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Entrainment and Dilution in Isolated Turbulent Puffs[1] ELHAM GHAEM-MAGHAMI, HAMID JOHARI, WPI — The flow field of isolated turbulent puffs was examined experimentally using the laser Mie scattering and Particle Image Velocimetry techniques. Puffs were generated by injecting air through a 5 mm diameter nozzle into a flow chamber with a weak coflow. The injection time was varied from 20 ms to 161 ms by a fast-response solenoid valve. Injection volumes corresponding to these times ranged from 6 to 58 cc. Past work has indicated that the mixing of burning puffs scales with the cube root of the injected volume. Isolated puffs with injection Reynolds number of 5,000 were examined in the range of 25 – 40 diameters downstream of the nozzle. The results indicate that as the injection volume and time increases, puffs evolve from a spherical geometry to an axially elongated form. The velocity field inside the puff consists of a toroidal vortex. For the elongated puffs, the vortex is followed by a jet-like flow. The half-width of the puff decreases with increasing injection volume. Dilution, as indicated by the ratio of entrained to injected volume, was substantially smaller for the elongated puffs when compared with the spherical ones. The reduced entrained volume of elongated puffs indicates that they are less efficient in entraining ambient fluid than the spherical ones.

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