An effect of turbulent crosswind on a reacting jet at a low velocity ratios

M M Hossain, D Cui, D Corbin, G A Kopp
Boundary Layer Wind Tunnel Laboratory, Western University

Abstract

Atmospheric turbulence was generated in a wind tunnel to capture the flaring events which resemble the real-world scenario of gas flaring at a reduced scale. The basic flow topologies were depicted by capturing sequential flame images using four cameras from the side side and the top of the flame. In this study, passive grids were used to produce the ideal turbulence intensities, I_u, and length scales, L_x, for lab-scale flare stacks to simulate real-world stacks in atmospheric turbulence. The main focus was to examine how the upstream turbulent crosswind interacts with non-premixed reactive jets at low velocity ratios.

Sequential color images reveal that the upstream shear layer in the jet is demonstrated to exhibit unstable behavior at low momentum flux ratios with the attendant formation of a recirculation zone at the leeward side. The size of the recirculation zone decreases with an enhanced turbulent crosswind. In addition to that, a comprehensive study of discrete flame pockets are carried out using instantaneous images. The color of the flame is closely analyzed in order to distinguish the mixing phenomena of crossflow fluid and jet fluid in the near field. Moreover, an empirical equation is proposed for predicting flame length in the presence of crosswind. The changes in flame length, discrete flame pockets, and color are monitored for the different upstream turbulent crosswind. Details will be discussed in the poster presentation.