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Two-Color Polarization Spectroscopy Measurement of Nitric Oxide

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ABSTRACT

Nitric Oxide (NO) is a greenhouse gas that contributes to smog and acid rain. Commercial combustion engines and turbines are significant sources of NO emission. Two-color Polarization Spectroscopy (PS) will be used to measure the collision-induced resonances of NO in gas mixtures. The effect of collision partners, such as He and Ar, on the line-shape of NO molecule will be studied. This experiment requires the use of two dye laser systems to generate 226nm beam from frequency mixing of 355nm and 622nm. This enhanced the scan range and improved the ease of operation. One dye laser will be used to generate circularly polarized pump beam, which will be tuned to excite the transitions across the X-A (0,0) band of NO. Another dye laser will be used to generate linearly polarized 226nm probe beam, which will be used to probe the transitions. A photomultiplier tube will be used to collect the polarization signal. Nitrogen will be mixed with the NO gas mixtures to measure the sensitivity of this technique. In the current stage of the project, the pump beam is aligned and its wavelength is controlled by a LabVIEW programmed motor. Laser induced fluorescence data was collected to calibrate the scanning frequency with NO's excitation frequency. The excitation spectrum of NO from this specific pump-probe transition pair will help us understand the fundamental collision dynamics of NO and create a more quantitative technique of NO concentration measurement.

KEYWORDS

Laser diagnostics, Polarization spectroscopy, Nitric oxide