It must be noted that the fluorescence of other impurities (mainly organics) contained in water is superposed on the fluorescence of oil. This results in definite difficulties in obtaining more detailed quantitative information than what has been presented above.

However, the authors continue to work in this area, and in the future methods will be developed for extracting information about the oil pollution and chlorophyll concentrations in water.

LITERATURE CITED

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INFLUENCE OF PHOTON TRANSPORT ON DIFFUSION PROCESSES
IN STRIPE HETEROLOASERS

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The influence of photon transport on the diffusion of nonequilibrium charge carriers in heterolasers with stripe contact and in structures with a transverse p–n junction arrangement is taken into account. Results are presented of a machine computation of the nonequilibrium charge carrier (NCC) concentration profile and the radiation density in the active layer of AlGaAs lasers in the prethreshold pumping mode.

The waveguide effect in the plane of the active layer is due to amplification in heterolasers of stripe geometry without a lateral optical constraint. Hence the generation threshold, structure and stability of the transverse modes, the response to excitation modulation, the linearity of the watt–ampere characteristic (presence or absence of "kinks") are interrelated with diffusion processes controlling the spatial distribution of the nonequilibrium charge carriers (NCC) and the radiation in the layer [1].

Two effects affecting the NCC concentration under the stripe contact are discussed in the literature, the current spreading into the passive layers between the contact and the active domain, and the lateral carrier diffusion into the active layer. A phenomenological description of the spreading [2] and separately of the lateral NCC diffusion [3] is given in earlier papers. The spreading and diffusion were later examined jointly [4], a self-consistent problem was formulated on the basis of a one-time use of the Laplace equation and the continuity equations for carriers of both signs [5], the influence of stimulated radiation was taken into account [6], a strict solution of the self-consistent problem was given for ambipolar carrier diffusion with linear and bimolecular recombination mechanisms [7].
list of papers presented does not pretend to rigor from the viewpoint of priority, nor, moreover, to completeness. Analysis of known publications on this question show that in the literature there is practically no estimate of the influence of photon transport on diffusion processes in stripe heterolasers. At the same time, the influence of reradiation on NCC diffusion under local excitation of the narrow-band layer of a double heterostructure has been established [8]. The results of [8] are not directly applicable to heterolasers since they are obtained for a thick (d > 1/a) active layer and specularly reflecting external boundaries of the structure. The fraction of reflected photons is reduced sharply in heterolasers because of the presence of absorbing near-contact layers of narrow-band material. Such an effect has been observed experimentally in [9] for double heterostructures (DHS) with nonremote substrate. Moreover, the probability of absorption of reflected radiation is low since in the case of heterolasers usually d << 1/a. On the other hand, NCC transport because of radiation being propagated into the layer because of total internal reflection on the boundaries with the broadband emitters, is inherent to DHS lasers without a lateral optical constraint. Let us note that this mechanism was also taken into account in [8]; however, it was masked completely here by the stronger influence of the external faces.

The purpose of this paper is a quantitative estimate of the role of photon transport in heterolasers with a stripe contact, and in structures with a transverse p-n junction arrangement. These latter are realized in the so-called TJS (transverse-junction-stripe) lasers and "one-channel" lasers using high resistance GaAs [10].

We use the continuity equation for the carriers in combination with the radiation transport equation [11] for the combined description of stationary NCC diffusion and radiation. Then under the assumption of a low excitation level and no amplification and a linear recombination law for an active domain of p-type, the initial equations will have the form

\[ \Delta n - \frac{n}{L_n^2} + \frac{g}{\tau} = 0; \]

\[ \psi \frac{ds}{dl} + \omega s - \frac{\eta_F}{4\pi} n = 0. \]

Here \( \Delta \) is the Laplace operator, \( L_n \), \( n \), and \( \tau \) are the diffusion length, concentration, and lifetime of the nonequilibrium electrons, \( v \) is the group velocity of light, \( s \) is the volume photon density per unit energy interval per unit solid angle, \( ds/dl \) is the derivative with respect to a given direction, \( \alpha \), \( \eta_F \), and \( F \) are the absorption coefficient, internal quantum yield, and formfactor of the luminescence line. The term \( g \) in (1) takes account of electron generation during photoactive absorption of the intrinsic luminescence.

Since the active layer thickness \( d \) is slight in stripe and TKS-lasers as compared with \( L_n \) and 1/a, while the laser length and width are much greater than these quantities, the problem reduces to seeking a one-dimensional NCC distribution and radiation in a direction parallel to the heteroboundaries and perpendicular to the resonator axis. Because of the isotropy of the luminescence, a part of the radiation is incident on the heteroboundaries at angles less than the critical angle of total internal reflection \( \psi_{in} \). This radiation emerges from the layer, practically without experiencing reflections by the heteroboundaries and without being absorbed (\( \alpha d << 1 \)). We shall henceforth neglect its contribution. We assume that the photons emerging from the active layer do not return. Under these conditions, NCC photon transport is related to the radiation being propagated at angles \( \psi \gg \psi_{in} \) within the luminescing domain.

When solving problems for a specific structure, the system (1), (2) must be supplemented by appropriate boundary conditions. Before proceeding to a detailed formulation for a laser with a stripe contact and a structure with a transverse p-n junction, let us note commonalities to both cases.

We take the nonequilibrium carrier concentration equal to zero on the lateral surfaces of the laser as one of the two boundary conditions for (1). This is due to the high surface recombination rate on the free (often matte) surface of GaAs, and the lowness of the excitation level as compared with the domain under the stripe contact or near the transverse p-n.