Intersubband Absorption Loss for 10.3μm Quantum Cascade Lasers

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Unlike traditional semiconductor lasers, which have only one energy bandgap, Quantum Cascade Lasers have multiple energy subbands. By transitioning from one subband to the next, then tunneling from the injector ground stage to the next upper laser level, one electron can emit multiple photons as it moves through the laser. In a traditional laser an electron makes only one interband transition as it moves through the device, emitting only one photon. Mathematical modeling can be used to investigate the intersubband absorption loss for quantum cascade lasers, in this case for devices with wavelength 10.3μm. Results will be compared to recent experimental data [1]. Intersubband absorption loss is an important parameter in determining wall plug efficiency.

[1] Z. Liu, G. Silva, J. Paulose, C. Gmachl, L Cheng, F.S. Choa, R. Leavitt. F. Towner, X Wang, and J Fan, "Temperature-dependant Gain and Loss in High Performance Quantum Cascade Lasers at 8.2 and 10.3μm" CLEO 2007