

Abstract Submitted
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On the limits of detection of a chemical vapor plume in air using the schlieren optical method RORY BIGGER, GARY SETTLES, Penn State —

A modest benchtop z-type schlieren optical system employing twin parabolic mirrors is characterized in terms of its sensitivity limit using the standard-lens method of calibration. A measurement by this method of the free-convection boundary layer on a heated vertical plate in air compares well with known theory. A mixing tube and oxygen sensor are then used to image laminar plumes of both helium and carbon dioxide in air at various mixture ratios, revealing a minimum value of the refractive-index gradient across the plume-air mixing boundary at its origin that is required for visibility. Thus the schlieren detection of a chemical vapor plume must depend upon the concentration of vapor in the air and the vapor refractive index. A range of chemicals is explored in order to determine the detectable concentration limit by this means. The results are discussed in terms of the possible use of schlieren optics to detect explosive vapor plumes in air.

Gary Settles
Penn State

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