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Near-Infrared Quantum Cascade Laser Based on the Intra-Cavity Second Harmonic Generation[1] YONG HEE CHO, ALEXEY BELYANIN, Department of Physics, Texas A&M University, College Station, Texas 77843 — We propose and theoretically analyze quantum cascade lasers operating in the near-infrared range due to the intra-cavity second harmonic (SH) generation. The latter process involves high lying subbands in the conduction band. Thus it requires an accurate determination of the band structure above ∼1eV from the bottom of the conduction band. Here we adopted a multiband k·p model to achieve it. The fundamental laser power is converted to the second harmonic laser power due to large resonant nonlinearity in the properly designed heterostructure. We show that the modal phase matching between EH_{00} (fundamental) and EH_{20} (second harmonic) modes is possible in ridge waveguides and their output powers are predicted based on the density matrix formalism. At current density J=8.5kA/cm^2, the second harmonic power of 0.14 mW is obtained with the conversion efficiency of 0.2mW/W^2 in GaInAs/AlAsSb/InP heterostructures.

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