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A Numerical Study on the Effects of N2 Dilution on the Flame Structure and Temperature Distribution of Swirl Diffusion Flames

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Abstract : The numerical modeling is performed to study the effects of N₂ addition to the fuel stream on the flame structure and temperature distribution of methane-air swirl diffusion flames with different swirl intensities. The Open source Field Operation and Manipulation (OpenFOAM) has been utilized as the computational tool. Flamelet approach along with modified k-ε model is employed to model the flame characteristics. The results indicate that the presence of N₂ in the fuel stream leads to the flame temperature reduction. By increasing of swirl intensity, the flame structure changes significantly. The flame has a conical shape in low swirl intensity; however, it has an hour glass-shape with a shorter length in high swirl intensity. The effects of N₂ dilution decrease the flame length in all swirl intensities; however, the rate of reduction is more noticeable in low swirl intensity.

Keywords : swirl diffusion flame, N2 dilution, OpenFOAM, swirl intensity
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