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Investigation of Stabilized Turbulent Diffusion Flames Using Synthesis Fuel with Different Burner Configurations

Authors : Moataz Medhat, Essam Khalil, Hatem Haridy

Abstract : The present study investigates the flame structure of turbulent diffusion flame of synthesis fuel in a 300 KW swirl-stabilized burner. The three-dimensional model adopts a realizable k-ε turbulent scheme interacting with two-dimensional PDF combustion scheme by applying flamelet concept. The study reveals more characteristics on turbulent diffusion flame of synthesis fuel when changing the inlet air swirl number and the burner quarl angle. Moreover, it concerns with studying the effect of flue gas recirculation and staging with taking radiation effect into consideration. The comparison with natural gas was investigated. The study showed two zones of recirculation, the primary one is at the center of the furnace, and the location of the secondary one varies by changing the quarl angle of the burner. The results revealed an increase in temperature in the external recirculation zone as a result of increasing the swirl number of the inlet air stream. Also, it was found that recirculating part of the combustion products decreases pollutants formation especially nitrogen monoxide. The predicted results showed a great agreement when compared with the experiments.

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