BROADENING AND SHIFT COEFFICIENTS IN THE ν_3 BANDS OF $^{12}C^{16}O_2$ AND $^{13}C^{16}O_2$

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In a previous study[a] we had reported N_2-broadening and pressure-induced shift coefficients for 34 rovibrational transitions in the $^{12}C^{16}O_2$ ν_3 fundamental band near 4.3 μm. These parameters were determined from spectra recorded with the McMath-Pierce Fourier transform spectrometer (FTS) of the National Solar Observatory on Kitt Peak, Arizona. We now report similar measurements of N_2-broadening and shifts for transitions up to $J'' = 56$ in the $^{13}C^{16}O_2$ ν_3 fundamental band, plus determinations of N_2-broadening coefficients in the $^{13}C^{16}O_2$ $\nu_2 + \nu_3 - \nu_2$ hot band and the $^{13}C^{16}O^{18}O$ ν_3 fundamental band. We also made new measurements of N_2-broadening and pressure-induced shift coefficients for rovibrational transitions up to $J'' = 46$ in the $^{12}C^{16}O_2$ ν_3 fundamental band. These results were obtained from simultaneous analysis of five absorption spectra using a multispectrum nonlinear least-squares technique[b]. A 4.08 cm sample cell at room temperature was used to record all of the spectra at 0.003 cm^{-1} resolution with the McMath-Pierce FTS. This data set includes one low pressure (0.15 Torr) spectrum obtained with a 90% ^{13}C-enriched CO_2 sample and four spectra of lean mixtures of the same $^{13}CO_2$ sample in N_2. Total pressures of the mixtures were between 101 Torr and 464 Torr. Because of the isotopic sample used, the ν_3 fundamental bands of $^{12}CO_2$ and $^{13}CO_2$ appeared together in the same spectra, and we were able to obtain a consistent set of line parameters for both molecules. The present measurements represent the first experimental determination of N_2-broadening and pressure-induced shift coefficients in isotopic bands of CO_2 in the 4.3 μm region. The results obtained for the various bands will be compared with each other, with the values in the HITRAN database[c], and with available values reported in the literature.

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[b] D. Chris Benner, C. P. Rinsland, V. Malathy Devi, M. A. H. Smith and D. Atkins, *JQSRT* **53**, 705-721 (1995).
[c] L. S. Rothman, R. L. Hawkins, R. B. Wattson and R. R. Gamache, *JQSRT* **48**, 537-566 (1992).