Announcing the Final Examination of Thamer Tabbakh for the degree of Doctor of Philosophy

Time & Location: July 10, 2018 at 10:00 AM in CREOL 103
Title: Monolithically integrated wavelength tunable laser diode for integrated optic surface plasmon resonance sensing

Tunable laser diodes are vital for environmental sensing applications requiring spectroscopic measurements such as chemical and biological agents’ detection. Furthermore, tunable laser diodes present an attractive solution to many challenges in dynamic networks with wavelength reconfigurability and optical communication networks that require complex multiplexing processes. Presently, distributed Bragg reflector (DBR) and distributed feedback (DFB) tunable lasers are already being used in many network applications. Those tunable lasers have narrow spectral bandwidth. Therefore, simple wavelength tunable semiconductor Fabry–Perot laser diodes can be fabricated more easily and the wavelength control circuitry is much simplified and broader. In this work, we demonstrate an InGaAsP multiple quantum well tunable laser diode that amalgamate two gain sections with different bandgap energies. This is achieved using selective area intermixing of the multiple quantum wells, and impurity-free vacancy induced disordering. This technique is usually performed by selectively capping the MQW sample with SiNx or SiOxNy dielectric layers and thermally annealing it to expand or shrink the energy level. The bandgap energy of the MQW section capped by a SiNx layer (Section A), which remains unchanged at a corresponding wavelength of 1560 nm. Meanwhile, the bandgap wavelength of the section capped by SiOxNy layer is blue shifted to 1530 nm. Different current combination was injected to each section. When the currents injected in the two sections are varied, the combination of the gain spectra leads to a laser wavelength peak in the overall effective gain whose position depend on the relative magnitudes of the two injected currents. The laser wavelength can be fine-tuned from 1538 nm to 1578 nm with relatively constant output power. The manipulation of bandgap energies on a single chip can enable different functionality of this tunable laser.

Major: Electrical Engineering

Educational Career:
Bachelor’s of Electrical Engineering, BS, 2011, Taibah University
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Approved for distribution by Patrick Likamwa, Committee Chair, on June 4, 2018.

The public is welcome to attend.