Concentration modulation technique for a continuous-scan FTIR spectrometer

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A new concentration modulation technique for a FTIR spectrometer was devised, and applied to the measurement of infrared emission spectra of OH X $^2\Pi$ ($v = 1 \rightarrow 0$) to demonstrate the selectivity in detection of short-lived species in discharge plasmas. Compared to the modulation technique developed by Guelachvili's group[1], in which the FTIR spectrometer is operated in the step-scan mode, the present technique may generally be used with commercially available FTIR instruments operating in the continuous-scan mode. A similar technique with high frequency (50 kHz) polarization modulation has already been reported[2], although the modulation frequency must be in the 10 kHz range or higher. The present technique is operative at low ($\sim$1 kHz) modulation frequencies.

The principle of the present method is as follows. The output signal of the IR detector is doubly modulated by ac discharge and by optical pass difference of the scanning interferometer. The doubly modulated signal is first demodulated by a PSD at the discharge frequency (2 kHz). The PSD is modified so that an output time constant circuit is replaced by a narrow band pass filter. The center frequency ω of the filter is set at the frequency where, without concentration modulation, the IR emission to be observed would give interferogram. The interferogram with frequencies near ω selected by the band pass filter is fed to the A/D converter of the IFS120HR spectrometer. The rest of the data processing is the same as in the case of an ordinary pass difference modulation spectrum. The infrared emission signal of OH X $^2\Pi$ ($v = 1 \rightarrow 0$) was observed with maximum intensity when the reference sine wave was in-phase with the discharge, and disappeared when out of phase.

1. A. Benidar, G. Guelachvili, and P. A. Martin, Chem. Phys. Lett., **177**, 563 (1991).
2. L. A Nafie, M Diem, and D. W. Vidrine, J. Am. Chem. Soc., **101**, 496 (1979).