NEAR-INFRARED SPECTROSCOPY OF ETHYNYL RADICAL, C_2H

ANH T. LE, GREGORY HALL, TREVOR SEARS[a], *Division of Chemistry, Department of Energy and Photon Sciences, Brookhaven National Laboratory, Upton, NY, USA*.

The ethynyl radical, C_2H, is a reactive intermediate important in various combustion processes and also widely observed in the interstellar medium. In spite of extensive previous spectroscopic studies, the characterization of the near infrared transitions from the $\tilde{X}^2\Sigma^+$ state to the mixed vibrational overtone and $\tilde{A}^2\Pi$ states is incomplete. A strong band of C_2H at 7064 cm^{-1} was first observed in a neon matrix and assigned as the $\tilde{A}^2\Pi(002)^1 - \tilde{X}^2\Sigma^+$ transition by Forney et al.[b] Subsequent theoretical work of Tarroni and Carter[c] attributed the strong absorptions in this region to transitions terminating in two upper states, each a mixture of vibrationally excited $\tilde{X}$ states and different zero-order $\tilde{A}$-state bending levels: a $^2\Sigma^+$ symmetry combination of $\tilde{X}(0,2^0,3)$ and $\tilde{A}(0,3,0)^0\kappa$ and a $^2\Pi$ symmetry combination of $\tilde{X}(0,3^1,3)$ and $\tilde{A}(0,0,2)^1$. Transitions to them from the zero point level of the $\tilde{X}$ state are calculated to differ in energy by less than 10 cm^{-1} and to be within a factor of two in intensity. Diode laser transient absorption was used to record Doppler-limited spectra between 7020 and 7130 cm^{-1}, using 193 nm photolysis of CF_3C_2H as a source of C_2H. Two interleaved, rotationally resolved bands were observed, consistent with a $^2\Sigma$ - $^2\Sigma$ transition at 7088 cm^{-1} and a $^2\Pi$ - $^2\Sigma$ transition at 7108 cm^{-1}, in good accord with the Tarroni and Carter calculation. Progress on the assignment and fitting of the spectra will be reported.

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[a] Also, Department of Chemistry, Stony Brook University, Stony Brook, New York 11794.

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