Paper Abstract

The CO_2-pumped CF_4 laser is a potentially useful source of line-tunable infrared radiation in the region 605-655 cm 1, and the spectroscopy of CF_4 has been carried to the point that the laser frequencies that will result from any given pump line can be calculated to better than 0.01 cm 1. We now report quantitative intensity and line-broadening studies on CF_4 and their application to modeling the laser gain. First, absorption measurements on isolated lines in the $v_2 + v_4$ pump band at a series of pressures yield an effective transition dipole moment for this band of 0.010 Debye. At the same time the transition moment for the $(v_2 + v_4) - v_2$ laser band has been calculated and agrees well with the results of laser self-absorption measurements. Finally, linewidths determined as a function of pressure yield a pressure-broadening coefficient of ca. 10 MHz/torr, significantly greater than that expected from a hard-sphere gas-kinetic model. From these data the gain of the CF_4 laser can be calculated at various pressures and temperatures; the results are in reasonable agreement with measured values.