HIGH SENSITIVITY DETECTION OF CH AND OH RADICALS IN FLAMES USING WAVELENGTH MODULATION SPECTROSCOPY AND DIODE LASER-BASED UV LIGHT SOURCES

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Tunable, wavelength modulated 426 nm and 310 nm were developed by second harmonic generation of modulated 852 nm DBR diode laser and sum frequency mixing with 488 nm Ar^+ laser output, respectively. The 426 nm beam was used to map CH radical distributions in ethylene/air diffusion flames using the $R_2(8)$ line in the $(0,0)$ band of the CH A←X transition by high sensitivity wavelength modulation absorption spectroscopy (WMS). Absorbances of 4×10^{-5} have been measured using second harmonic ($2f$) WMS with a signal-to-noise ratio of 3:1 in a 3 Hz measurement bandwidth. Concurrent $2f$ detection of CH LIF was also demonstrated in flames with high sensitivity and spatial resolution. The 310 nm beam was used to detect OH radicals in an ethylene/air flame using the $P_2(4)$ transition in the $(0,0)$ band of the OH A←X transition. Using $2f$ WMS absorption detection, we achieved a minimum detectable absorbance of 3×10^{-6} at a 1 Hz measurement bandwidth. Experimental results to date along with the feasibility of extending to shorter wavelengths to access other flame species including NO and SO_2 will be discussed.