pure injection method without the necessity of using high-level doping and degenerate p-n junctions. Owing to the potential barriers and the wave guide symmetry of the structure ($n_2 > n_1$ and n_3), there are practically no recombination and light losses, as a result of which the threshold generation currents are drastically reduced and the efficiency increased (at 300° K, $j_{thr} \approx 10^3$ A/cm^2, the differential quantum yield $\eta_d \approx 70\%$, the efficiency $\eta = 25\%$ instead of $j_{thr} \approx 50 \times 10^3$ A/cm^2, $\eta_d \approx 10$—15%, and $\eta = 1$—2% for lasers with p-n junctions). The performance parameters of a number of other devices (solar converters, photodiodes, phototransistors, switching diodes) have also been considerably improved and completely new devices, which could not be realized on the basis of homo-p-n junctions, have been constructed: converters of infrared radiation to visible radiation, selective picture receivers, etc. The spectral band of emitting and photoelectric devices can be considerably broadened into both the visible and the infrared regions, since the possibility of producing ideal heterojunctions based on other $A^{III}B^{V}$ compounds (AlSb – GaSb, AlP – GaP, and some others) has now been demonstrated.

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V. S. Vavilov and E. A. Konorova. Semiconductor Diamonds. Diamond is structurally one of the simplest and, with respect to physical properties, one of the most interesting nonmetallic crystals. The high thermal conductivity and the chemical and thermal stability of diamond, as well as the high mobility of the charge carriers—electrons and holes[1]—make the production, study, and practical application of semiconducting diamonds a pressing problem. Advances in the synthesis of insulating and semiconducting diamonds under laboratory conditions[2,3] and the increase in the output of natural diamonds suggest that in the next decade, besides the traditional industrial applications, diamonds will also become a valuable material in electronics. The investigation into the possibility of an ionic implantation of electrically active donor (lithium, phosphorus, antimony) and acceptor (boron) impurities in plates of natural diamond carried out at the P. N. Lebedev Physics Institute of the USSR Academy of Sciences in collaboration with the I. V. Kurchatov Institute of Atomic Energy[4,5] has led to the production of n- and p-type semiconducting layers which are stable right up to 1400°C and have highly mobile carriers.

It was established in the course of the indicated investigations that for implanted-ion doses not exceeding certain critical values, annealing leads to the restoration of the diamond lattice structure. It has been demonstrated that we can, using the ion-implantation method, fabricate p-n junctions which possess diode volt-ampere characteristics and exhibit the barrier-layer photoeffect in the spectral range corresponding to the inter-band electron transitions in diamond ($h\nu > 5.4$ eV)[6]. It has been established that upon increase in the concentration of the implanted impurity (in particular, boron and antimony), the conductivity realized in the conduction or valence band is changed into conductivity of the "hopping" type. Using the ion-implantation method, we can realize not only structures consisting of n- and p-type semiconducting layers on the surface of or inside an insulating diamond plate, but also heterogeneous structures—in particular, layers of silicon carbide SiC implanted in diamond[7].

Further investigations should be directed towards the production of low-resistance contacts based on n-type semiconducting diamonds and the investigation of the electron processes near the surface of semiconducting diamonds, after which we can, in principle, realize electronic devices characterized by the ability to operate at high temperatures and by stability. As an example of a diamond-based electronic device which has already found practical application, we can cite the nuclear-particle and photon detectors constructed at FIAN[8].

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L. N. Kurbatov. Photoelectric Solid-State Receivers and New Methods of Optical-Radiation Reception. The development of instrument manufacture and the working out of optico-electronic systems have led in the last decade to a rapid growth of interest in the reception of radiation in the optical band. A considerable impetus to the investigations and the development of receivers was given by quantum electronics, the attainment of which allowed the production of high-power radiation fluxes with a high degree of coherence. The characteristics of coherent radiation made it possible to carry over to the optical band certain principles of reception which had been known for a long time in radio engineering—in particular, heterodyne reception.

Still another circumstance, connected with the appearance of lasers, is the necessity for the broadening of the frequency band, i.e., for the construction of receivers with a high speed of response.

Radiation receivers have been the subject of an ex-