(113)B GaAs ウエハ接合で作製した GaAs/AlGaAs 多層膜結合共振器への電流注入によるレーザ発振

Current-injection lasing from a GaAs/AlGaAs coupled multilayer cavity fabricated by (113)B GaAs wafer bonding

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We have proposed a novel terahertz (THz) emission device based on difference-frequency generation (DFG) in a GaAs/ AlAs coupled multilayer cavity structure.[1] To obtain a larger THz DFG signal, it is necessary to control the nonlinear polarization via the face-to-face bonding of two epitaxial wafers.[2] We have demonstrated a current-injection two-color lasing in the coupled multilayer cavity, which was fabricated by bonding of (001) and (113) epitaxial wafers.[3,4] Since the effective second-order nonlinear coefficient is zero on a (001) GaAs, stronger polarization and DFG are enabled if two (113)B epitaxial wafers were bonded.

In this study, a coupled cavity structure was fabricated by the face-to-face bonding of two (113)B epitaxial wafers. The schematic of the current-injection device based on the coupled cavity structure was shown in Fig. 1. InGaAs multilayer quantum well were embedded in the upper cavity as gain materials. Optical emission properties of the devices were studied using a pulsed-current source with a repetition rate of 1 kHz and a pulse duration of 0.5 μs. Figure 2 shows the spectra measure at room temperature. Two emission peaks due to the cavity modes were observed at a current of 25 mA. Oscillation of long-wavelength mode was observed at a current of 60 mA. Long-wavelength mode shows a threshold at approximately 40 mA.

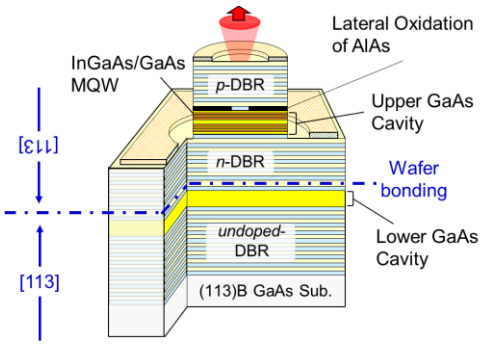

Fig. 1. Schematic of device

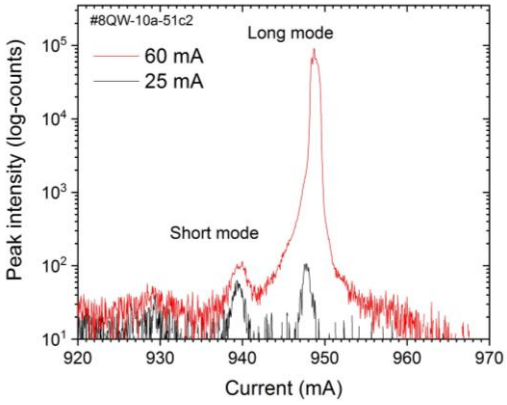

Fig. 2 Emission spectra of device

[1] T. Kitada *et al.*, APL. **95**, 111106 (2009). [2] T. Kitada *et al.*, APL.**102**, 251118 (2013). [3] Y. Minami *et al.*, JJAP. **56**, 04CH01 (2017). [4] T. Kitada *et al.*, JJAP. **57**, 04FH03 (2018).