TIME RESOLVED INFRARED DIODE LASER SPECTROSCOPY OF THE ν_1 BAND OF CoNO PRODUCED BY THE ULTRAVIOLET PHOTOLYSIS OF $Co(CO)_3NO$

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Rovibrational transitions of the ν_1 band (N-O stretch) of CoNO produced by the ultraviolet photolysis of $Co(CO)_3NO$ were observed in the 1775-1800 cm^{-1} region by time resolved infrared diode laser spectroscopy. In total, 35 absorption lines were assigned to the ν_1 fundamental band, and their J quantum numbers were determined by a simultaneous analysis with millimeter-wave spectroscopy[a]. Hotband lines originated from the ν_2 (bending), $2\nu_2$, and ν_3 (Co-N stretch) vibrationally excited states were also observed. Molecular constants, including the band origin ν_0 1796.22371(49) cm^{-1}, the rotational constant B_0 4669.7578(29) MHz, and the vibration rotation constant α_1 31.325(28) MHz, were derived from the observed spectrum. The equilibrium rotational constant B_e (4676.949(51) MHz) was determined with the α_1 value derived in the present study and the α_2 and α_3 values reported by the millimeter-wave spectroscopy[a]. The equilibrium bond-length $r_{\mathrm{Co-N}}$ was calculated to be 1.583 Å assuming r_{NO} = 1.182 Å by $ab\ initio$ calculation[b]. The absorption lines for the $\nu_1 + \nu_2 \leftarrow \nu_2$ and $\nu_1 + 2\nu_2 \leftarrow 2\nu_2$ bands were split into two components due to the Δl=2 interaction. The electronic ground state of CoNO was confirmed to be $^1\Sigma^+$ by this infrared study as reported by our previous millimeter-wave spectroscopy[a].

[a]Tanaka et al, the 59th OSU International Symposium on Molecular Spectroscopy (2004).
[b]M. Zhou and L. Andrews, $J.\ Phys.\ Chem.$ A 104, 3915 (2000).