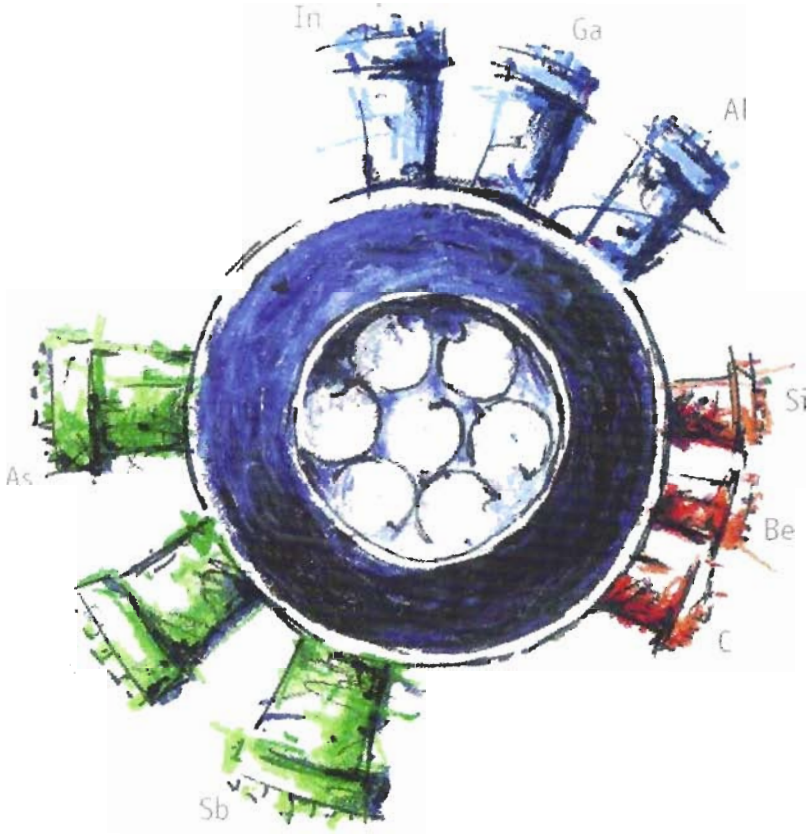
iscs 2005

32nd International Symposium on Compound Semiconductors

18 - 22 September 2005



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Widely tunable twin-guide laser diodes with over 40 nm-tuning range

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Wavelength tunable laser diodes have become valuable single-frequency light sources in the near infrared region and are being employed for fiber-optic telecommunications as well as for various sensing applications.

We present device and tuning characteristics of widely tunable twin-guide laser diodes that achieve full-wavelength coverage over a tuning range of more than 40 nm. The device is based on the tunable twin-guide laser diode with distributed feedback (DFB) [1]. In the widely tunable twin-guide laser diode [2,3], the tuning region is longitudinally split into two tuning sections that contain sampled gratings in order to make the device capable of Vernier-effect tuning [4]. Due to the transverse integration of active and tuning section, a phase tuning section, which is required in longitudinally integrated tunable lasers to adjust the cavity mode position, is redundant. Hence, the device requires at least one tuning current less than comparable monolithic widely tunable lasers, which eases the device characterization and control.

The devices were fabricated in the GaInAsP-InP material system using standard buried heterostructure laser fabrication technology. To suppress spurious facet reflections that would interfere with the sampled grating reflection spectrum, window structures in combination with AR-coated facets have been employed. Characterization of the 1200 μm-long and 1.0 μm-broad laser diodes was carried out at 20 °C, using an active region current of 150 mA.

The wavelength map reveals the location of the various supermodes, which are located within the tuning range between 1516 and 1566 nm. The supermodes are spaced by ~ 5 nm, in good agreement with the sampled grating design. Continuous wavelength tuning can be carried out within each of the supermodes. For the central supermode around 1550 nm, the continuous tuning range amounts to 7.7 nm. The side-mode suppression ratio (SMSR) remains above 30 dB over most of the tuning range and the ex-facet output power varies between 20 and 7 mW. Due to the high tuning efficiency of the device, only moderate tuning currents below 35 mA are required.

In conclusion, we realized widely tunable twin-guide laser diodes at ~ 1.55 μm that are quasi-continuously tunable over a wavelength range of more than 40 nm and require only two tuning currents.

Acknowledgment: This work was supported by the European Union via the Information Society Technologies (IST) project IST-2000-28244 "NEWTON".

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Figures

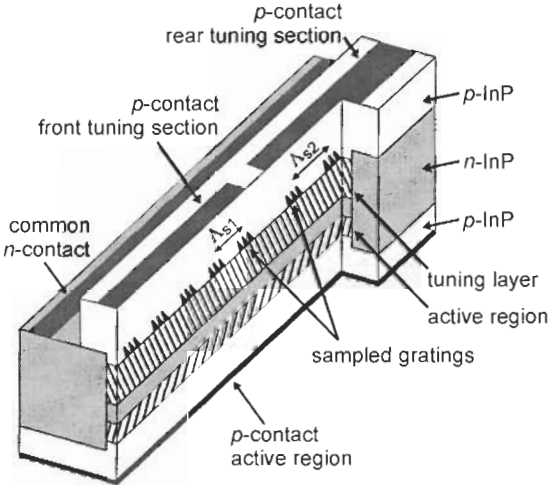

Fig. 1. Schematic drawing of a widely tunable twin-guide laser diode with sampled gratings. For the sake of the clarity, the window structures have not been included in the figure.

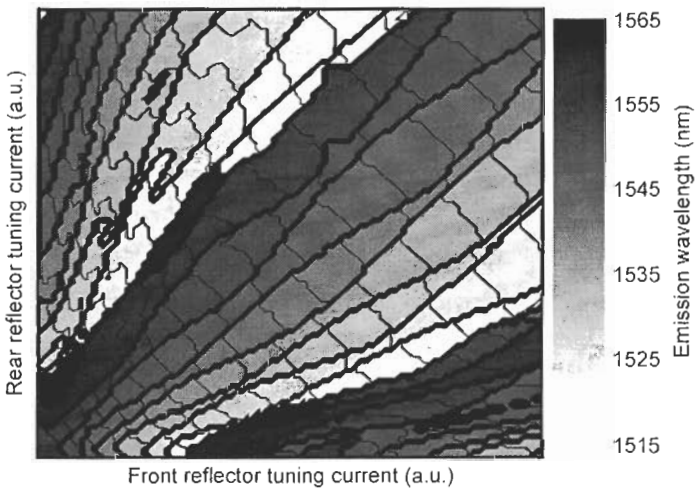

Fig. 2. Wavelength map of a widely tunable twin-guide laser diode. The various supermodes are enclosed by thick solid lines. Within the supermodes, continuous wavelength tuning of up to 7.7 nm is possible. Thin solid lines indicate iso-wavelength contours that are spaced by 0.5 nm.

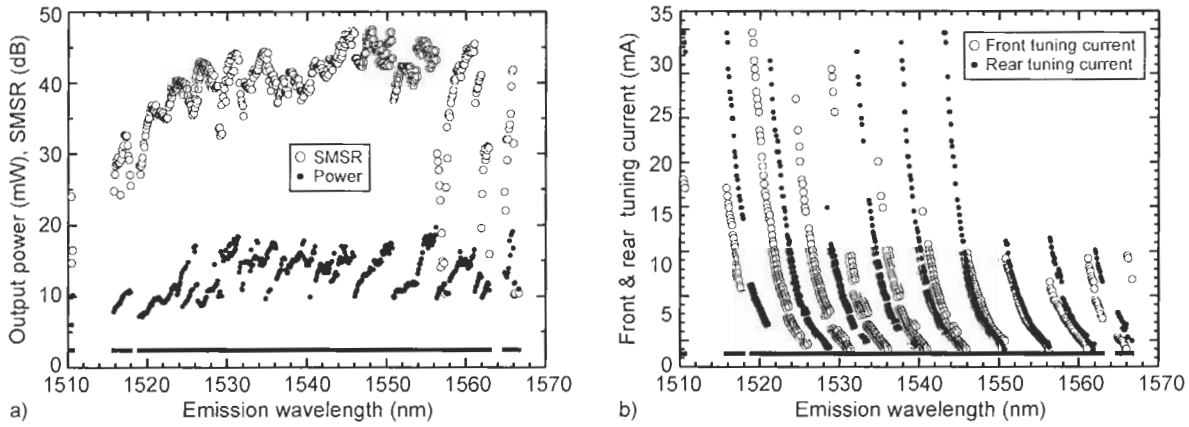

Fig. 3. Ex-facet output power and side-mode suppression ratio (a) as well as front and rear tuning current (b) versus emission wavelength. The bold horizontal line at the bottom of the graphs is shown as a visual guide to easily locate gaps within the tuning range. In total, a wavelength range of more than 40 nm is covered.