[7] P. E. Krasnushkin, Dokl. Akad. Nauk SSSR 171, 61 (1966) [Sov. Phys. Dokl. 11, 932 (1967)].

[8] R. B. Baĭbulatov and P. E. Krasnushkin, ibid. 174, 84 (1967).

[9] G. F. Remenets, G. I. Makarov, and V. V. Novikov, in: Problem of Diffraction and Propagation of Waves, v. 8, LGU, 1968.

[10] J. Galejs, Radio Sci. 2 (6), 557 (1967).

[11] H. Bremmer, Terrestrial Radiowaves, N. Y., 1949.

[12] S. T. Rybachek, ibid. v. 7, LGU, 1968.

[13] S. T. Rybachek and E. M. Gyunninen, ibid. v. 6, LGU, 1966.

[14] G. F. Remenets, ibid. v. 7, LGU, 1968.

[15] G. I. Makarov and V. V. Novikov, ibid. v. 7, LGU, 1968.

E. A. Konorova and S. F. Koslov. Diamond Detector for Nuclear Radiation.

In spite of the progress made in germanium and silicon detectors for nuclear radiation, there are fields of application where the diamond detector has definite advantages because of its high chemical and thermal stability. The counting properties of diamond have been the subject of a rather large number of investigations[1-3]. These investigations, however, did not lead to the development of a diamond detector—an instrument suitable for practical use.

Natural diamonds are insulators with resistivity 10^{14} ohm-cm and higher. Electric fields up to 10^6 V/cm still produce no breakdown of the crystal. The carrier mobility is large and amounts to 1550 cm^2/V-sec for holes[4] and 2000 cm^2/V-sec for electrons[5]. These properties of diamonds are very favorable for its use as a radiation detector.

However, the use of very strong electric fields is limited by the dependence of the mobility on the field, as in other valent crystals. According to[5,6], the electron drift velocity in diamond reaches its limiting value $10^7 \pm 0.2 \times 10^7$ cm/sec at room temperature in a field of approximately 2×10^4 V/cm. This circumstance was not taken into account in any of the published papers on the counting properties of diamonds, and therefore the treatment of the experimental results was not always satisfactory. Since the electron and hole lifetimes in diamond exceed in very rare cases 10^{-8} sec[5], the maximum depth of the work in the region of the detector is limited to 200–300 μ.

An essential shortcoming of diamond detectors is the polarization of the crystal, since the very low electric conductivity prevents the electric equilibrium from becoming reestablished inside the crystal within the time between pulses. Known methods of eliminating the polarization by heating, illumination, or applying an alternating field are not suitable and have little efficiency. To avoid polarization, we have proposed to use an injecting contact on the side of the diamond opposite to the irradiated side[7]. In the vicinity of such a contact there is maintained an equilibrium of the field and the charge. When this equilibrium is violated by the captured carriers, say electrons produced in the crystal following ionization by the registered radiation, their neutralization is effected by the hole current from the contact (space-charge-limited current).

Sample No.	Thickness, mm	Working voltage	Counting efficiency, %	Energy resolution, %	ε_α *), eV
1	0.15	400	100	5	15.6
2	0.16	600	100	5	15.4
3	0.21	600	100	8	16.2
4	0.27	400	100	9	16.1
5	0.14	600	100	8	16.3
6	0.20	300	100	4	15.9
7	0.20	400	100	10	16.2
8	0.19	200	100	15	16.2
9	0.13	400	100	15	16.6
10	0.40	600	100	5	16.2

*ϵ_α—energy necessary to produce a pair of carriers, calculated from the momentum at the maximum of the curve of the amplitude distribution.

After overcoming many difficulties connected with the development of injecting contacts for diamond, the selection of crystals with necessary lifetime, and others, we have constructed 10 diamond detectors. The properties of these detectors were investigated by registering 5.5-MeV α particles from a $Pu^{238-242}$ source. The obtained results are summarized in the table, the data in which pertain to room temperature.

The working area of the detectors ranged from 2 to 10 mm^2.

The operation of the detectors was investigated by registering particles in the temperature range 300–1000°K. Up to 490–550°K, the properties of the detector remained essentially unchanged, but at higher temperatures, the amplitude of the pulses and the counting efficiency decreased, but the count continued in some cases up to 1000°K.

At the present time we can point out the following fields of application of diamond detectors for nuclear radiations: 1) registration of short-range particles (α particles, protons) at increased temperature, 2) registration of short-range particles in aggresive media—in acids and alkalis, 3) registration of low-energy β particles at room temperature and at increased temperatures, and also in active media (for example, the radiation of tritium in biological objects).

[1] F. C. Champion, Proc. Phys. Soc. B65, 465 (1952).

[2] P. J. Kennedy, Proc. Roy. Soc. A253, 37 (1959).

[3] P. J. Dean, J. C. Male, J. Phys. Chem. Solids 25, 311 (1964).

[4] P. J. Dean, E. C. Lightowlers, and D. R. Wight, Phys. Rev. 140, A352 (1965).

[5] E. A. Konorova, S. F. Kozlov and V. S. Vavilov, Fiz. Tverd. Tela 8, 3 (1966) [Sov. Phys. Solid State 8, 1 (1966).

[6] E. A. Konorova and S. A. Shevchenko, Fiz. Tekh. Poluprov. 1, 364 (1967) [Sov. Phys. Semicond. 1, 299 (1967)].

[7] S. F. Kozlov and E. A. Konorova, Authors Certificate (patent) No. 224697 (Disclosure No. 1144951).

I. V. Karpova, S. G. Kalashnikov, O. V. Konstantinov, V. I. Perel', and G. V. Tsarenkov. Recombination Waves in Compensated Germanium.

The paper presents data on the observation and investigation of a new type of electric instability in semiconductor plasmas, called recombination waves (RW). The existence of RW was theoretically predicted in[1], where it was shown that waves of carrier density