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High performance THz Quantum Cascade Lasers in very high magnetic fields LORENZO SIRIGU, GIACOMO SCALARI, CHRISTOPH WALTHER, NICOLAS HOYLER, MARCELLA GIOVANNINI, JÉRÔME FAIST, Inst. of Physics, Univ. of Neuchâtel, CH-2000 Neuchâtel, Switzerland, MARCIN SADOWSKI, Grenoble High Magnetic Field Laboratory, F-38042 — A new design for a terahertz quantum-cascade laser emitting at $\lambda \simeq 80$ μm is presented. A bound-to-continuum active region is coupled to an optical phonon extraction stage in order to improve the population inversion at high temperatures. The device processed with a single-plasmon waveguide shows a threshold current density in pulsed operation of $J_{thresh} = 190$ A/cm^2, sensibly lower of what measured in other optical-phonon based structures. Maximum operating temperature in pulsed mode is 100 K and peak powers of the order of 40 mW are observed at low temperatures. Device performances in a double-metal waveguide configuration reach 117 K in pulsed operation and 53 K in continuous-wave. This laser has been investigated also in presence of a strong magnetic field up to 27 T, in order to study the influence of an external confinement on the gain and lifetime of the electron states of a superlattice-based quantum cascade structure. Upon increasing of the magnetic field intensity, strong modulation of laser emission and threshold current are observed over the full range of magnetic field up to 27 T, with an overall reduction of the latter of a factor of two with respect to the zero field value. Spectral characterization in the presence of magnetic field has also been performed.

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