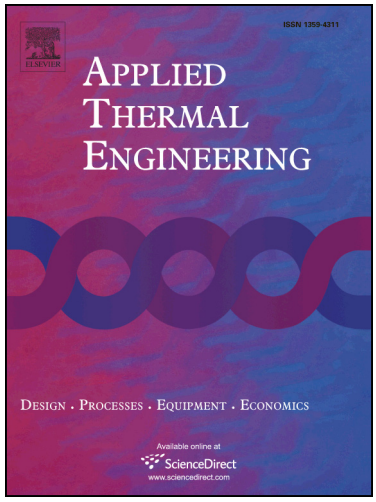

Experimental study of natural gas flame enriched by hydrogen and oxygen in a coaxial burner

Zouhaier Riahi, Mohamed Ali Mergheni, Jean-Charles Sautet, Sassi Ben Nasrallah

PII: S1359-4311(16)31210-8
DOI: http://dx.doi.org/10.1016/j.applthermaleng.2016.07.079
Reference: ATE 8677

To appear in: *Applied Thermal Engineering*

Received Date: 26 May 2016
Revised Date: 9 July 2016
Accepted Date: 12 July 2016

Please cite this article as: Z. Riahi, M.A. Mergheni, J-C. Sautet, S. Ben Nasrallah, Experimental study of natural gas flame enriched by hydrogen and oxygen in a coaxial burner, *Applied Thermal Engineering* (2016), doi: http://dx.doi.org/10.1016/j.applthermaleng.2016.07.079

Experimental study of natural gas flame enriched by hydrogen and oxygen in a coaxial burner

Zouhaier RIAHI[* a,b], Mohamed Ali MERGHENI [c], Jean-Charles SAUTET [b], Sassi BEN NASRALLAH [c]

[a]*Research and Technology Center of Energy, Laboratory of Wind Energy Master and Waste Energy Recovery (LMEEVED), B.P. 95 Hammam-Lif, 2050, Tunisia*

[b]*Normandie University, UNIROUEN, INSA Rouen, CNRS CORIA, 76000 Rouen, France*

[c]*National Engineering School of Monastir, LESTE, Monastir, Tunisia*

[*]*Corresponding author: Zouhaier.Riahi@crten.rnrt.tn*

Abstract

In air combustion, nitrogen brings about a low yield of combustion and a high energetic consumption because the nitrogen contained in the air acts as energy ballast. The substitution of air by oxygen or the oxygen addition to the air permits the improvement of the heat yield, the rise of the adiabatic flame temperature and the extension of the flammability limits. The hydrogen addition to the natural gas combustion shows an increase in adiabatic flame temperature, a reduction in flame thickness and further enhances the auto-ignition characteristics and the global rate of heat release. This work presents the effects of enrichment with oxygen and hydrogen on a non-premixed flame behavior. More specifically, the study focuses on the flame stability, the pollutants emissions such as NOx, CO_2, and CO and the jet flow dynamic. Chemiluminescence of OH* radical and Particle image velocimetry (PIV) are conducted to describe the structure, the stability and the dynamic of the flame. The measurements are conducted at the stoichiometry for oxygen rate varying from 20 to 50% by volume and hydrogen varying from 0 to 15%.The results show that the addition of oxygen and hydrogen improves the flame stability, increases the CO_2emission, decreases the CO formation but favors the NOx formation.

Keywords: Oxygen enrichment, Hydrogen enrichment, Flame stability, Chemiluminescence, PIV, gas emissions.