Optimization of stepped conical swirler with multiple jets for pre-mixed turbulent swirl flames

Ibrahim Shahin ⇑, Ismail M.M. Elsemary, Ahmed A. Abdel-Rehim, Ahmed A.A. Attia, Khairy H. Elnagar

Mechanical Engineering Department, Benha University, Shoubra Faculty of Engineering, Combustion and Energy Technology Lab, Egypt

In the following numerical simulations and experimental work had been used to optimize a new stepped conical swirler that used in lean pre-mixed combustion process. Three dimensional computational models were built-up to solve the swirling reacting flow and experimental setup was used to validate this model. Several jet swirl angles were studied so that the developed flow structure varied as a consequence of changing the swirler geometry. New swirl flow structures were identified and analyzed. The velocity and temperature distribution after the swirl plate were presented for jet angles changed from 0_ to 25_ with step equal to 5_. The numerical model results give good agreement with the experimental results. Well defined large swirl structures were shown by results and it is highly depend on the jet swirl angle. The conclusion is that the jet swirl angles have a big effect not only on the temperature distribution but also on the pressure drop across the swirler. The Swirl plat with jet angle from 10_ to 15_ gives the most uniform temperature distribution and also the minimum pressure drop across the swirler.