FTIR FLAME EMISSION SPECTROSCOPY FOR TEMPERATURE AND SPECIES CONCENTRATION MEASUREMENTS

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We compare in this study different data reduction techniques to measure the local temperature and H_2O, CO_2 and CO concentrations in a two-dimensional burner. The spectra are recorded with a 0.02 cm^{-1} spectral resolution in the 1700-4300 cm^{-1} range which contains significant emission from the above cited molecules. The emission spectra are calibrated using a blackbody which also serves to correct the absorption by residual air in the optical path (about 20 mm.atm). In the first technique, the calibrated high resolution spectra are downgraded to a 25 cm^{-1} resolution and a non linear least-square adjustment is used to fit the experimental spectra to theoretical ones calculated from the EM2C high temperature approximate spectroscopic data bases. The unknown parameters in this adjustment are both the temperature and species concentrations. This method yields reliable temperature and H_2O and CO_2 concentrations as compared to other conventional techniques, but not accurate CO concentrations. In the second technique, the ratio of two CO line intensities is used to determine the temperature. We choose the 1-0P(27) and 2-1P(27) to avoid uncertainties due to line shapes. This technique gives good agreement with the previous one but is limited to regions where CO concentration is high enough (more than 0.002). CO concentration is determined from the center-line intensity value using several lines. The uncertainty in this last measurement is about 5 to 10% due mainly to the uncertainty in CO collisional line widths at high temperature. Nevertheless, the detection limit is evaluated to 10^{-3} mole fraction.