IMPROVEMENT OF LUMINESCENCE INTENSITY OF Bi / III-V SEMICONDUCTOR MQW STRUCTURE GROWN ON InP(311)B SUBSTRATE

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1. Introductions

It has been reported that a small amount of Bi incorporated into III-V compound semiconductor (dilute bismide) reduces the temperature dependence of the semiconductor band gap. However, the crystal quality of dilute bismide will degrade because Bi incorporation is achieved at a growth temperature below 300 °C, which decreases luminescence intensity. In this study, we investigated the annealing effect for InAsBi/InGaAsPBi quantum well structure grown by molecular beam epitaxy (MBE).

2. Methods

The samples were grown on a semi-insulating (SI) InP substrate. After a 100 nm InP buffer layer was grown at 490 °C, three quantum well structures with 0.9 nm InAs well layers and 100 nm barrier layers were grown at 290 °C with and without Bi irradiation. After the crystal growth, samples (with and without Bi) were annealed at 550 °C for 480 s. Photoluminescence (PL) spectra were measured at 10 K with InGaAs detector array.

3. Results

The emission wavelengths appeared at the telecom-wavelength band around 1550 nm, as shown in Fig. 1. Additionally, a significant increase in luminescence intensity was observed after annealing both with and without Bi. Therefore, the crystal quality of the sample grown at low temperature can be improved via post growth annealing.

4. Conclusions

In conclusion, post growth annealing facilitates improvements to the luminescence intensity of InAsBi/InGaAsPBi nanostructures.