SO_2 SPECTROSCOPY WITH A TUNABLE UV LASER

W. W. Morey, C. M. Penney and M. Lapp

Optical Physics Branch

General Electric Co., Corporate Research and Development

Schenectady, New York

ABSTRACT

A portion of the fluorescence spectrum of SO_2 has been studied using a narrow wavelength doubled dye laser as the exciting source. One purpose of this study is to evaluate the use of SO_2 resonance re-emission as a probe of SO_2 in the atmosphere.

When the SO_2 is excited by light at 300.2 nm, for example, a strong re-emission peak is observed which is Stokes-shifted from the incident light wavelength by the usual Raman shift (the ν_1 symmetric vibration frequency 1150.5 cm^{-1}).

The intensity of this peak is sensitive to small changes (.01 nm) in the incident wavelength. Measurements of the N_2 quenching and self quenching of this re-emission have been obtained. Preliminary analysis of this data indicates that the quenching is weak but not negligible.

The dye laser in our system is pumped by a pulsed N_2 laser. Tuning and spectral narrowing are accomplished using a telescope-echelle grating combination. In a high power configuration the resulting pulses have a spectral width of about 5×10^{-3} nm and a time duration of about 6 nsec. The echelle grating is rotated by a digital stepping motor, such that each step shifts the wavelength by 6×10^{-4} nm.

In addition to the tunable, narrow wavelength uv source and spectral analysis of the consequent re-emission, the system also provides time resolution of the re-emitted light to 6 nsec resolution. This capability is being used to study the lifetime of low pressure SO_2 fluorescence at different wavelengths and pressures.

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