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Optimization of annular cavity dimensions in the circular jet burner to the enhancement of flame stability

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ABSTRACT

The stability of a jet diffusion flame has gotten reestablished consideration lately because of its assorted industrial applications in several burners. Further at a lower methane flow rate, the flame is attached to the burner tip. On the other hand, diffusion flame tends to lift off from the burner tip at higher fuel stream rates because of a reduction in the flow residence time. The lifted flame can be unstable, lift-off and even blow-off from the burner rim. Therefore, the significant criterion in designing burners is the stability of a diffusion flame, in either attached or lifted conditions. The annular cavity inside a burner is one of the passive control strategies. Past investigations have demonstrated that there is an optimum cavity diameter (D) and post-cavity length (L_1), which provides maximum flame stability. The cavity length (L_2) to its diameter (L_2/D) ratio is also a critical parameter. When the (L_2/D) ratio is less than unity, increase stability is accomplished. The objective of the current investigation is to comprehend the marvel of flame instability when such cavities are utilized. CFD simulations can be used to investigate the influence of upstream annular cavity parameters on flame characteristics, such as the flame length, lift-off velocities, and lift-off heights.