

DFB laser array in the 2.3 μm wavelength range on a silicon photonic integrated circuit

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The spectral range of 2.3 μm is of interest for gas sensing as many important gases have strong absorption lines in this wavelength range, including NH_3 , CH_4 , CO , C_2H_2 and HF . Besides, it also attracts interest in bio-sensing applications, such as non-invasive blood glucose measurements. Recently developed short-wave infrared and mid-infrared silicon photonic integrated circuits offer great potential to realize miniature gas and bio-sensors on silicon photonics chips. Low-loss and compact mid-infrared circuits can be fabricated in a CMOS pilot line, which enables high performance passive components such as (de)multiplexer. A compact silicon photonics spectroscopic sensor requires an integrated light source on silicon. However, the development of silicon photonics light sources above 2 μm wavelength still lags behind.

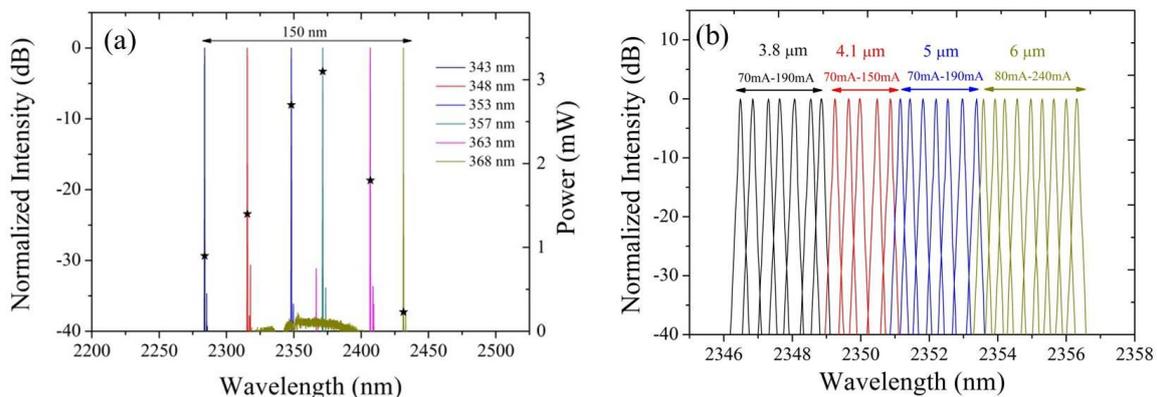


Fig.1. Heterogeneously integrated 2.3 μm III-V-on-silicon DFB lasers with different silicon grating pitches (a) and device widths (b) in an array.

At Ghent University-IMEC, we developed a heterogeneous III-V-on-silicon platform for optical communication and sensing applications [1]. Here we report 2.3 μm range InP-based type-II DFB laser arrays heterogeneously integrated on a silicon photonic integrated circuit (PIC). An InP-based type-II epitaxial layer stack with “W”-shaped InGaAs/GaAsSb quantum wells is used as the gain medium and bonded to the silicon PIC. Detailed information of the device structure and fabrication process flow can be found in [2]. As shown in Fig. 1(a), the continuous wave (CW) operated DFB lasers can cover a broad wavelength range from 2.28 μm to 2.43 μm by varying the silicon grating pitch. By adjusting the laser device widths, a four wavelength DFB laser array with 10 nm continuous tuning is achieved as shown Fig. 1(b). In CW regime, the DFB laser can operate up to 25 $^{\circ}\text{C}$ and emits a maximum optical power of around 3 mW at 5 $^{\circ}\text{C}$.

References

- [1] G. Roelkens et al., *Photonics*, **2** (2015) 969.
- [2] R. Wang et al., *Appl. Phys. Lett.*, **109** (2016) 221111.