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Visualization of Buoyancy Opposing Flow Structures in a Small Length Scale Fluidic Junction

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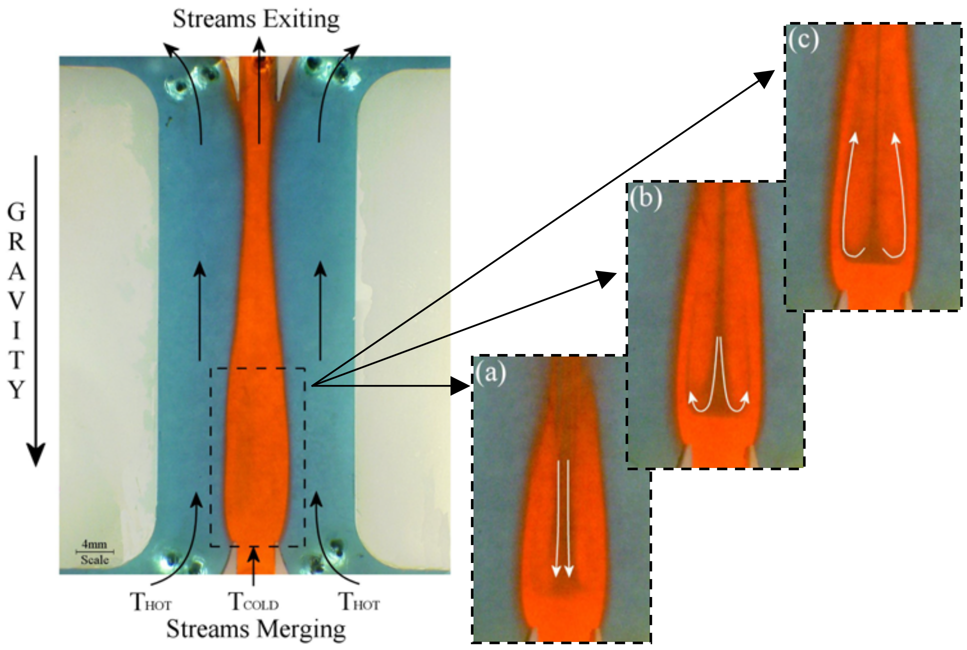

Fig. 1. Laminar Plume structure observed in a small length scale fluidic junction under buoyancy opposing flow boundary conditions. Re of outer streams, 23, Re of center stream, 2.8 and Gr between streams, 688. Also shown are three instantaneous subfigures (a), (b) & (c) of the plume structure developing and indicating the presence of a symmetrical recirculation within the plume.

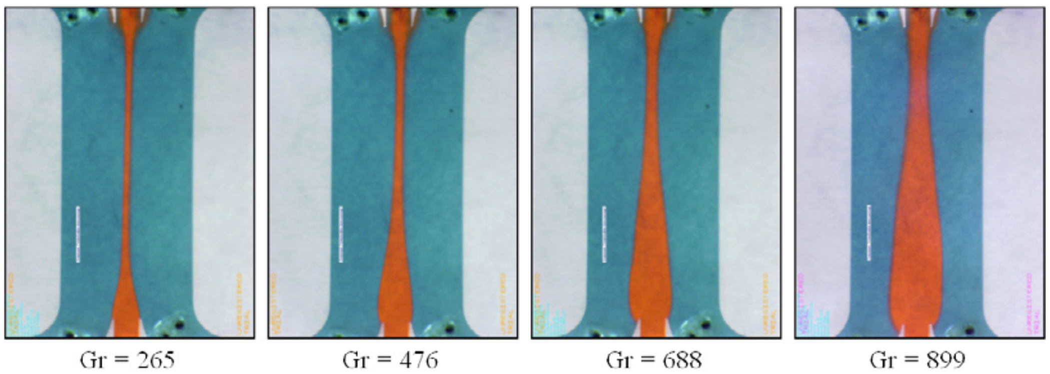

Fig. 2. Visualization images outlining the effect of increasing Grashof number for the same Re boundary conditions as in Fig. 1. Forced viscous flow conditions seen to prevail at low Gr numbers and laminar recirculation zones seen to develop at high Gr numbers. The corresponding Richardson number range for these images is 0.5 to 1.7 from left to right.

The plume structure obtained in a laminar viscous flow regime under buoyancy opposing flow conditions is detailed by means of flow visualization using dyed water streams. The boundary conditions are obtained by raising the temperature of outer streams entering the device above that of the center stream. It is seen that a plume structure is inhibited at low Gr numbers due to a dominant inertia force exerted by the forced outer stream. A laminar plume in the form of a symmetrical recirculation zone develops at higher Grashof numbers due to the equalising and subsequent dominance of buoyancy forces over inertia forces.