EMISSION SPECTRA OF NiH SHOWING EXTENSIVE ELECTRONIC ENERGY TRANSFER BETWEEN EXCITED STATES

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Fourier transform resolved laser induced fluorescence spectra have allowed us to investigate the low-lying electronic states of NiH arising from the Ni(3d⁴ 4s¹) configuration. Although laser excitation with a single mode laser should promote the molecule (formed in a hollow cathode discharge running at 1 torr pressure, with 10% H₂ in argon) to a unique excited state that should be readily identifiable from the work of Kadavathu and co-workers,⁴ the resolved fluorescence spectra are unexpectedly complex. Efficient energy transfer occurs between excited electronic states, retaining only isotopic selectivity. Analysis of the spectra locates energy levels up to 8000 cm⁻¹ above v=0 in the electronic ground state (X²Σg⁻), from all components of the ³Σ, ²Π and ²Δ states forming the supermultiplet complex studied by Gray et al.⁶ Measurements have been made so far for ⁶⁸NiH and ⁶⁹NiH. To observe heavier isotopes of nickel, an intracavity fluorescence experiment is required. Signals are increased by a factor 25, but the signal/noise ratio in Fourier spectra is disappointing when compared with intracavity excitation results.⁷ Nevertheless, this work has allowed us almost to double the range of known energy levels below 10000 cm⁻¹ for NiH.