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12.24 Enhanced throughput and spatial resolution modifications for infrared absorption measurements

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High-temperature, atmospheric pressure plasma systems operated in molecular gases present complex diagnostic challenges. Infrared spectroscopy has been used to make measurements of the absorbance spectrum of complex molecular gas mixtures, and thereby calculate the concentrations and species temperatures in these systems. For high-pressure systems, high spatial gradients arise and high spatial-resolution measurements are thus desirable. Some systems have achieved increased spatial resolution by reducing the source aperture size. However, this increase in spatial resolution comes at the expense of the optical throughput. Here we propose modifying a commercial Fourier Transform, Infrared spectrometer system with a set of simple optical elements to achieve high spatial resolution scannable absorbance spectrum measurements of a complex molecular gas mix. We design such a system for a high-pressure plasma torch with diameter 1cm to achieve a spatial resolution of less than 1mm. This design improves the signal-to-noise ratio relative to reducing the source aperture size while transmitting nearly all of the source power.
[1] B.C. Stratton, et al., Plasma Chem. Plasma Proc. 19 (1999) 191.

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