

Thesis Title	Improvement of Performance of Staged Porous Burner for Mixed Fuels without Spray Atomization
Thesis Credits	12
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Program	Master of Engineering
Field of Study	Mechanical Engineering
Department	Mechanical Engineering
Faculty	Engineering
Academic Year	2013

Abstract

A new design of staged porous burner for mixed fuels without spray atomization is proposed to eliminate melting and thermal expansion problems of the existing burner. Moreover, the newly proposed burner is more compact. The new burner can be efficiently operated with a gaseous fuel (liquefied petroleum gas, LPG), a liquid fuel (kerosene) and a mixed fuel (50% LPG + 50% kerosene) either in a premixed or non-premixed combustion mode. The burner consists of a two-layer porous medium burner, i.e. an upstream porous burner (PB) and a downstream porous emitter (PE). The PB is used as a fuel distributor and vaporizer, while the PE is used as a combustion chamber and porous emitter. Moreover, the PB is movable in a telescopic manner in relation to the fixed PE. The distance between the PE and PB is defined as X_{PB} and this serves as a mixing chamber. The combustion mode can be controlled by the telescopic action of the PB. With the $X_{PB} = -20$ mm, the combustion air feeding is swirling flow, yielding the premixed combustion, whereas at $X_{PB} = 0$ mm, the combustion air feeding is annular flow, yielding the non-premixed combustion. The fuels are supplied directly into the PB, while air is supplied into the air jacket surrounding the PB, not only for cooling effect but also for air preheating before combustion with the fuel in the PE. The experiment focused on the influence of combustion mode on the temperature profile and emission characteristics (CO and NO_x) by gradually increasing the X_{PB} by 4 mm from -20 mm to 0 mm. Moreover, the operating range of this burner was also studied by the variation of equivalent ratio (Φ) and firing rate (FR). The results show that non-premixed combustion mode yielded a lower

peak temperature due to the enlarged reaction zone and hence reduced NO_x emission due to the reduced thermal NO_x . Moreover, the CO emission also decreased due probably to the increased oxidation time from the enlarged reaction zone included with heat recirculating combustion. This burner can be operated at a wide range of Φ (0.26-0.66)

Keywords : Two-layer porous medium burner / Swirling flow / Annular flow / Premixed combustion / Non-premixed combustion