SELF-BROADENING, SHIFTING AND LINE MIXING IN THE FUNDAMENTAL BAND OF $^{12}C^{16}O$

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Many previous investigators have addressed the broadening and pressure-shift coefficients of the transitions in the fundamental band of CO broadened by CO and several other perturbing gases. Several recent studies have also reported the line mixing effects in the CO fundamental band. The majority of those studies usually involve least-squares fittings to short spectral intervals of one spectrum at a time. In this study we report self-broadening, self-shift and off diagonal relaxation matrix element coefficients of CO transitions in the fundamental band obtained by fitting a much wider spectral interval (¿100 cm^{-1}) involving several spectra simultaneously. We fit nine high-resolution (0.005 cm^{-1} or better) absorption spectra of high-purity CO samples (including one that was 99.999% ^{12}C-enriched) in the 2143 to 2258 cm^{-1} region covering the R(0) through R(36) transitions of the 1-0 band. Another wide spectral interval was similarly fit covering the P-branch transitions. All of the spectra had been recorded at room temperature using the 1-m Fourier transform spectrometer at the National Solar Observatory on Kitt Peak, Arizona. Two sample cells with pathlengths of 4.08 and 10.00 cm were used, and the CO pressures varied from approximately 0.3 Torr to 507 Torr. The fitting of nine spectra simultaneously was made possible using a multispectrum nonlinear least-squares fitting technique[a]. This procedure has great advantages over fitting shorter spectral intervals and is highly recommended, especially when determining the line mixing effects involving spectra recorded at a relatively high values of pressure times pathlength. The effects of line mixing on line intensities, Lorentz broadening coefficients and spectral line positions retrieved from our analysis will be discussed. Present results will be compared with previous measurements where possible.

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[a] D. Chris Benner, C. P. Rinsland, V. Malathy Devi, M. A. H. Smith and D. Atkins, *JQSRT* **53**, 705-721 (1995).