B－4－2 15 mW Single Mode CW Operation of Crank Structure TJS Laser Diodes at High Temperature

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1. Introduction

A fundamental transverse mode semiconductor laser with output power higher than 10 mW/facet is required for optical writing of disk memories, laser printer, and so on. However, there have been few reports regarding long term CW operation in a single mode at power levels higher than 10 mW/facet at high temperature, and no established devices as light sources for optical writing systems have been realized.

We succeeded to improve practically available output power of single mode TJS lasers as high as 15 mW in CW operation at 50°C by applying a crank structure. In this paper, we describe on the static characteristics at high power levels.

2. Structure and Fabrication

The schematic diagram of the crank type TJS laser is shown in Fig.1. Although it is fabricated by the same means as the conventional TJS laser, the crank laser has non-straight pn interfaces in the neighborhood of both facets. The n-type region has a wider band gap than that of p-type region because of no band tailing of the valence band. Therefore, the crank decreases light absorption near the mirror facets. The diodes were mounted on to heatsinks in a junction-up (p-side up) configuration by inserting Si submount.

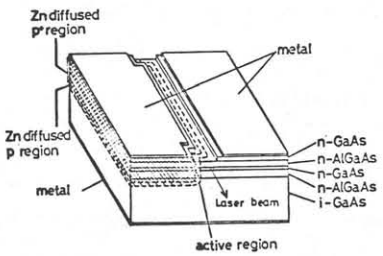

Fig.1 Schematic Diagram of the Crank TJS Laser

3. Results

The threshold current of laser depends on the crank length (L_2). We examined crank length dependence of the threshold current. The results are shown in Fig.2. In Fig.2, the dashed line shows calculated values. The experiments agree with theory in the range of short crank length.

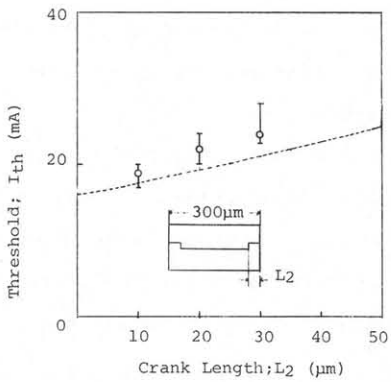

Fig.2 Crank Length Dependence of the Threshold

Figure 3 shows the CW output power-current characteristics in series of temperature levels from -20°C to 80°C. The crank laser oscillates up to 80°C with 15 mW CW output power. The power increases almost linearly up to 15 mW below 50°C. In CW operation, the output power saturates around 35 mW, because of high thermal resistance. In this experiments, it was confirmed that the maximum powers were about 150 mW in pulsed and 35 mW in CW, respectively. The minimum threshold is 17 mA at 20°C with a 10 um crank length 300 um cavity length laser.

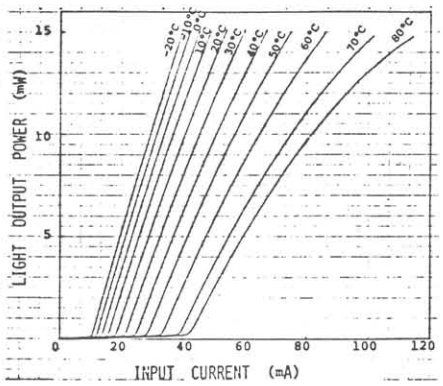

Fig.3 CW Output Power-Current Characteristics

The lasing mode is a single longitudinal and fundamental transverse up to 20 mW in CW operation. The far field patterns at 10 mW and 20 mW are shown in Fig.4. The transverse mode has no obvious change up to 20 mW. The full angles at half maximum in parallel and perpendicular directions were 12° and 36°, respectively.

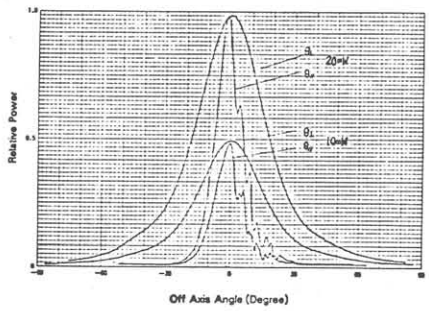

Fig.4 Far Field Pattern at 10 mW and 20 mW

We started the preliminary operation life test of the crank laser with automatic power control circuits at CW power level of 15 mW at 45°C and 50°C, respectively. Figure 5 shows time change of operating current. One diode failed at 40 hours. However, no other samples failed and no obvious change of the operating current is observed till about 550 hours.

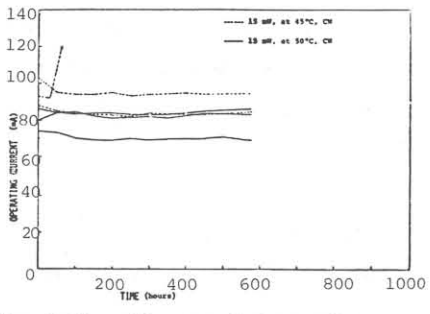

Fig.5 Time Change of Operating Current at 15 mW at 45°C and 50°C

The output power of TJS laser was improved by applying crank structure, and the threshold and the temperature dependence were improved to be comparable with the conventional one by shortening the crank length.

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