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EXPERIMENTAL INVESTIGATION OF TURBULENT PREMIXED FLAME QUENCHING IN NORMAL- AND MICRO-GRAVITY

Abstract

Flame quenching by turbulence is of importance for the design of practical combustors and for the understanding of turbulent combustion. In the present work, the quenching of premixed turbulent methane-air flames has been explored in a counterflow burner. The experiments were conducted under normal gravity and reduced gravity conditions utilizing the 3.6 s drop tower at the National Microgravity Laboratory of China. Several lean methane-air flames with different equivalence ratios were investigated. Each case covered a range of turbulent intensities, and the highest strain rate was obtained until the flame quenching occurred. The flame behaviors were recorded by a high-speed camera, which clearly displayed steady flame propagation and flame quenching progress. The turbulent Karlovitz number was achieved for each equivalence ratio and turbulent intensity. The quenching boundaries were compared with available data and theoretical prediction in literature, and the effects of turbulent straining and equivalence ratio were analysed. Based on the experimental results, the mechanism of turbulent flame quenching was also discussed.