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Enhanced Integral Burning Rate of Turbulent Premixed Flames Through Stratification[1] SINA KHEIRKHAH, SAJJAD MOHAMMADNEJAD, LESLIE SACA, RAMIN HEYDARLAKI, University of British Columbia, QIANG AN, PATRIZIO VENA, SEAN YUN, National Research Council Canada, PHILIPPE VERSAILLES, GILLES BOURQUE, Siemens Energy — Burning rate of turbulent premixed flames with compositionally inhomogeneous mixtures were investigated experimentally. Hydrogen-enriched methane-air turbulent flames with a global fuel-air equivalence ratio of 0.8 were tested. Two nozzles, each containing 4 fuel/air injection lobes were used in the experiments. The lobes of the first nozzle are straight, while those of the second nozzle are not, producing a swirling motion. The fuel is injected through several small diameter holes into the lobes, generating stratified conditions. Simultaneous OH and CH_2O Planar Laser Induced Fluorescence (PLIF) along with Stereoscopic Particle Image Velocimetry (SPIV) were performed for the reacting conditions. SPIV and acetone-PLIF experiments were conducted to study the background turbulent flow characteristics and fuel-air mixing of non-reacting flow, respectively. The results show that stratification can lead to broadening of the preheat layer and generation of shredded-like heat release rate structures. Despite featuring a small intensity of burning rate, the shredded flame structure can feature a relatively large integral burning rate. This suggests some degree of stratification may enhance the stratified flames integral burning rate.

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