

## BARELY FLUORESCENT MOLECULES I. TWIN DISCHARGE JET SPECTROSCOPY OF HSnCl

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The divalent tin HSnCl transient molecule has been detected for the first time by LIF spectroscopy. HSnCl and DSnCl were produced in a twin discharge jet using separate precursor streams of SnH<sub>4</sub> and HCl (DCl), both diluted in high pressure argon. The  $\tilde{A}^1A' - \tilde{X}^1A'$  spectrum of HSnCl consists of a single rotationally resolved 0-0 band with a very short fluorescence lifetime ( $\sim 25$  ns). In contrast, the spectrum of DSnCl exhibits three bands ( $0_0^0$ ,  $2_0^1$  and  $2_0^2$ ) whose fluorescence lifetimes decrease from 400 ns ( $0^0$ ) to less than 10 ns ( $2^2$ ). Single vibronic level emission spectra have been recorded, providing information on all three vibrational modes in the ground state. Fluorescence hole burning experiments have shown that a few higher nonfluorescent levels are very short-lived but still detectable. Our detailed ab initio studies indicate that these molecules dissociate into SnCl + H on the excited state potential surface and this is the cause of the short fluorescence lifetimes and breaking off of the fluorescence. It is fortunate that the HSnCl excited state zero-point level is still fluorescent or it would not be detectable by LIF spectroscopy. Our calculations also predict that HSnBr should also fluoresce on excitation of low-lying bending levels in the excited state.