Theoretical study of near-infrared absorption spectra

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Abstract

Diode-laser based absorption spectroscopy can provide non-intrusive, line-of-sight absolute measurements of multiple flow parameters. An accurate prediction of absorption spectra is essential for extracting species concentrations and temperature in combustion gases using a diode-laser based absorption spectroscopy. In the present study, high-resolution absorption spectra of CO2, CO, O2, H2O, and CH4 in the near-infrared (IR) region are numerically simulated to understand their spectral structures. The calculated spectra are compared with reported experimental data under various temperature and pressure conditions to assess the numerical models. Results demonstrate that the present simulations can excellently reproduce the measured spectra, and the developed numerical models can be utilized for future combustion emission measurements.

Keyword：Absorption spectroscopy, Line strength, Collisional broadening, Voigt function