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Effect of microgravity on the formation and geometry of whirling flames[1] SRIRAM BHARATH HARIHARAN, University of California, Berkeley, MICHAEL R. JONES, JOSEPH L. DOWLING, University of Maryland, College Park, ELAINE S. ORAN, Texas A&M University, College Station, MICHAEL J. GOLLNER, University of California, Berkeley, SANDRA L. OLSON, PAUL V. FERKUL, NASA Glenn Research Center, Cleveland — Fire Whirls (FWs) are structures that frequently occur in wildfires and are formed when a buoyant plume is subjected to ambient circulation. The two primary physical processes controlling FW structure are circulation and buoyancy. Here, we describe experimental investigations performed at the NASA Glenn Research Center's Zero Gravity Research Facility drop tower, which provides 5.18 s of microgravity time to study the effects of normal (1g) and micro gravity (μg) on FW geometry. The FWs were formed in both 1g and μg, using a paraffin wax wick in an enclosure formed by two offset half cylinders. Ambient circulation was controlled using a vertical bank of fans at each inlet. Results show that in μg, where the effects of circulation are higher, the flame height reduces dramatically, and the flame width increases moderately. The burning rate also reduces in μg, sometimes leading to short-lived blue flames, attributed to the increased importance of diffusion. Elevated gravity (˜35g), due to deceleration at the end of the drop, resulted in a brief transition to a blue-whirl-like regime, that is, a state in which a recirculation zone exists. Finally, a scaling approach to analyze whirling flames in μg is presented.

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