INVESTIGATION OF J-DEPENDANCE OF LINE SHIFT AND LINE BROADENING IN THE $\nu_1$+3$\nu_3$ BAND OF ACETYLENE

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Line shift and line broadening coefficients $\delta\nu$ and $\gamma$ have been measured for 21 rotational lines of the P and R branch of the $\nu_1$+3$\nu_3$ band of acetylene at 789 nm using a tunable cw semiconductor laserdiode system. The absorption cell was of the multi-pass Herriot-type with an effective absorption length of 35 m. Up to now, self-broadening and broadening by $N_2$, Ar and air perturbers have been investigated. Taking air-broadening as an example we obtained $\gamma = 0.176(12)$ cm$^{-1}$/bar and $\delta\nu = 0.012(2)$cm$^{-1}$/bar for the P(4) line. With increasing value of J the values of $\gamma$ decrease, e.g. to $0.147(2)$ cm$^{-1}$/bar for R(13) whereas $\delta\nu$ increases to $0.016(2)$ cm$^{-1}$/bar. A similar behaviour has been observed for the case of other foreign gas perturbers and for self-broadening. The present investigation might be of interest for the reliable detction of small amounts of acetylene in air of atmospheric pressure. In our system we could detect a minimal concentration of 1 $\mu$bar acetylene in a $N_2$ atmosphere of 15 mbar pressure.