New Type of Photoconductivity, M. I. Korsunskii, N. S. Pastushuk, and G. D. Mokhov, pp. 1942–1943.

A new type of photoconductivity has been found in which the photoresponse does not depend on the light intensity but does depend on its wavelength. We prepared selenium samples, treated with mercury, which displayed unusual photoconductivity under certain conditions.

Long-Time Strength of Metals and How It Is Affected by Surface-Active Metallic Melts, L. S. Bryukhanova, I. A. Andreeva, and V. I. Likhtman, pp. 2025–2028.

The dependence on time and on temperature of amalgamated zinc and gallium-treated cadmium was investigated. It is shown that the graph showing the dependence of the time required for rupture on stress in the presence of a surface-active melt discloses an abrupt change in the region of small stresses. The lifetime of the samples under loading drops within an extremely narrow interval of stresses from one of days to one of seconds or fractions of a second. This sudden drop in the graph of $\log \tau = f(P)$ in the presence of a thin film of active melt is associated with the transition to a new rupture mechanism in connection with the very large drop in surface energy in the presence of the active melt. This mechanism comes into play only after a definite level of normal stresses has been reached, corresponding to the brittle strength of the metal, which is greatly reduced in the presence of the active melt. The kinetics of the increased cracking in this case is fully determined by the surface migration rate of the active melt in the rupture zone and is no longer connected with thermal activation of the rupture process.

Investigation of Macroradicals Arising during Mechanical Breakdown of Polymers, S. N. Zhurkov, É. E. Tomashevskii, and V. A. Zakrevskii, pp. 2074–2078.

Volume 3, Number 10, April 1962

Method of Homogeneous Static Deformation for Calculating Elastic, Piezoelectric, and Dielectric Tensors of an Ionic Crystal, V. S. Oskotskii, pp. 2132–2140.

The method of homogeneous static deformation was used to calculate the elastic characteristics of ionic crystals. It was possible to disregard the boundary conditions by separating the macroscopic electric field according to the Ewald method. The results coincide with those of the method of long waves in the absence of initial stresses.

Solution of the Kinetic Equation for Anisotropic Electron Scattering, A. G. Samoilovich, I. Ya. Korenblum, I. V. Dakhovskii, and V. D. Iskra, pp. 2148–2156.

The vibrational scattering of electrons is examined in an external electric field, when a temperature gradient is applied. It is assumed that the constant energy surfaces are ellipsoidal. The kinetic equation leads to an infinite system of linear algebraic equations. A convenient equation is obtained for the coefficients of the system. The projection of the nonequilibrium correction of the distribution function on the first spherical harmonic, which is necessary for calculating the current, is established in the form of a rapidly converging series. The problem of anisotropic scattering is analyzed from the viewpoint of the method of eigenfunctions.

Production and Investigation of Thermoelectric Materials Based on Bi-Sb-Te, A. D. Goletskaya, V. A. Kutasov, and E. A. Popova, pp. 2189–2193.

Specimens of n-type Bi_2T3E and of p-type solid solution consisting of 75% Sb_2Te_3 + 25% Bi_2Te_3, with maximum efficiencies of $2.4 \cdot 10^{-3}$ and $3 \cdot 10^{-3}$ deg^{-1}, respectively, have been produced by controlled crystallization. The maximum temperature difference ΔT_{max} attained by a thermocouple made from these materials reaches 70°C (with a hot junction temperature of +30°C).

The marked increase in the practical application of thermoelectric cooling in recent years has aroused considerable interest in the various thermoelectric materials. In a series of papers thermoelectric materials based on Bi-Te-Se and Bi-Te-Sb are regarded as the most promising. But whereas the greater part of the work by foreign authors has been devoted to studying the properties of single crystals and oriented crystals prepared from the forementioned materials, in the USSR systematic studies have been carried out on extruded specimens prepared by the powder-metallurgy method. It must be noted that there are considerable differences in the values obtained by various authors for the efficiency of materials having the same composition; these differences may be due either to the methods used in preparing the specimens or to certain inaccuracies in measuring their parameters.

The object of the present work was to obtain materials for the positive and negative branches of thermocouples by controlled crystallization and to determine their thermoelectric properties: thermal-emf α, specific thermal conductivity $\varkappa$, specific electrical conductivity σ, efficiency z, and maximum attainable difference ΔT_{max} of a thermocouple consisting of these materials.

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Magnetohydrodynamic Surface Waves, L. S. Solov'ev, pp. 294–301.

Nonlinear waves on the plane surface of an incompressible ideally conducting plasma in the presence of an external magnetic field are studied. The equations for steady helical flow of an incompressible plasma are given, and with their help the problem of stability of a plasma cylinder rotating about its axis is investigated in the linear approximation.

Shock Ionization and Detonation in Magnetohydrodynamics, V. P. Demutskii and R. V. Polovin, pp. 302–307.

Possible shock ionization and detonation regimes are determined for the motion of a conducting piston in a magnetohydrodynamic medium. We investigate which types of magnetohydrodynamic shock and progressive waves can be accompanied by shock ionization and detonation waves. We consider the conditions for which detonation occurs at the Chapman-Jouget point. The piston velocity, the Alfvén velocity, and the reaction energy are assumed to be small.

We determine the possible detonation and shock-ionization regimes in a magnetohydrodynamic medium. This problem is of interest in astrophysical work.

Detonation in a magnetohydrodynamic medium, in the case when the magnetic field is perpendicular to the direction of propagation of the wave, has been considered by Larish and Shekhtman and by Lyubimov. The ionization shock wave for the same magnetic-field direction was investigated by Kulikovskii and Lyubimov. In these articles, for simplicity, the authors neglected the absorption of energy in the ionized wave.

In the present work, this problem is solved for arbitrary magnetic-field direction with the energy of ionization taken into account.

For simplicity, we will assume that the medium is bounded by a perfectly conducting piston moving with a constant velocity $\mathbf{u}$. We will also assume that the piston velocity and the Alfvén velocity $\mathbf{U} \equiv \mathbf{H}/\sqrt{4\pi\rho}$ are much smaller than the sound velocity c, and that the energy of reaction referred to zero temperature $q = (w_2 - w_1)_{T=0}$ (where w is the heat content) is much smaller than the square of the sound velocity.

We will limit ourselves to the case where the magnetic field, the piston velocity, and the normal to the piston surface are coplanar (in the xy plane).

If the shock ionization wave is propagated in a nonconducting, i.e., a non-ionized medium, then in front of the wave there will be an electromagnetic wave with an amplitude determined by the relation between the dissipation coefficients. There will be no such wave if the medium is originally ionized, and an increase in the degree of ionization in the shock wave will be produced. We will consider this case.

Study of Feasibility of Obtaining Steady Magnetic Fields in Coils Cooled with Liquid Hydrogen, E. S. Borovik, F. I. Busol, and S. F. Grishin, pp. 331–335.

One of the methods of thermally insulating a hot plasma is by its containment in magnetic traps. In order to obtain steady magnetic fields of high intensity great expenditure of power is involved. The reduction of the power expenditure on the creation of the magnetic field may facilitate the realization of a controlled thermonuclear reaction with a useful energy yield.

The electrical resistivity of pure metals decreases with temperature reduction. There is a corresponding reduction in the Joule loss in coils producing a magnetic field.

However, heat removal at low temperature by means of any coolant requires the expenditure of work A which is substantially greater than the amount of Joule heat Q produced in the coil. If the ratio A/Q is less than the ratio of the resistance R_{300} of the metal at room temperature to its resistance R_T at low temperature, i.e., if $A/Q < R_{300}/R_T$, the use of low temperatures will insure a saving in the power expended on creating the magnetic field. We will show that this saving can be very considerable.

The construction of coils with liquid hydrogen raises the important question of the magnitudes of the heat transfer coefficient in these conditions, and the main problem of the present work consisted in the determination of the maximum permissible heat load and in the devising of efficient coil designs and cooling methods. Some results of such studies have already been published and will be discussed here.

Coefficients of Mutual Diffusion of Some Gases Measured by Optical Method, P. E. Suemin and B. A. Ivakin, pp. 359–361.

In a previous paper we described the method and setup for measuring the optical coefficients of mutual diffusion of gases.

In the present paper we present the experimental results obtained using this setup with the "Industar-11" objective which has a focal length of 75 cm. The table contains the experimental values of the coefficients of mutual diffusion of 25 pairs of gases and the standard deviation (root-mean-square error) for each measurement. For purposes of comparison we present in the table the coefficients of mutual diffusion as measured by other authors and computed theoretically.

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Magnetoacoustic Method for Ionizing Plasma, E. K. Zavoiskii, I. A. Kovan, B. I. Patrushev, V. D. Rusanov, and D. A. Frank-Kamenetskii, pp. 369–372.

All known methods of producing a concentrated plasma in a magnetic field have a limited range of application. The thermal method is suitable only for atoms characterized by a low ionization potential (cesium). Ionization by a longitudinal current leads to instabilities of the hydromagnetic type as well as kinetic instabilities due to the excitation of various kinds of plasma oscillations by the electrons which move through the plasma. The best of the available methods is one in which ionization is accomplished by an oscillating electron beam, but this technique involves a number of experimental and engineering difficulties.

It has been known for a long time that a radio-frequency discharge can be used to produce ionization; in general, this method has been used only to facilitate breakdown for the following reason: in order for an alternating electric field freely to accelerate electrons it must be directed along the magnetic field, in which case it penetrates the plasma only at low densities, that is to say, densities for which the plasma frequency is lower than the frequency of the alternating field. When this technique is used the plasma density which can be achieved is limited by the plasma frequency. For example, for a vacuum wavelength of 3 cm it is impossible to obtain a density greater than $1.6 \cdot 10^{12}$ cm^{-3}. In order to obtain concentrated plasmas by means of a longitudinal alternating electric field it would be necessary to use millimeter and submillimeter waves.

In this paper we consider a method of producing plasma in which the density is not limited by the plasma frequency; in this method we use alternating fields in which the electric vector is perpendicular to the static magnetic field. In this case we use either electron (ion) cyclotron resonances or the magnetoacoustic resonance. Cyclotron resonances represent the most effective means for acceleration of independent particles at low densities. We wish to consider the magnetoacoustic technique, since this technique is not limited by density. In this method the electrons can acquire the energy necessary for further ionization by two means: first, in the crossed fields electrons acquire a drift velocity which can be adequate for ionization if the fixed magnetic field is not too strong; second, the application of a transverse alternating electric field can, under certain conditions, lead to the production of oblique waves in the plasma which have components of electric field along the magnetic field.

Reflection and Refraction of Shock Waves in Magnetohydrodynamics, S. E. Grebenshchikov, M. D. Raizer, A. A. Rukhadze, and A. G. Frank, pp. 381–387.

We present the results of an experimental investigation of the interaction between a converging circular shock wave and a cylindrical magnetic wall. The width of the shock front is much smaller than the radial dimensions of the magnetic system, so that the experimental results can be interpreted in terms of the interaction of a plane shock wave and a magnetic wall. Good agreement is obtained between the experimental and theoretical values of the magnetic fields necessary for complete reflection of shock waves; the velocities of the reflected and refracted shock waves are also found to be in good agreement with the theoretical values.

Method of Measuring Plasma Temperature in Magnetic-Probe System, I. Electron Model, V. A. Ovsyannikov, D. G. Bulyginskii, B. V. Galactionov, and K. A. Dolmatova, pp. 413–415.

To a large extent the methods used at the present time for measuring plasma temperature in thermonuclear machines are indirect methods.

In principle, the most comprehensive technique is a direct determination of the energy distribution function for the plasma particles. However, it is difficult to use Langmuir probes for this purpose in thermonuclear machines; this difficulty arises because of the high currents, the magnetic fields, and the need for magnetic thermal isolation of the plasma.

In a cold stationary plasma the difficulties associated with the presence of intense magnetic fields can be avoided by using a three-grid analyzer located outside the plasma. This technique was suggested by Ionov for analyzing the energy distribution in a plasma in a discharge at "room temperature."

The only work known to us on the determination of electron velocity in a thermonuclear machine is that reported by Ellis; in this work use was made of absorbing filters to determine the distribution of electron velocity for electrons which escape through the magnetic mirror of the pyrotron. The function which is obtained in this way can be converted into a function which describes the distribution inside the plasma by making use of the cross sections for all processes which enter into the escape particles through the mirror.

The determination of plasma temperature is of interest in hot plasma systems, for example, the pyrotron. We consider a method proposed by us for direct measurements of the velocity distributions of both electrons and ions in a plasma.

Kinetic Theory of a Low-Pressure Plasma Converter, M. I. Kaganov, R. Ya. Kucherov, and L. E. Rikenglaz, pp. 420–426.

The kinetic theory of a plasma thermal converter is considered under the assumption that the mean free paths for electrons and ions are much greater than the dimensions of the device and that the potential variation in the space between the anode and cathode is monotonic.