CHARACTERIZATION OF DISTRIBUTED-FEEDBACK QUANTUM-CASCADE (QC) LASERS

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Although the operating principles for the QC devices are fundamentally different than for lead-salt diode lasers, QCs provide similar operational attributes which can be used for spectroscopy applications. However, in contrast to the lead-salt diode lasers, the QC lasers are extremely robust in design and operation. Results based on experiments performed at PNNL, Lucent Technologies [a] and Stevens Institute of Technology [b] will be presented, describing the lasing characteristics of QCs and their potential use in high resolution infrared spectroscopy. Depending on the mode of operation, QCs may be operated at or above room temperature by keeping the duty cycle low and pulsing them on for brief periods of time. Alternatively, these devices can be run continuously (CW) with cooling. Time averaged line widths for pulsed and continuous operation are better than 75 and 25 MHz, respectively. Suppression of side-modes is found to be better than -35 dB with CW powers of several milliWatts or greater. As with lead-salt devices, the QCs can be tuned either by temperature or current. Temperature tuning allows a much greater spectral region to be covered (e.g., 20 cm^{-1}), while observed current tuning is on the order of 2.5 cm^{-1} (500 Hz sawtooth). Several spectra will be presented and discussed, to demonstrate the applicability of the QCs to high resolution spectroscopy.

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