MEASUREMENTS OF THE SPECTROSCOPIC PARAMETERS OF $^{12}C^{16}O$ AT TERRESTRIAL ATMOSPHERIC CONDITIONS

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High-resolution spectroscopic measurements of isotope-enriched carbon monoxide ($^{12}C^{16}O$) have been made with a Bruker IFS-120 HR Fourier-transform spectrometer. In order to retrieve the spectral line parameters from the observed spectra, a multiple-spectra non-linear least-squares fitting algorithm has been developed. In this study, more than 100 spectra were taken at several temperatures between 170 and 296 K, thereby covering the temperature range encountered in the terrestrial atmosphere. We have measured the line strengths, self- and air-broadened line widths, and self- and air-induced line shifts of the spectral lines between P(24) and R(23) in the first overtone band of $^{12}C^{16}O$. The line strengths, air-broadened line widths and air-induced line shifts have also been retrieved for the spectral lines between P(23) and R(25) in the fundamental band of this molecule. The dependence of these important line parameters upon temperature has also been determined. Using the measured data on the air-broadened line widths and air-induced line shifts in the fundamental band and first overtone band, we have been able to examine their vibrational dependence. While the air-broadened line widths do not show any vibrational dependence, the air-induced line shifts are clearly dependent on the vibrational states. The band strengths of the fundamental band and of the first overtone band have been determined to be $(1.013 \pm 0.007) \times 10^{-17}$ cm/molecule, and $(7.532 \pm 0.066) \times 10^{-20}$ cm/molecule, respectively. Although there have been many measurements of the spectroscopic parameters of CO, many of the parameters reported in this paper have not been measured previously. Comparison of our results with some of the previous studies will also be presented.