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 $\mathrm{cm}^{-1}$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 μsec resulted in an effective pathlength of approximately 700 m for the absorption measurements. Several transitions were observed, including 3 transitions involving 2 previously unreported electronic states. The (0,0) and (1,0) bands of the [13.5] $^2\Phi_{7/2}$-[0.16] A $^2\Delta_{5/2}$ transition were observed near 13,709 $\mathrm{cm}^{-1}$and 13,318 cm^{-1}, respectively. The (0,0) band of the [13.8] $^2\Pi_{1/2}$ - [0.38] X $^2\Pi_{1/2}$ 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.