LASER SPECTROSCOPY OF NiI: NEW ELECTRONIC STATES AND HYPERFINE STRUCTURE

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Two new electronic transition systems of NiI namely: the [14.0] $^2\Phi_{7/2}$ - $X^2\Delta_{5/2}$ and the [15.7] $^2\Delta_{5/2}$ - $X^2\Delta_{5/2}$ transitions were observed and analyzed using laser vaporization/reaction supersonic free jet expansion and high resolution laser induced fluorescence spectroscopy. In addition, the (v, 0) bands with v = 6 - 10 of the previously identified [14.6] $^2\Delta_{5/2}$ - $X^2\Delta_{5/2}$ transition were found to be perturbed by the [15.7] $^2\Delta_{5/2}$ state. All observed spectra show partially resolved hyperfine structure. Hyperfine width of rotational lines decreases rapidly as J increases suggested that the hyperfine structure for the [14.0] $^2\Phi_{7/2}$, the [14.6] $^2\Delta_{5/2}$ and the [15.7] $^2\Delta_{5/2}$ states conform to the Hund's case a_β coupling scheme. The interaction between the [14.6] $^2\Delta_{5/2}$ and the [15.7] $^2\Delta_{5/2}$ states is evident in the progressive increase in hyperfine width in rotational lines of the [14.6] $^2\Delta_{5/2}$ - $X^2\Delta_{5/2}$ transition as the vibrational quantum number increases. Deperturbation procedures were successfully applied to analyze the interaction between these two states. Accurate molecular and hyperfine constants for the [14.0] $^2\Phi_{7/2}$, the [14.6] $^2\Delta_{5/2}$ and the [15.7] $^2\Delta_{5/2}$ states were obtained and interpreted.