

## Broadband Superluminescence Diodes

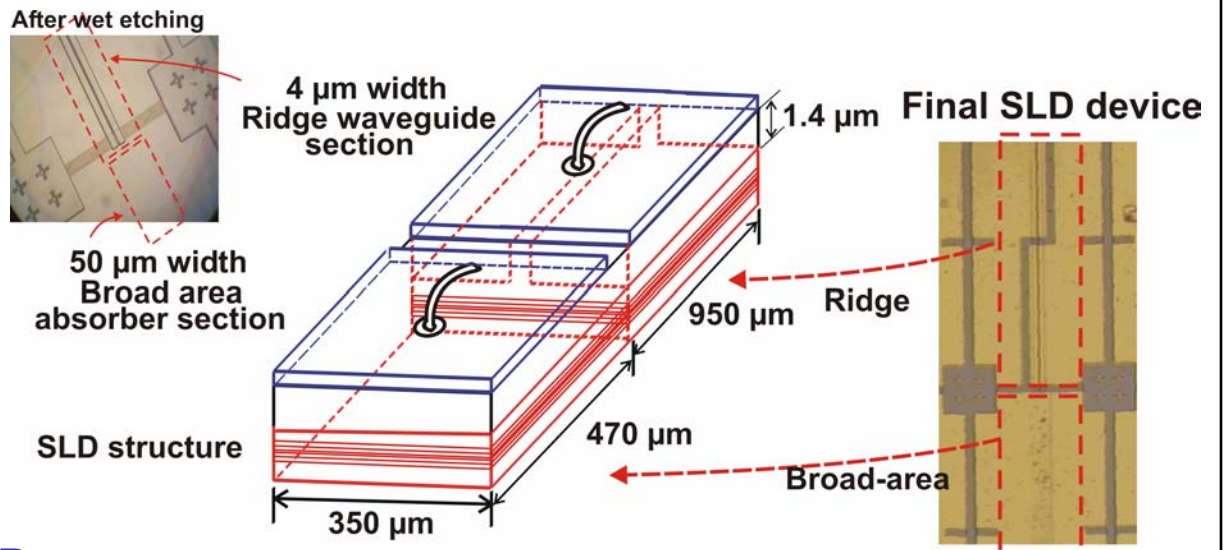
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**Objective:** to develop ultrabroadband superluminescence diode (SLD) on quantum well (QW) and quantum-dot (QD) III-V heterostructures suitable for high resolution optical coherent tomography, optical fiber and chemical sensors, high sensitive optical gyroscopes, biomolecular imaging, etc.

### Technology platforms:

- **Materials:** QW, QD, and hybrid dot-in-well quantum structures.
- **Engineering process:** postgrowth lattice interdiffusion or intermixing process to further expand the device bandwidth.
- **Device Structure:** multiple-section index-guided gain media butt-integrated with a broad-area absorber. The absorber section suppress the optical feedback and acts as power monitor.

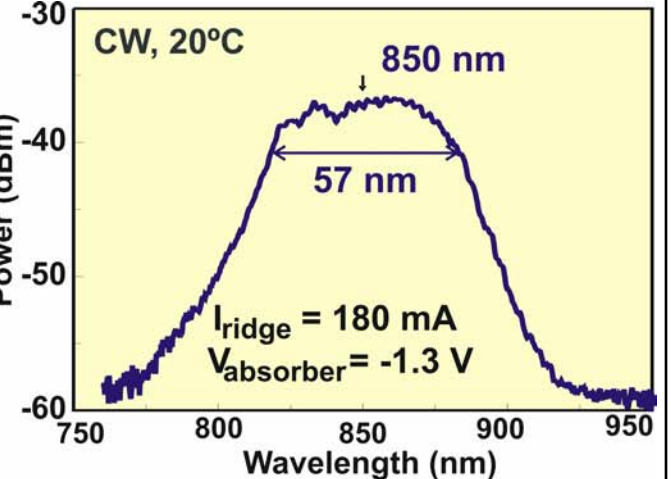
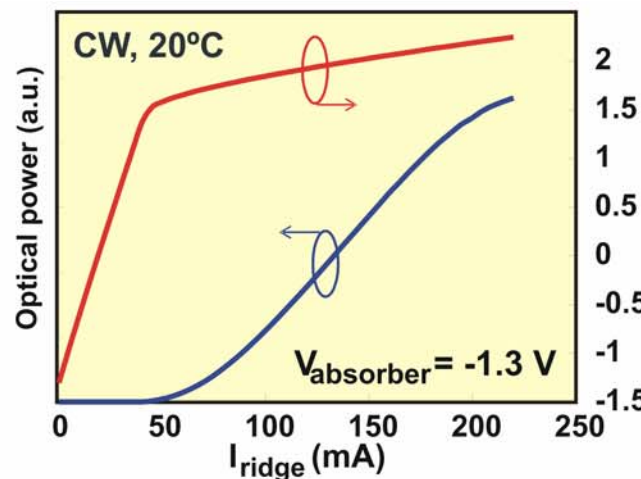
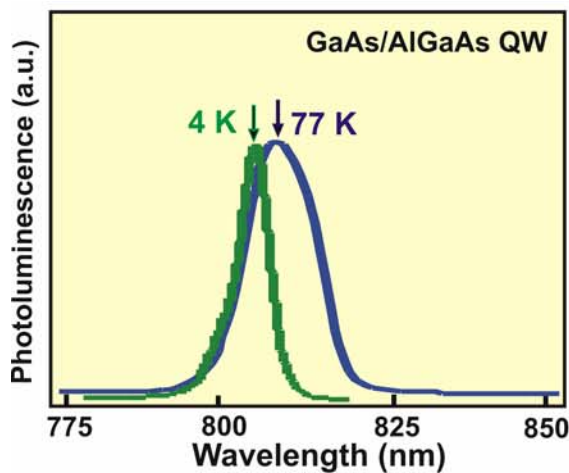


### GaAs/AlGaAs Quantum Well SLDs:

➤ Photoluminescence at 4K and 77 K

➤ Light-voltage-current characteristics

➤ QW SLD spectrum



- **Device structure:** 4 μm wide rib gain section butt-integrated with 50 μm wide absorber section.

- Spectral bandwidth of 57 nm, with estimated on-chip power of >5 mW achieved from SLD device pumped at 180 mA.
- The absorber region was reverse-biased to -1.3 V to suppress lasing action.

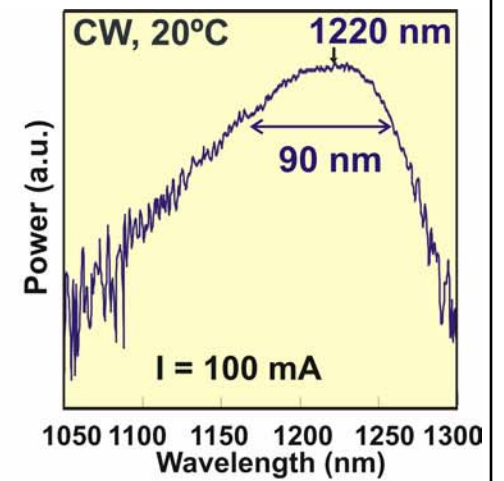
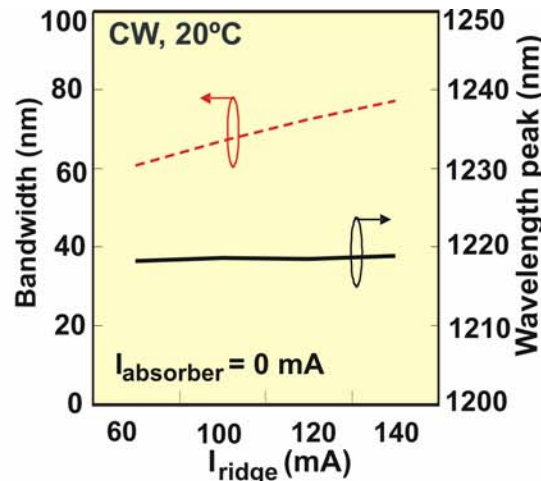
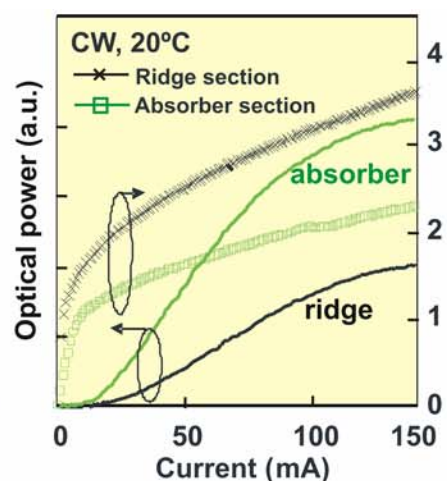
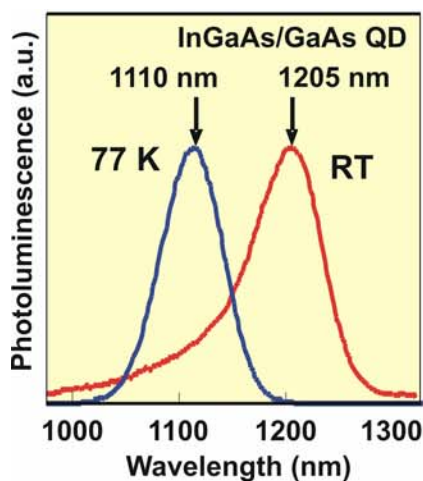
### InGaAs/GaAs Quantum-Dot SLDs

➤ Photoluminescence at 77K and RT

➤ Light-voltage-current characteristics

➤ Spectral bandwidth vs current

➤ QD SLD spectrum



- 5 stacks InGaAs/GaAs QDs grown by atomic layer molecular beam epitaxy
- Broad photoluminescence (PL) spectra with the peak at 1205 nm at room temperature (RT) originating from the inhomogeneous QDs.

- Bandwidth tunability from 60 to 80 nm by CW pump the gain region with the absorber section grounded.
- Electroluminescent bandwidth of 90 nm observed from device pump at 100 mA in both the ridge waveguide and the absorber sections.

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