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Broadening of reaction zones in turbulent lean methane-air premixed flames[1] SAJJAD MOHAMMADNEJAD, School of Engineering, University of British Columbia, Kelowna, Canada, V1V 1V7, QIANG AN, PATRIZIO VENA, SEAN YUN, Gas Turbine Laboratory, Aerospace Research Centre, National Research Council, Ottawa, Canada, K1A 0R6, SINA KHEIRKHAH, School of Engineering, University of British Columbia, Kelowna, Canada, V1V 1V7, NATIONAL RESEARCH COUNCIL TEAM, UNIVERSITY OF BRITISH COLUMBIA TEAM — Internal structure of extremely turbulent premixed flames stabilized on a large diameter Bunsen burner is investigated using simultaneous planar laser-induced fluorescence of formaldehyde molecule and hydroxyl radical as well as stereoscopic particle image velocimetry. Lean methane-air flames with the mean bulk flow velocities of 5 to 35 m/s are tested. Reynolds and Karlovitz numbers for the tested conditions change from 19 to 2729 and 0.3 to 76.0, respectively. Results show that the preheat and reaction zone thicknesses can increase to values that are about 6.2 and 3.9 times those of the laminar flame counterpart, respectively. While preheat zone broadening is expected from results in the literature, thickening of the reaction zone is not commonly observed, especially for a relatively large diameter Bunsen burner. Turbulent flow characteristics such as vorticity, swirling strength, and rotational kinetic energy of vortices are estimated to investigate the underlying reason for the broadening of preheat and reaction zones. The results suggest that penetration of energetic vortices into the preheat and reaction zones may be a potential reason for the broadening of these zones.

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