

Gas-phase Velocity Field Measurements Without Particle Seeding Close to Droplets and Surfaces

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The application of the newly developed Gaseous Image Velocimetry (GIV) technique to (burning) sprays and flames close to surfaces is demonstrated. GIV is not based on seed particles as most other planar velocimetry techniques, but instead on molecular tracers such as NO. The wavelength shift of the laser-induced fluorescence (LIF) from the molecular tracer with regard to the laser excitation line is exploited to discriminate it against stray light from the liquid or solid phase. Thus, GIV can be performed very close to surfaces and also in the presence of droplets. This can be used to study the interactions of gas and liquid phase in (burning) sprays and the interaction of flames and walls respectively. It has recently been demonstrated that GIV can be used to measure velocity and turbulence fields in sprays [1], and it can be combined with Particle Image Velocimetry (PIV) to measure the velocity fields of both phases simultaneously in gas/liquid two-phase flows [2]. Previously it was demonstrated that GIV based on NO can be combined with Rayleigh scattering and spontaneous Raman scattering for diagnostics in turbulent jet flames [3]. Here we report on progress in studies on automotive sprays, and also measurements of the flow field of high-temperature postcombustion gases close to a quartz rod in a propane-oxygen flame are presented. It should be noted that very few seed particle materials exist to perform precise velocity measurements under these conditions by using velocimetry methods based on particles.

- [1] G. Grünefeld, J. Bartelheimer, H. Finke, S. Krüger, "Gas-Phase Velocity Field Measurements in Sprays Without Particle Seeding", submitted to Experiments in Fluids, 1998.
- [2] G. Grünefeld, H. Finke, J. Bartelheimer, S. Krüger, "Probing the Velocity Fields of Gas and Liquid Phase Simultaneously in a Two-Phase Flow", submitted to Experiments in Fluids, 1998.
- [3] G. Grünefeld, A. Gräber, A. Diekmann, S. Krüger, P. Andresen, „Measurement System for Simultaneous Species Densities, Temperature and Velocity Double-Pulse Measurements in Turbulent Hydrogen Flames“, Combust. Sci. and Tech. 135 (16th Special Issue on Dynamics of Reactive Systems), S. 135-152, 1998.