experiment, as in [1, 2], the source of the "priming" active centers needed to realize the chain reaction (1) - (2) was the auxiliary chemical reaction

$$F_2 + NO \rightarrow FNO + F, \quad \Delta H = -18 \text{ kcal/mole}. \tag{4}$$

The observed continuous generation corresponded to the state of molecular transition $CO_2[00^01] \rightarrow CO_2[10^00]$ with radiation wavelength 10.6 μ.

3)According to [4], in individual cases the accommodation region may reach several hundred microns. At such dimensions, its contribution to the change of the magnetoresistance is comparable with the changes observed in the present investigation. However, if the influence of the accommodation band reduces simply to a decrease of the carrier mobilities, then one cannot understand, without making additional particular assumptions, the cause of the anisotropic (relative to the magnetic-field direction) change of the magnetoresistance in the part of the sample containing the twins, and also the cause of the small change of $R_0(300°K)/R_0(4.2°K)$ of this part of the crystal.

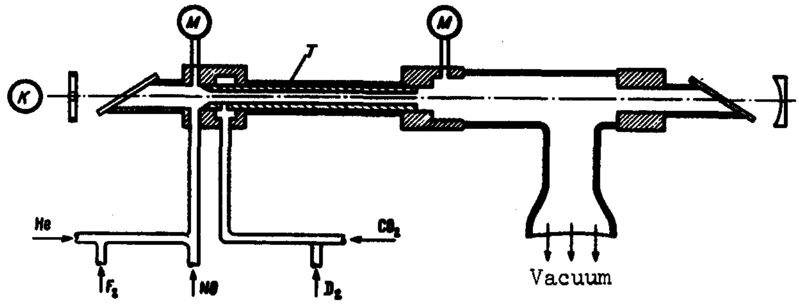

Fig. 1. Schematic diagram of experimental setup.

A diagram of the experimental setup is shown in Fig. 1.

Reactions (1) - (3) were realized in a teflon tube. The tube length was 150 mm, the inside diameter 8 mm. The reaction (4) occurred in a stream of He + F_2 + NO in a conducting copper tube, in a section 35 cm long, and the produced gas mixture was fed to the end part of the reactor.

The mixture of the gases CO_2 and D_2 was injected in the reaction volume through a number of openings in the perimeter near the end part of the teflon tube. The semiconfocal resonator was made up of gold-coated mirrors.

The laser radiation emerged through an opening of 1 mm diameter on the side of the flat mirror. The pressure on entering the reaction volume was 15 - 20 Torr under the experimental conditions. To ensure sufficient velocity of the gas-mixture stream through the reaction tube, the latter was connected to a ballast volume by a tube of large diameter. Under the experimental conditions, the average stream velocity was estimated at ∿200 m/sec.

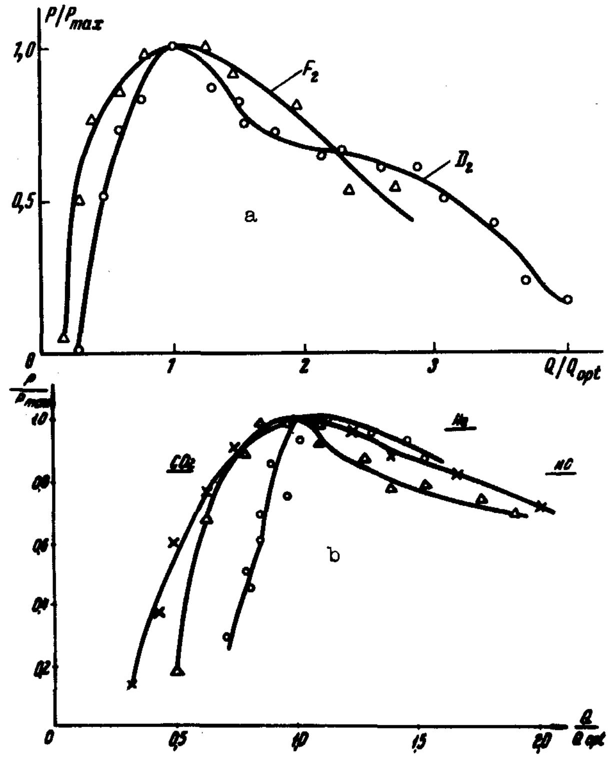

Fig. 2a, b. Dependence of cw laser power on the flow rates of the gas components.

Experiments aimed at optimizing the laser radiation power yielded the following values for the flows of the working components of the mixture (in micromole/sec):

NO – 40; F_2 – 450; D_2 – 370; CO_2 – 1650; He – 5070.

Figures 2a and b show plots of cw laser power against the gas flow. The abscissas represent the flows of the gas components referred to the optimal values and the ordinates the ratio of the laser radiation power to the optimal value.

It should be noted that the output power of a cw laser based on chemical reactions depends strongly on the rate of mixing of the initial reagents. In our experiments, the conditions of the reagent mixing were varied by decreasing the diameter of the injection openings. At an opening diameter d = 1 mm, the pressure drop between the injected medium and the reaction volume was ΔP = 10 - 15 Torr, and at d = 0.35 mm and at the same gas flow we obtained $\Delta P \sim 1$ atm. The decrease of the diameter led to an increase of the velocity of the injected jets, improving by the same token the conditions for the mixing of the components. The improvement of the mixing conditions in the second case increased the cw radiation power by approximately 4 times, to 2.1 W.

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EXPERIMENTAL INVESTIGATION OF THE INTERACTION OF MODULATED RELATIVISTIC BEAMS WITH A PLASMA

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A study of the collective processes of interaction of relativistic electron beams with a plasma is of great interest for plasma physics and for numerous applications. The linear theory of this interaction was considered in [1, 2], and the nonlinear one in [3].

The main conclusion of the linear theory is that the relativistic increase of the longitudinal and transverse masses of the electrons in the beam causes the increments of the excited oscillations to decrease strongly. While this statement is true, it would be incorrect to conclude from it that the efficiency of plasma-beam interaction is lower at relativistic electron-beam energies. The nonlinear theory shows [3] that the beam remains monoenergetic even at the appreciable momentum spread due to the reaction exerted on the beam by the excited oscillations, which are naturally taken into account only in the nonlinear theory.

Owing to the resonant character of the interaction of the monoenergetic beam with the plasma, the "hydrodynamic" phase of this interaction is stretched out, leading to a strong increase of the fraction of energy transferred from the beam to the plasma.

Thus, the interaction efficiency, defined as the relative amount of energy transferred from the beam to the plasma, increases rather than decreases. For an experimental observation of the effects it is necessary to increase either the beam currents or the length of the interaction at not very large currents.

An appreciable enhancement of the effect is obtained under conditions that permit coherent deceleration of the relativistic electron beam by the plasma, which is the inverse of V.I. Veksler's effect of coherent acceleration [4].[1] It is necessary to use for this purpose modulated beams and effects of accumulation of electromagnetic energy [6].

[1] We note that the effect of coherent Cerenkov radiation of nonrelativistic beams in dielectrics was first investigated by V.L. Ginzburg and I.M. Frank [5].