HIGH-RESOLUTION TERAHERTZ GAIN SPECTRA OF MID-INFRARED PUMPED NH_3

MARTIN MICICA, *Institut d'électronique de microélectronique et de nanotechnologie, Université de Lille 1, Villeneuve d'Ascq, France*; SOPHIE ELIET, *Institut d'Electronique de Microélectronique et de Nanotechnologie, Université de Lille 1, Villeneuve d'Ascq, France*; A. PIENKINA, *Laboratoire PhLAM, UMR 8523 CNRS - Université Lille 1, Villeneuve d'Ascq, France*; R. A. MOTIYENKO, *UMR 8523 - PhLAM - Physique des Lasers Atomes et Molécules, University of Lille, CNRS, F-59000 Lille, France*; L. MARGULÈS, *Laboratoire PhLAM UMR 8523, Université de Lille, 59655 Villeneuve d'Ascq, FRANCE*; MATHIAS VANWOLLEGHEM, *UMR CNRS 8520, Institut d'Electronique de Microélectronique et de Nanotechnologie, Villeneuve d'Ascq, France*; KAMIL POSTAVA, *IT4Innovations, VSB - Technical University of Ostrava, Ostrava - Poruba, Czech Republic*; JEAN-FRANÇOIS LAMPIN, *UMR CNRS 8520, Institut d'Electronique de Microélectronique et de Nanotechnologie, Villeneuve d'Ascq, France*.

Inversion of population in the terahertz (THz) range can be obtained thanks to the optical pumping of polar molecules in the mid-infrared range. Generally it is done with CO_2 lasers but recently we have demonstrated the first molecular laser pumped by a quantum cascade laser (QCL). It is based on the optical pumping of the NH_3 molecule in the ν_2=1 state. The gain is obtained by the stimulated emission on pure inversion transitions of NH_3 (large amplitude motions) around 1 THz that are not accessible to continuous-wave (CW) CO_2 lasers. We present here CW high-resolution gain measurements of two strong lines: the (3,3) around 1.073 THz and the (4,4) around 1.083 THz. The measurements are done with a THz multiplication chain and an InSb bolometer. The gain profiles are recorded at different pressure and different QCL frequencies as for an IR/THz double resonance experiment. The highest gain at the best conditions are obtained with the (3,3) line: 10 dB/m for a pump power of about 40 mW. To our knowledge this gain is highest measured in the THz range for a CW-pumped molecule. These measurements will help the understanding and the design of our NH_3 lasers. This kind of laser will find applications in THz molecular spectroscopy/astronomy as a source or as a local oscillator for heterodyne detection.