In the wavelength region investigated by us, the surface-wave phase velocity was 10^7 - 10^8 cm/sec and was approximately double the helicon phase velocity. However, if the dispersion characteristics remain linear outside this range, then they should cross the quadratic dispersion characteristics of the helicons at two points, so that at these points one should expect different singularities to appear.

It is physically clear that the existence and the properties of the surface waves must of necessity follow from the simultaneous solution of Maxwell's equations and the equations of motion for the carriers in the semiconductor under suitable boundary conditions and, apparently, with allowance for the presence of carriers of both sides, inasmuch as at T = 300°K the conductivity of our InSb samples was close to the intrinsic conductivity. However, insofar as we know, in spite of the fact that the question of surface waves was raised a number of times in the literature [1 - 3], no waves were observed earlier in a magnetoactive plasma with the properties described above. Therefore a further study of these waves is of undoubted interest.

[1] A.B. Mikhailovskii and E.A. Pashitskii, Zh. Eksp. Teor. Fiz. 48, 1787 (1965) [Sov. Phys.-JETP 21, 1197 (1965)].
[2] S.I. Khankina and V.I. Yakovenko, Fiz. Tverd. Tela 9, 58 (1967) [Sov. Phys. -Solid State 9, 446 (1967)].
[3] N.Ya. Kotsarenko and A.M. Fedorchenko, Zh. Tekh. Fiz. 39, 1132 (1969) [Sov. Phys.-Tech. Phys. 14, 853 (1970)].

RECORDING OF OPTICAL INFORMATION ON AMORPHOUS FILMS OF SEMICONDUCTING COMPOUNDS

N.S. Belokrinitskii, A.V. Gnatovskii, M.V. Danileiko, V.P. Zakharov, A.V. Kozlov, and M.T. Shpak
Physics Institute, Ukrainian Academy of Sciences
Submitted 7 January 1972
ZhETF Pis. Red. 15, No. 4, 198 - 200 (20 February 1972)

At the present time optical methods of recording and processing information are among the most timely scientific and technical problems. Their extensive introduction, however, depends in many respects on the availability of media for recording the signal, and the choice of these, especially for the IR band, is limited.

We have realized experimentally a new method of optical information, based on the local variation of the structural and optical characteristics of certain semiconducting compounds under the influence of laser radiation. This uncovers a possibility of producing media with a large recording speed (10^{-4} - 10^{-5} sec) and with large spatial resolution, requiring in addition no further processing.

When powerful light pulses act on thin amorphous semiconducting films, the crystallites in the films grow, and this is accompanied by an appreciable increase in their electric conductivity and reflectance in the IR region. A study of the kinetics of the phase transition from the amorphous to the polycrystalline one has shown that this transition can be effected within a time on the order of 10^4 sec at a definite activation energy of this process [1].

In our experiments, the media for the recording of optical signals were amorphous GeTe and InSb films sputtered in vacuum on glass and NaCl substrates. The experimental setup was as follows. A laser beam was split with a semitransparent mirror into two beams of approximately equal intensity and aimed at the sample at a convergence angle ∿55° for GeTe and ∿25° for InSb. This produced on the film an interference grating - a halogram of the radiation field. The samples were subjected to the action of radiation pulses of a ruby (λ = 0.69 μ)

and neodymium ($\lambda = 1.06\ \mu$) free-running lasers. At a sufficiently uniform distribution of the radiation-field amplitude, interference gratings with up to 1000 lines/mm were obtained, comprising alternating sections with different spectral and structural properties. The figure shows an electron-microscope picture of an interference grating with 700 lines/mm, recorded on a GeTe film by neodymium laser radiation. A connection was established between the conditions under which the samples were prepared and the maximum attainable grating line number. There are optimal values of the radiation energy for the production of gratings in the pulsed regime. For example, the energy needed to produce a grating on a GeTe film by a neodymium-laser pulse of $\sim$500 μsec should be $\sim$0.1 J/mm^2.

In the obtained samples, the efficiency (E_{inc}/E_{trans}) was 1 - 4% when an LG-56 He-Ne laser was used. Encouraging results were obtained also at $\lambda \sim 10.6\ \mu$. Thus, spatial structures on the order of $\sim$10 lines/mm could be recorded with a CO_2 laser operating in the continuous regime, and this is apparently not the limit. In this case, obviously, an overall heating of the sample takes place and leads to a "blurring" of the image during an exposure time $\sim$1 sec at an energy density $\sim$20 W/cm^2 in the plane of the film.

Depending on the density of the recorded grating, we observed two types of structure changes accompanying the recording of the information in the films. When a grating with $\sim$100 - 200 lines/mm was recorded, the lines were strips of polycrystalline material separated by amorphous film sections. In the case of gratings with $\sim$100 lines/mm an increase of grain was observed in the entire area of the film section processed by the light radiation, but the optical density of the lines of the interference grating was different, making it possible to obtain in this case a grating with sufficient efficiency.

We are continuing further research on the kinetics of the phase transition from the amorphous to the polycrystalline state in the indicated materials and in many others, as well as investigations of the use of these films as carriers for the recording of information in the visible and infrared regions of the spectrum.

In conclusion, we are grateful to V.D. Samoilov for useful discussions.

[1] V.P. Zakharov and V.I. Zaliva, Kristallografiya 17, 198 (1972) [Sov. Phys. -Crystallography 17, No. 1 (1972)].

PHASE MODULATION OF COHERENT LIGHT WITH THE AID OF LIQUID CRYSTALS

N.G. Basov, P.D. Berezin, L.M. Blinov, I.N. Kompanets, V.N. Morozov, and V.V. Nikitin
P.N. Lebedev Physics Institute, USSR Academy of Sciences
Submitted 20 January 1972
ZhETF Pis. Red. 15, No. 4, 200 - 203 (20 February 1972)

1. We report here investigations of the effect of phase modulation by means of an electric field, of coherent light passing through a nematic liquid crystal with positive isotropy of the dielectric constant ($\varepsilon_\parallel > \varepsilon_\perp$). Such a