HOT BAND ANALYSIS AND KINETICS MEASUREMENTS FOR ETHYNYL RADICAL, C_2H, IN THE 1.49 μm REGION

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Ethynyl, C_2H, is an important intermediate in combustion processes and has been widely observed in interstellar space. Spectroscopically, it is of particular interest because it possesses three low-lying electronic surfaces: a ground $^2\Sigma^+$state, and a low-lying $^2\Pi$ excited electronic state, which splits due to the Renner-Teller effect. Vibronic coupling among these states leads to a complicated, mixed-character, energy level structure. We have previously reported work[b] on three bands originating from the $\tilde{X}(0,0,0)\,^2\Sigma$ ground state to excited vibronic states: two $^2\Sigma\,-\,^2\Sigma$ transitions at 6696 and 7088 $\mathrm{cm}^{-1}$and a $^2\Pi\,-\,^2\Sigma$ transition at 7108 cm^{-1}. In this work, the radicals were formed in a hot, non-thermal, population distribution by *u.v.* pulsed laser photolysis of a precursor. Kinetic measurements of the time-evolution of the ground state populations following collisional relaxation and reactive loss were also made, using some of the stronger rotational lines observed. Time-dependent signals in mixtures containing a variable concentration of precursor in argon suggested that vibronically hot C_2H radicals were less reactive than the relaxed, thermalized, radical. Two additional hot bands originating in states $\tilde{X}(0,1^1,0)\,^2\Pi$ and $\tilde{X}(0,2^0,0)\,^2\Sigma$, have now been identified in the same spectral region. In a new series of experiments, we have measured the kinetics of formation and decay of representative levels involving all the assigned transitions, i.e. originating in $\tilde{X}(0,v_2,0)$, with $v_2 = 0, 1, \mathrm{and}\, 2$, in various concentrations of mixtures of precursor, inert gas and hydrogen. The new spectra also show greatly improved signal-to-noise ratio in comparison to our previous work, due to the use of a transient FM detection scheme, and additional spectral assignments seem likely. Both kinetics and spectroscopic results will be described in the talk.

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