Extinction phenomena of a lean premixed flat flame impacting with a periodical jet

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Extinction phenomena of a lean methane air premixed flat flame formed horizontally in a wall stagnating flow impacting with a periodical air jet flow has been investigated experimentally. The burner system consist 40mm nozzle burner and a solid wall with 8mm diameter air jet placed in line vertically. The periodical frequencies (f) set up to 80Hz while the jet oscillation intensity (u') generates up to 6 m/s by using a loud speaker. Approximately 100mm disk shape flame front synchronize with the air jet frequencies. The flame front is curved by the air jet periodical motion. The air jet impacts to the center of the flat flame and the flame extinction starts from center of the impinging point as a small hole. Basically, the fuel concentration of quenching condition increases with increasing the intensity of air jet, because the increased jet speed intensifies the flame strain rate due to flame front curvature and heat loss to the cold air from the jet. The small quenching hole develops to outer direction finally whole flame extinguished. However, there is no guarantee that the hole will not develop to the whole extinction. For example, in f=20Hz and the range within u'=0~1m/s, the quenching hole develops to the whole flame extinction and there is no chance to recover from the hole quenching. In the condition of u'<1m/s, the flame hole may not trigger to develop to the whole extinction. Once the quenching hole creates, but the hole may close by the propagating flame. In this condition, the quenching hole and recovering cycle occur synchronizing with each periodical jet motions. Especially, in u'<2.5m/s, the whole flame extinction limits are lower than no jet impacting condition. The disturbance by the periodical air jet induces the quenching hole and it also works to recover from the local quenching with conditional on the flame edge propagation mechanism. Note that the flame front can not synchronize the high frequency of periodical air jet motion.