LASER-INDUCED FLUORESCENCE STUDY OF JET-COOLED TUNGSTEN MONOXIDE (WO) IN GAS PHASE

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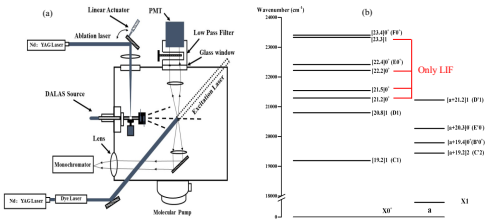

Combining laser ablation and pulsed discharge supersonic beam techniques, we investigated the laser-induced fluorescence (LIF) excitation spectra of jet-cooled WO molecule in the range of 18900 – 23500 cm^{-1}. Fig.1 (a) shows our experimental setup, where the gas phase WO molecules were produced by the reaction of O_2 molecules with the tungsten atoms ablated from a pure tungsten target. In this energy range, totally 63 bands were observed, and 60 bands were classified to 10 electronic transition progressions as shown in Fig.1 (b). Among them, 6 electronic transition progressions were previously reported by Ram et al. [1] using Fourier transform emission (FTE) spectroscopy, 4 electronic transition progressions [21.2]0^+ – X0^+, [21.5]0^+ – X0^+, [22.2]0^+ – X0^+, and [23.3]1 – X0^+ were only identified in the LIF spectra. The symmetry of all upper electronic states were determined using the ducted selection rules in the known symmetry of the ground state. Among the four transition systems only observed in LIF spectra, three electronic states have the 0^+ symmetry, which are [21.2]0^+, [21.5]0^+, and [22.2]0^+states. Considering the E0^+ and F0^+ states, there are five electronic states having the symmetry of 0^+ in this energy region. Ram et al. performed a high-level *ab initio* calculation of the lowest three configurations of WO molecule involving to the electron promotions of $3\sigma \rightarrow 1\delta$, $1\delta \rightarrow 2\pi$, and $3\sigma \rightarrow 2\pi$, respectively, in which only two states have the 0^+ symmetry in this energy region. Therefore, it is a great challenge for the theoretical calculation to comprehensively understand the electronic structure of WO molecule.

References: [1] R. S. Ram, J. Liévin b, Peter F. Bernath, J. Mol. Spectrosc. 256, 216 –227 (2009).