



IR-ON SEMINAR

Free carrier absorption in quantum cascade structures

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Free carrier absorption (FCA) is a well-known source of losses in lasers. It consists in the re-absorption of the emitted photons by the carriers that is made possible thanks to the unavoidable presence of static scatterers and phonons. It may severely hamper the Quantum cascade lasers (QCL) that have small gains in the THz range. A Drude – like approach to FCA leads to losses as large as several 10^2cm^{-1} . This would preclude any lasing action in these materials.

However, in QCL's, the free carrier absorption must proceed via virtual intersubband photon absorption (allowed if \mathbf{F}/z) followed by an intersubband scattering assisted by defects or phonons. We have considered the scattering by interface defects, ionized impurities and Longitudinal Optical phonons. The FCA absorption coefficients computed for actual QCL structures (based on the double well design) are small (typically ranging from 10^{-2}cm^{-1} to a few cm^{-1}). At room temperature FCA is dominated by the LO phonon scattering.

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