IDENTIFICATION OF TWO NEW ELECTRONIC STATES OF NiCl USING INTRACAVITY LASER SPECTROSCOPY AND THE CORRELATION BETWEEN THEORETICAL PREDICTIONS AND EXPERIMENTAL OBSERVATIONS

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The near-infrared spectrum of NiCl has been recorded in high resolution in the 13,200-13,500 cm\(^{-1}\) and 13,600-13,750 cm\(^{-1}\) regions using Intracavity Laser Spectroscopy (ILS). The NiCl molecules were produced in the plasma discharge of a Ni-lined copper hollow cathode with 0.3-0.6 torr of argon as the sputter gas, and a trace amount of CCl\(_4\). The hollow cathode was located within the laser cavity of a Verdi V-10 pumped Ti:sapphire system. A generation of 90 \(\mu\)sec resulted in an effective pathlength of approximately 700 m for the absorption measurements. Several transitions were observed, including 2 transitions involving 2 previously unreported electronic states. The (0,0) and (1,0) bands of the \([13.5]^{2}\Delta_{1/2} - [0.16]^{2}\Delta_{5/2}\)transition were observed near 13,709 cm\(^{-1}\) and 13,318 cm\(^{-1}\), respectively. The (0,0) band of the \([13.8]^{2}\Pi_{1/2} - [0.38]^{2}\Pi_{1/2}\) transition was observed near 13,480 cm\(^{-1}\). With the analysis of these transitions, molecular constants have been obtained for 9 of the 12 doublet states of NiCl predicted by Zou and Lou in 2006. Analysis of these transitions and a comparison between the experimentally observed transitions and the theoretically predicted states of NiCl will be presented.