AIR-BROADENING IN NEAR-INFRARED CARBON DIOXIDE LINE SHAPES: QUANTIFYING CONTRIBUTIONS FROM O_2, N_2, AND Ar

ERIN M. ADKINS, DAVID A. LONG, JOSEPH T. HODGES, *Material Measurement Laboratory, National Institute of Standards and Technology, Gaithersburg, MD, USA*.

Line-by-line spectroscopic databases containing CO_2, such as HITRAN, include so many transitions and bands that it is intractable to provide reference data for every transition and relevant collisional partner. To address this dilemma, theoretical line parameters enabling widespread coverage need to be validated in terms of accurate spectroscopic measurements having well-established uncertainties. In this work, we present frequency-agile, rapid scanning cavity ring-down spectroscopy (FARS) measurements of CO_2 (30012) $\leftarrow$ (00001) band transitions up to $J'' = 50$. These data correspond to foreign broadening by four gas mixtures: air, N_2, and two Ar-enriched synthetic air samples, with each sample containing CO_2 at a mole fraction near atmospheric levels. The measured O_2, N_2, and Ar foreign broadening parameters in addition to advanced line shape parameters were simultaneously determined using a multi-spectrum fitting algorithm which used constraints for pressure, temperature, and sample composition. These results were compared to theoretical and experimental broadener-specific line shape parameters from the literature. Additionally, requantized classical molecular dynamic simulation results were explored as constraints to enable differentiation between narrowing mechanisms in finite signal-to-noise ratio spectra.