

TIME-RESOLVED INFRARED DIODE LASER SPECTROSCOPY OF THE $\nu_1 + \nu_2 - \nu_2$ HOT BAND OF THE FeCO RADICAL PRODUCED BY THE ULTRAVIOLET LASER PHOTOLYSIS OF Fe(CO)₅

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Time-resolved infrared diode laser spectroscopy was applied to the observation of the $\nu_1 + \nu_2 - \nu_2$ hot band of the iron carbonyl (FeCO) radical. The FeCO radical was produced by the ArF excimer laser photolysis of iron pentacarbonyl Fe(CO)₅. Although the FeCO radical has the $^3\Sigma^-$ electronic ground state, the ν_2 bending vibrational excited state has vibronically the $^3\Pi$ symmetry, which allows the vibronic interaction with the $^3\Pi$ electronic state located very closely, 6400 cm^{-1} , to the ground electronic state ^a.

In the frequency region of $1930\text{-}1950\text{ cm}^{-1}$, more than 50 *R*- and *P*-branch lines were identified which split into triplet ($P = 0, 1, \text{ and } 2$) due to the spin-spin interaction. Each spin component split further into doublet, as Λ -type doubling, because of the vibronic interaction with the nearby $^3\Pi$ electronic state. The band origin $\nu_0 = 1941.54573(50)\text{ cm}^{-1}$ was determined as well as the molecular constants for the $\nu_1 + \nu_2$ state, fixing the molecular constants for the ν_2 state to those of the millimeter-wave ^b results. The effective spin-orbit constant $A_e f f$ and the Λ -type doubling constants for the $\nu_1 + \nu_2$ state are much different from those of the ν_2 state indicating that the effect of vibronic interaction with the $^3\Pi$ electronic state has increased due to the excitation of the ν_1 vibration.

^aK. Tanaka, M. Shirasaka, and T. Tanaka, *J. Chem. Phys.*, 106, 6820 (1997).

^bK. Tanaka, M. Nakamura, M. Shirasaka, and T. Tanaka, *The 53rd Symposium on Molecular Spectroscopy*, Columbus Ohio, (1998) MG16.