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Dependence of penetration and entrainment on injectant properties for a jet in supersonic crossflow[1] DAN FRIES, DEVESH RANJAN, SURESH MENON, Georgia Institute of Technology — Four gases with different molecular weights and specific heat ratios are injected as circular, sonic jets into a supersonic crossflow (Mach 1.72). The jet fluid concentration distribution is quantified using a solid particle Mie-scattering technique. To account for the freestream Mach number, the bow shock in front of the jet and boundary layer thickness, an effective momentum flux ratio and a penetration relation based on momentum balance between jet and crossflow are used to improve the collapse of jet trajectories. The trajectory results also suggest a systematic influence of injectant properties on penetration that goes beyond what has been considered in the past. Trends are presented and analyzed further by association with Particle Image Velocimetry velocity data. The development of the velocity field especially in the windward shear layer of the jet elucidates changing compressibility effects on jet spreading and crossflow fluid mass entrainment.

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