decreasing temperature occurs for the upper branch of the electron-nuclear resonance. In the paramagnetic region (above 32°K) the dependence of the hypersound intensity on the magnetic field disappears.

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INJECTION SEMICONDUCTOR LASER WITH COMPOUND RESONATOR

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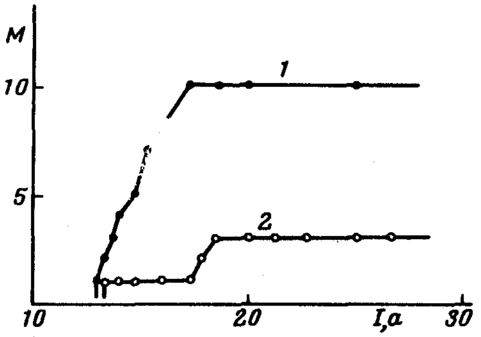
In injection semiconductor lasers (SL) the number of spectral modes excited is usually quite large, leading to an appreciable broadening of the generation band. To improve the spectral characteristics of SL, it is possible to use an interference effect in a resonator having more than two mirrors [1]. A system of parallel aperiodically arranged mirrors can be used to select individual axial modes [2], a fact already observed in SL with electron excitation [3]. In the present investigation we used for injection SL a system (compound resonator) comprising a semiconducting diode with parallel faces and a transparent dielectric plane-parallel plate in optical contact with the face of the diode. Observations of the generation spectra of SL based on GaAs and on GaP_xAs_{1-x} with an ordinary Fabry-Perot resonator and with a compound resonator (77°K) yielded the following results:

1. In the compound resonator, the excitation thresholds of the oscillation modes following the first modes are greatly increased, as shown by the example illustrated in the figure. The output power in the single-mode regime was in this experiment about 0.5 W (at a wavelength λ = 7401.5 Å).

2. The generation bandwidth, at a considerable excess above threshold (50 times in one experiment), remains within 4 - 8 Å in the compound resonator, whereas in an ordinary resonator it is 3 - 5 times larger. The obtained CW output power is 90 mW in a 4 Å band (GaAs, current 1 A).



Number of excited modes M vs. current in an injection SL based on GaP_xAs_{1-x} ($\lambda \approx$ 7400 Å) with an ordinary resonator and with a compound resonator (1 and 2, respectively). The diode resonator length is 525 μ, the supplementary plate is of SiC and is 50 μ thick.

3. In the resonance region, the position of the spectral generation band in the compound resonator is stabilized in the passive plate and consequently changes little in a wide interval of current density and in the temperature range from 15 to 20°. At a larger temperature rise, the generation switches jumpwise to another band, corresponding to the neighboring resonance in the passive plate.

These data show that the compound resonator has undisputed advantages over the ordinary one when it comes to the spectral characteristics of the SL. Such resonators are also used to advantage to decrease the scatter in the SL generation wavelengths, and for spectral matching of the SL radiation in multi-element installations.

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CONCERNING ONE MODEL PSEUDOPOTENTIAL

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Recent developments in the theory of pseudopotentials [1] have shown that in many cases model pseudopotentials are preferable to the so-called "first-principle" pseudopotentials.

The most universal of the known model pseudopotentials is apparently the Heine-Abarenkov-Animalu (HAA) potential [2 - 5], in which the unknown parameters are determined from spectroscopic data, i.e., the experimental information on the properties of the atoms of a given metal is taken into account on almost the microscopic level.

The main shortcoming of model potentials (including HAA) is that they are usually described in $\vec{r}$-space by a discontinuous function. As a result, their Fourier transforms (form factors) oscillate at large values of q and do not ensure sufficiently rapid convergence of the series (or the integrals). When summing over reciprocal space, it is therefore necessary to introduce artificially a rather arbitrary exponential damping factor [4]. This shortcoming is felt most strongly in the study of so-called atomic properties of metals (stability of crystal lattices, in the calculation of phonon spectra, binding energies, energies of various defects, etc). In this paper we attempt to construct a model pseudopotential free of the aforementioned shortcoming, i.e., one continuous in $\vec{r}$-space.

We denote by $w^{0}(r)$ the unscreened local pseudopotential produced by one ion. Its form factor is

$$w^{0}(q) = \frac{1}{\Omega_0}\int d^3 r\, w^{0}(r) e^{iqr}, \tag{1}$$

where Ω_0 is the atomic volume.

Let r_c be a certain radius characterizing the dimension of the region of internal electron shells. It is obvious that when $r \gg r_c$ any model unscreened potential should behave like