بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

MONA MAGHRABY

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جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

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MONA MAGHRABY

Combustion Characteristics Of Non-Premixed Hydrogen Micro-Jet Flame And The Influence Of Various Bluff Bodies To Its Extinction Limits

By

Ahmed Ismail Mahmoud Saleh

A Thesis Submitted to the

Faculty of Engineering at Cairo

University in Fulfillment of the

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MECHANICAL POWER ENGINEERING

FACULTY OF ENGINEERING, CAIRO

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Title of Thesis: Combustion Characteristics Of Non-Premixed Hydrogen Micro-Jet Flame And The Influence Of Various Bluff Bodies To Its Extinction Limits

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Nomenclatue

Symbol Quantity

c_p	Constant pressure specific heat
c_s	Solid material specific heat
g	Acceleration of gravity
h	Enthalpy; heat transfer coefficient
k	Thermal conductivity; suppression decay factor
L	Length scale
$\dot{m}_a$	Air mass flow rate
$\dot{m}_f$	Fuel mass flow rate
p	Pressure
R	Universal gas constant
Re	Reynolds number
T	Temperature
t	Time
M_α	Molecular weight of gas species α
x	(x, y, z) Position vector
X_α	Volume fraction of species α
Y_α	Mass fraction of species α

Greek Letters

∇	Gradient
λ	Wave length
μ	Dynamic viscosity
ρ	Density
o	Stefan-Boltzmann constant

Superscripts and Subscripts

Δ	Change interval of any property
∞	Ambient property
F	Fuel property
flow	Flow property
g	Gas property
ij	Indicates two different Cartesian coordinates
w	Wall property
α	Property for species

Abbreviations

MEMS	Micro-Electro-Mechanical Systems
SSME	Space Shuttle Main Engine

Abstract

In this study, the thermal and chemical structure of non-premixed Hydrogen micro-jet flames in co-flow air was investigated over a wide fuel flow velocity range numerically to extend the knowledge on micro flames.

A reduced nineteen step chemkin chemical reaction mechanism with nine species was employed in a 2-D axis-symmetric laminar numerical computation to consider the consumption, generation and transportation of radicals and major species in a pure hydrogen flame in a co-flow air, studies were extended to investigate the effect of bluff body to the extinction limits of the flame.

It has been confirmed that the extinction limits of the flame has been extended to a much lower flow velocities under the influence of different bluff body shapes.

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