MILLIMETER-WAVE SPECTROSCOPY OF THE IRON CARBONYL RADICAL(FeCO) IN THE $\nu_2$ BENDING VIBRATIONAL STATE

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The rotational spectrum of iron carbonyl radical FeCO in the $\nu_2$ bending vibrational state of the ground $X^3\Sigma^-$ electronic state was observed in the millimeter-wave region. The radical was produced by a dc discharge of iron pentacarbonyl Fe(CO)$_5$. Seven rotational lines, split into sextet by the electron spin-spin interaction and $\Lambda$-type doubling, were identified in the frequency region of 154-254 GHz. Molecular constants derived, the rotational and centrifugal distortion constants, the spin-spin coupling constant $\gamma_0 = 679.37(291)$ GHz and the spin-rotation coupling constant $\gamma_0 = 679.37(291)$ MHz, are reasonably similar to those of the ground state $^3\Sigma^-$. Although the electronic state is $^3\Sigma^-$, a large spin-orbit coupling constant $A = 14.074(57)$ GHz was derived, indicating the vibronic coupling with the $^3\Pi$ electronic state located about 6500 cm$^{-1}$ above the ground state. From the $\Lambda$-type doubling, large interaction constants, $\alpha = -18.289(55)$ GHz, $p = -355.36(64)$ MHz, and $q = 9.5167(69)$ MHz, were determined, where the figures in parentheses are a standard error to be attached to the last digits.