Radiation Intensity of a Turbulent Sooting Ethylene Flame

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Turbulent sooting flame radiation is relevant to applications ranging from fire safety to gas turbine engines. The complex direct interactions of soot and radiation intensity are of particular importance when creating accurate soot prediction models. Previous studies have measured gas-band and broadband radiation intensity from turbulent sooting flames. The focus of the current study is the characterization of radiation intensity emanating from soot. A high-speed infrared camera (FLIR Phoenix) was used to acquire time-dependent quantitative images of radiation intensity of a turbulent sooting ethylene flame. The flame had a Reynolds number of 15,200 and was stabilized on a burner with an exit diameter of 8mm. The radiation intensity was collected utilizing a bandpass filter (3.77 ± .12 µm) to limit the radiation intensity source to soot. Time-dependent and time-averaged soot radiation intensities are plotted. Radiation intensity structures similar to those found in soot volume fraction diagnostics are observed and statistical analyses are employed to characterize the distribution of soot radiation intensity. The centerline distribution of radiation intensity from soot was qualitatively similar to earlier measurements of gas-band radiation intensity. Time-dependent images of radiation intensity exhibited discrete structures similar to images of soot volume fraction measured by laser-induced incandescence.