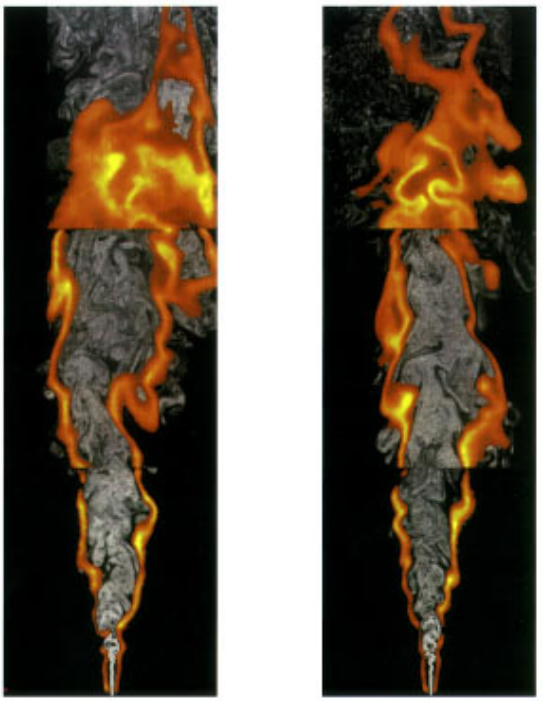

FIG. 1. $Re_{exit}=500$.

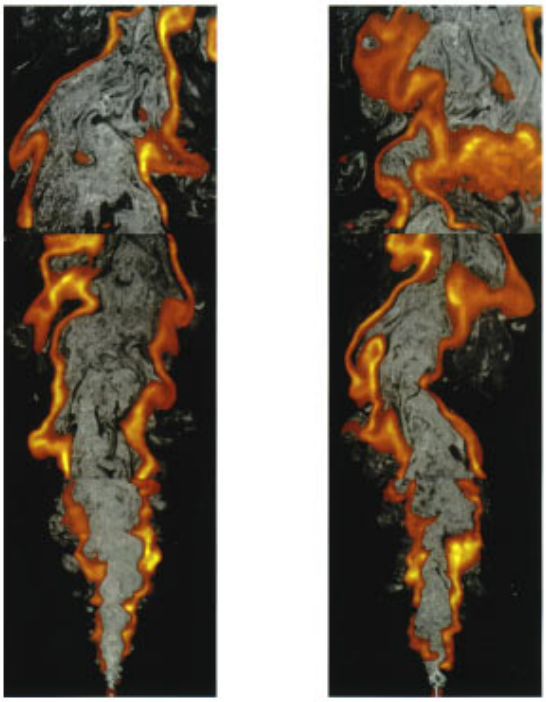

FIG. 2. $Re_{exit}=1000$.

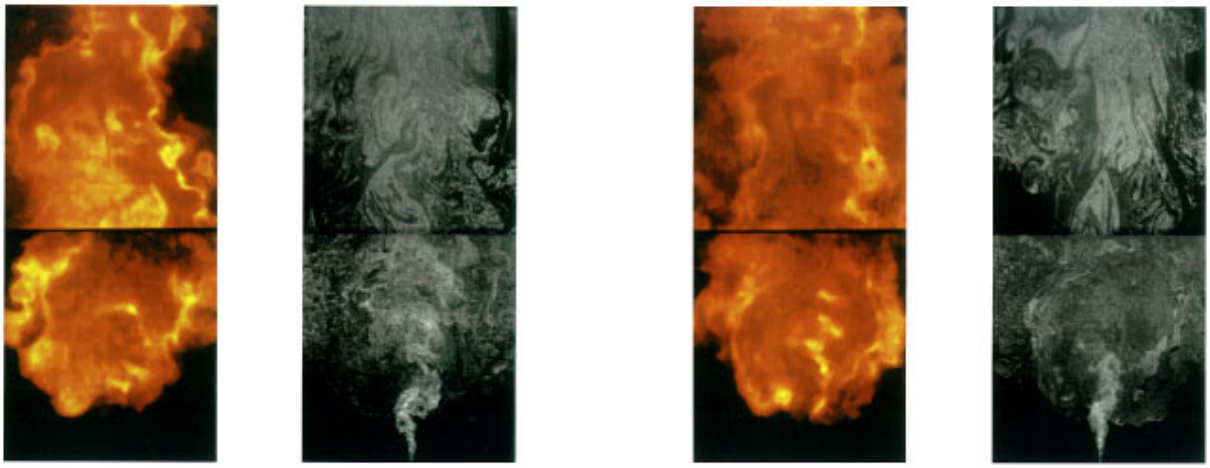

FIG. 3. $Re_{exit}=2500$.

HYDROGEN/HELIUM PLANAR DIFFUSION FLAMES

Submitted by J. E. Rehm and N. T. Clemens (University of Texas at Austin)

Simultaneous planar laser Mie scattering (PLMS) and planar laser-induced fluorescence (PLIF) techniques were used to visualize the flames shown above. The 40% H_2/60% He mixture was seeded with 1 μm alumina particles and issued from a 1 mm$\times$150 mm planar nozzle. PLMS of the seeded particles serves as an approximate marker of the jet fluid and appears white in the images. Simultaneous PLIF of the OH radical marks the reaction zone and is pseudo-colored yellow-red. Uncorrelated sets of images were taken at consecutive downstream locations spanning a total distance of 390 mm for the low and moderate Re flames, and 260 mm for the lifted flame.

Low and moderate Reynolds number (Figs. 1 and 2). The particle images illustrate the initially laminar region near the jet exit which rolls up into anti-symmetric vortices. Farther downstream, the jet undergoes a transition to turbulence where large-scale structures can be seen. Local Richardson number calculations show that these flames should be strongly influenced by buoyancy. The OH zones lie outside the particles in the laminar field due to differential diffusion. In Fig. 2 the flame can be seen to locally extinguish near the transition region due to the high strain rate. The OH zones are seen to become more diffuse with downstream distance as expected from the lower strain rates.

Lifted flame (Fig. 3). The lifted flame flow-field is dominated by large coherent motions upstream of the OH field. The jet transitions to an unusually rapid growth rate downstream of the flame base. In this lifted case, the OH zones are highly distributed to the extent that the instantaneous reaction surface is difficult to identify.

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