BROADENING AND SHIFT COEFFICIENTS IN THE $\nu_3$ BANDS OF $^{12}\text{C}^{16}\text{O}_2$ AND $^{13}\text{C}^{16}\text{O}_2$

M. A. H. SMITH, C. P. RINSLAND, Atmospheric Sciences, NASA Langley Research Center, Mail Stop 401A, Hampton, VA 23681-2199; D. CHRIS BENNER, V. MALATHY DEVI, Department of Physics, The College of William and Mary, Box 8795, Williamsburg, VA 23187-8795.

In a previous study\textsuperscript{a} we had reported N$_2$-broadening and pressure-induced shift coefficients for 34 rovibrational transitions in the $^{12}\text{C}^{16}\text{O}_2$ $\nu_3$ fundamental band near 4.3 $\mu$m. 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 $^{13}\text{C}^{16}\text{O}_2$ $\nu_3$ fundamental band, plus determinations of N$_2$-broadening coefficients in the $^{13}\text{C}^{16}\text{O}_2$ $\nu_2 + \nu_3 - \nu_2$ hot band and the $^{13}\text{C}^{16}\text{O}^{18}\text{O} \nu_3$ 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 $^{12}\text{C}^{16}\text{O}_2$ $\nu_3$ fundamental band. These results were obtained from simultaneous analysis of five absorption spectra using a multispectrum nonlinear least-squares technique\textsuperscript{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 $\nu_3$ 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 $\mu$m region. The results obtained for the various bands will be compared with each other, with the values in the HITRAN database\textsuperscript{c}, and with available values reported in the literature.