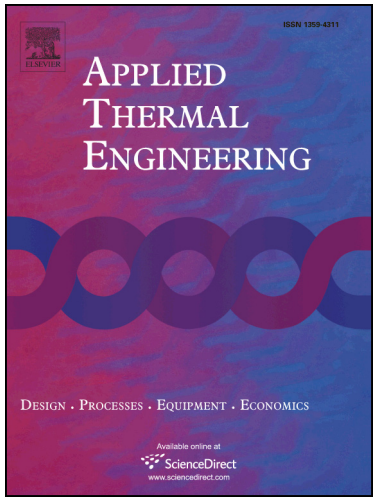

Experimental investigation of central jet displacements on theturbulence and gas dynamics of a coaxial burner

Hassan Boualia, Ammar Hidouri, Mouldi Chrigui, Jean-Charles Sautet

PII: S1359-4311(17)30541-0
DOI: http://dx.doi.org/10.1016/j.applthermaleng.2017.01.085
Reference: ATE 9849

To appear in: *Applied Thermal Engineering*

Received Date: 17 September 2016
Accepted Date: 24 January 2017

Please cite this article as: H. Boualia, A. Hidouri, M. Chrigui, J-C. Sautet, Experimental investigation of central jet displacements on theturbulence and gas dynamics of a coaxial burner, *Applied Thermal Engineering* (2017), doi: http://dx.doi.org/10.1016/j.applthermaleng.2017.01.085

EXPERIMENTAL INVESTIGATION OF CENTRAL JET DISPLACEMENTS ON THETURBULENCE AND GAS DYNAMICS OF A COAXIAL BURNER

Hassan BOUALIA[1,2,3], Ammar HIDOURI[1], Mouldi CHRIGUI[1,3,4], Jean-Charles SAUTET[2]

1: Research Unit "Materials, Energy and Renewable Energies", University of Gafsa, Tunisia

2:Interprofessionnel Research Complex in Aerothermochemistry, Saint Etienne du Rouvray Rouen, France

3: National Engineering School of Gabes, Gabes-Tunisia

4: Institute for energy and power plant technology, Technische Universiteat Darmstadt, Germany

hassan.boualia@hotmail.fr

Abstract

Isothermal turbulent flow issued by a coaxial burner that consists of three jets is experimentally studied. In this investigation different configurations that depend on the central jet displacement are examined. The offset varies between -30 mm and +30 mm using a step of 10 mm. The central and the outer jets provide pure oxygen whereas the in-between jet bears fuel. Various profiles of mean axial and radial velocity, fluctuations, intensity of turbulence and turbulent kinetic energy are carried out using the Particle Image Velocimetry (PIV) technique. The obtained results describe the behavior of the isothermal turbulent flow for each test case. These results show that the inner core depends on the central jet displacement. The main objective of this investigation is to better understand the dynamics of coaxial burner and provide a reliable data for the numerical validation of stratified combustions.

Key words : isothermal turbulent flow, coaxial burner, central jet displacement, Particle Image Velocimetry, stratified flows

Introduction

Coaxial turbulent jets released from two or three nozzles are encountered in wide industrial applications, such as combustion chambers or premixed burners. They show important physical phenomena during the interaction and mixing between turbulent shear flows i.e. stratification. Forstall and Shapiro [1] studied, for conditions of nearly identical densities and inlet temperatures and using different initial velocities, fuel and oxidizer mixing at constant pressure for circular coaxial stream jets. They showed that the velocity ratio (U_i/U_0, where $U_i$is the axial mean velocity issuing from the