N-PT19

Operation GaAs/$Al_{0.45}Ga_{0.55}As$ quantum cascade laser with emission wavelength at $\lambda \approx 8.6\mu m$

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In this paper, we report the operation of a GaAs/$Al_{0.45}Ga_{0.55}As$ quantum cascade laser (QCL) based on a conventional three quantum well active design. QCL structure were grown by molecular beam epitaxy. Active material which consists of injector and active region was repeated 40 times. The conduction band profile under an applied electric field *F=48kV/cm* and the relevant wave function of an active region are represented in Figure1. L-I characteristics at 78K and pulse mode is shown in Figure 2. The laser emission wavelength is 8.6μm and threshold current density is 13.2kA/cm^2.

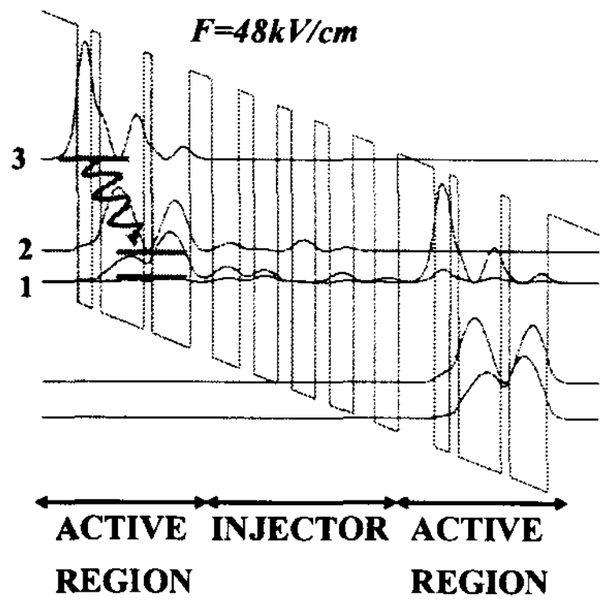

Figure 1. Conduction band energy diagram of a portion of the quantum cascade laser under an applied electric field *F=48kV/cm*. The layer sequence starting from the injection barrier is **42**, 17, **10**, 50, **10**, 44, **26**, 31, **16**, 28, <u>17</u>, <u>26</u>, <u>18</u>, <u>28</u>, **24**, 28 Å. $Al_{0.45}Ga_{0.55}As$ layers are in bold, GaAs layers are in regular typeface, and doped layers are under lined. The calculated energy level difference are E_{32}=129meV and E_{21}=43meV.

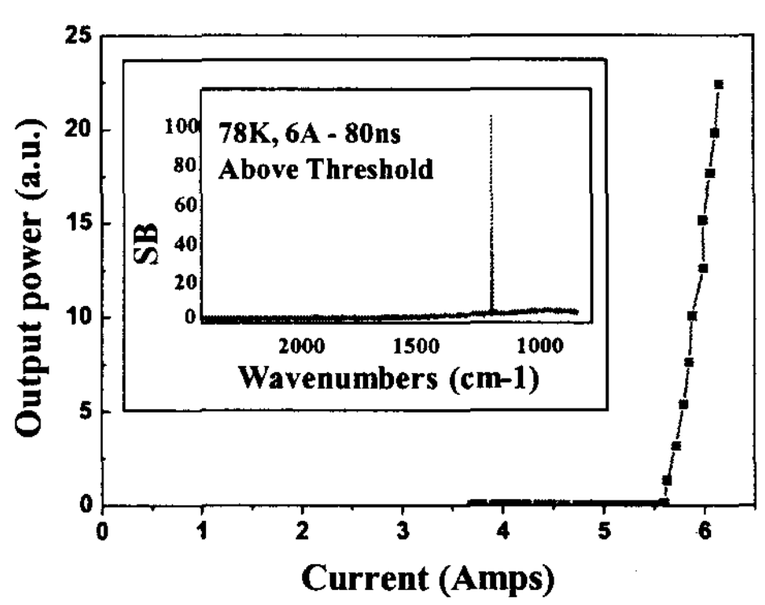

Figure 2. Light-Current (L-I) characteristic measured at 78k. The device is driven(1.5mm long, 30μm wide) in pulsed mode(80ns with). The inset of the figure shows the Lasing spectra at 78K.