OPTIMIZATION OF PL- AND LASING-WAVELENGTH DETUNING OF MEMBRANE LASERS FOR UNCOOLED OPERATION

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INTRODUCTION

The explosive increase in datacenter traffic created a demand to introduce an optical interconnect for very short distance. For this purpose, membrane photonic devices on Si are promising candidate. We have so far demonstrated single-mode lasing with a small injection current, and high-speed modulation of directly modulated lasers (DMLs) and electro-absorption modulators (EAM). To use membrane lasers as an integrated optical bias light, single-mode operation and mW-class output power under uncooled condition is required. In this paper, we investigate the tolerance of wavelength detuning between photoluminescence (PL) and lasing peaks in consideration of temperature dependence of material gain.

METHODS

Figure 1 (a) shows the cross-section of the membrane laser. The laser consists of InP-based membrane layers that includes 100-micron-long 6-period InGaAlAs MQWs, with a PL peak wavelength of 1275 nm. The lateral p-i-n structure was fabricated by Zn thermal diffusion and Si ion implantation. The surface gratings were used for single mode operation, and we varied their pitch to compare the lasing characteristics with different wavelength detuning.

RESULTS AND CONCLUSION

Figure 1 (b) shows the lasing spectra at 80°C. All lasers exhibited single-mode lasing with the wavelength range of 70 nm. To evaluate the capability of bias light, we compared the optical output powers from 25°C to 80°C when a bias current is 20 mA (Fig. 1 (c)). The lasers with wavelength detuning from 21 to 62 nm exhibited output powers of >1.7 mW at 80°C, and we consider this range is suitable for uncooled operation.