PRESSURE AND TEMPERATURE DEPENDENCE OF ABSORPTION CROSS-SECTION OF HCN IN THE LONG-WAVE MID-INFRARED REGION

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Hydrogen cyanide (HCN) is extensively studied in combustion and exoplanetary research for its important role in both fields. Laser-based detection of HCN in both fields, among other applications, necessitates quantifying the pressure and temperature dependence of its absorption cross-section. Here, we introduce a method to access HCN's strongest IR band, ν_2, near 712 $\mathrm{cm}^{-1} via$ a high-resolution custom-designed laser source. Difference-frequency generation (DFG) between a cw EC-QCL and a pulsed CO_2 gas laser in an orientation-patterned GaAs crystal is employed to generate laser light in the long-wavelength mid-IR region. The DFG laser can be wavelength-tuned over 667 - 865 cm^{-1}. We employed our DFG laser to quantify the pressure dependence of absorption cross-section of the Q-branch of the ν_2 band of HCN over the range 100 - 800 Torr. Furthermore, we exploited the developed laser source in conjunction with a shock tube to measure the temperature dependence of absorption cross-section of the peak of the Q-branch behind reflected shock waves over the temperature range 850 - 3000 K. We compared our results with HITRAN simulations. Ultimately, we utilized these results in measuring HCN formation time-histories in a reactive environment behind reflected shock waves.