Collisional energy transfer between excited electronic states in NiH

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In the course of spectroscopic investigations of NiH, working with a sputter source operating at pressures around 1 Torr and with a flow of ~10% H_2 in Ar, we have found that collisional processes are particularly efficient in redistributing energy: not only amongst neighbouring rotational levels, but also between different electronic states. In fact, laser excitation of NiH to electronic states located 17000 – 18500 cm^{-1} above the ground state produces emission spectra in which collisionally-induced features dominate direct laser-induced fluorescence in our experimental conditions! Because collisional energy transfer is so efficient (with $\Delta E \sim$ 200-1000 cm^{-1}), many bands appear in any given spectrum. We have also studied NiH in a static magnetic field, allowing examination of partially resolved Zeeman patterns following collisional energy transfer. We find that there is partial conservation of M_J in rotational collisional energy transfer within a given electronic state, whereas J, parity and M_J selectivity are lost in electronic energy transfer.