larger by three orders of magnitude than $\mu_\perp$ for sample No. 4, which has the same dislocation density. In sample No. 3a, with $N_D = 4\times10^6$ cm^{-2}, the minimum at T = 16°K is barely noticeable.

It is important to note that in the entire interval of investigated temperatures all the deformed samples had p-type conductivity. The hole density in the deformed samples decreases with decreasing temperature, and remains lower than the density in the control sample practically everywhere, thus demonstrating the donor action of the dislocations [1].

The described singularities in the behavior of the mobility in deformed p-germanium cannot be explained qualitatively from the point of view of the known scattering mechanism, and are undoubtedly connected with the features of the effect of the dislocations on the energy spectrum and on the carrier-scattering processes in semiconductors.

Our future experiments will be aimed at investigating the mechanism of the observed effect.

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EFFECT OF LASER RADIATION ON THE TEMPERATURE OF THE SUPERCONDUCTING TRANSITION OF AN Nb-Sn ALLOY

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We investigated the temperature dependence of the electric resistance of $Nb_{0.8}$-$Sn_{0.2}$ samples in the region of T_c before and after application of pulsed-laser radiation. We show that the superconducting-transition temperature rises significantly after the irradiation, and that the new state of the alloy is stable.

We report here observation, for the first time, of an increase in the superconducting transition temperature of a niobium-tin alloy, resulting from irradiation with CO_2-laser pulses ($\lambda = 10.6\mu$).

It is known by now that when giant laser pulses act on the surface of a solid crystal, an increased defect concentration is produced in the surface layers [1 - 4] and leads to a noticeable change in the physical properties of these layers.

The superconducting-transition temperature T_c is a characteristic that reflects electron interactions in real crystal structures. It is therefore of interest to investigate the residual changes of T_c following laser irradiation of superconducting materials. We note that destruction of superconductivity of lead films (type-I superconductor) was observed [5] at the instant of irradiation with laser pulses.

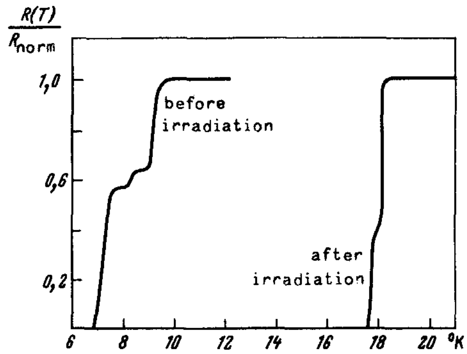
We have investigated the effect of laser pulses on the superconducting properties of a niobium-tin alloy (type-II superconductor). A pulsed CO_2 laser with helical excitation was used. We investigated samples of the alloy $Nb_{0.8}$-$Sn_{0.2}$, which has $T_c \simeq 10$°K (T_c of $Nb_{0.75}Sn_{0.25}$ is $\simeq$18.3°K), in the form of parallelepipeds measuring 10×3×2 mm. The composition of the initially cast samples was uneven. The tin concentration ranged from 21 to 11 at.% in different points. The irradiation by focused laser pulse was effected in air at room temperature and was accompanied by the appearance of plasma flares.

The transition to the superconducting state was fixed by measuring the electric resistance. The sample temperature was measured with a miniature resistance thermometer based on single-crystal germanium. The temperature of the superconducting transition was determined accurate to 0.05°K.

Owing to oscillations of the composition in the initial samples, a two-stage superconducting transition at 7.6 and 9.6°K was observed prior to the irradiation (see the figure). After the irradiation with the pulsed laser, the transition temperature increased appreciably. A much more abrupt but still two-stage superconducting transition was observed at T_c = 18.2°K, with $\Delta T_c < 0.05$°K, and at T_c = 17.85°K with $\Delta T_c \simeq 0.15$°K (see the figure).

Different sections of the irradiated sample have different values of T_c with different critical fields.

The new state of matter obtained in the surface layer as a result of the action of the laser pulses on the sample surface is stable and is preserved at room temperature. The observe strong increase of T_c following laser irradiation cannot be attributed, within the framework of modern ideas concerning superconductors, solely to distortions of the crystal structure, to the appearance of point defects, etc. The nature of the observed phenomenon calls for further research.



Superconducting transition temperature of $Nb_{0.8}Sn_{0.2}$ before and after laser action

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EXPERIMENTAL STUDY OF GASDYNAMIC AMPLIFICATION OF N_2O-N_2-He LASER EMISSION

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Results are presented of gain measurements in a shock-heated ternary mixture (20% N_2O, 10% N_2, 70% He) escaping through a nozzle, at a distance 15 mm from the end face. The maximum gain is 1.15×10^{-2} cm^{-1} at a Mach number 2.75.

Amplification of infrared radiation in the 10.9 μ band was observed following adiabatic expansion, through a wedge-shaped nozzle, of a shock-heated mixture of nitrous oxide, nitrogen, and helium.

The feasibility of obtaining inverted population in vibrational levels having different relaxation times by adiabatic expansion of a gas mixture containing molecular gases, particularly CO_2-N_2 and N_2O-N_2, was suggested in [1 - 3].

The general ideas concerning the construction of gasdynamic lasers were formulated in [4, 5]. So far, a theoretical model of such a laser, using a CO_2-N_2 mixture, was developed in [2, 3, 6, 7]; experimental studies of this model were made in [8 - 12].

We have investigated experimentally the gain of laser radiation passing through a supersonic molecular stream of nitrous oxide. The gas escaped through a wedge-shaped nozzle into a receiver (nozzle aperture angle 30°, length of supersonic part 3.6 cm, critical-section dimensions 1.3×90 mm). The mixture (20% N_2O, 10% N_2, 70% He) was used. The mixture was heated in a shock tube behind a reflected shock wave, the incident wave having Mach numbers M from 2 to 3.5. The stagnation temperature was 1000 - 2200°K and the stagnation pressure 3 - 12 atm. The low-pressure chamber of the shock tube, of 98 mm diameter, was separated from the nozzle by an aluminum diaphragm. The pressure in the receiver was 10^{-2} Torr, and the initial pressure of the investigated mixture was 150 Torr, i.e., the gas escaped without back-pressure.

Figure 1 shows a two-pass system for measuring the gain (1 - flow-through electric-discharge N_2O cw laser, 2 - semitransparent silicon mirror, 3 - KCl window, 4 - flat rotary mirror, 5 - focusing lens, 6 - chopper modulating the laser beam, 7 - Ge-Au receiver). The receiver signal was fed to an S1-37 oscilloscope triggered by a synchronizing pickup P. The sounding eam of a single-mode N_2O laser was directed parallel to the larger dimension of the critical section and passed at a distance 15 cm from the nozzle end face.