The 10th TSME International Conference on Mechanical Engineering
10th – 13rd December 2019
Pattaya, Thailand

Effect of equivalent ratio variation on a two-stage distributed combustion

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Abstract. Distributed combustion is a recent technology that has a feasibility to apply in the industrial scale. It provides relatively-low combustion temperature with rather uniform distribution and very low emission (NOx). The two-stage distributed combustion system is established to reduce the complexity of operation in the industrial application. The operation range of this combustion system is governed by the equivalent ratio of the first and second-stages of combustion. This research is attempted to study the effects of equivalent ratio to identify the operation range. The experiment is set up using a diesel combustor as the first-stage combustor and a LPG distributed combustor as the second-stage in order to improve the efficiency of the single-stage diesel combustor. The air to fuel ratio of the first-stage combustor is controlled to provide the 5% excess oxygen for the second-stage combustor. The equivalent ratio of the second-stage is varied as 1, 0.9, 0.8, 0.7 and 0.6. The results shown that stoichiometric distributed combustion yields the highest outlet temperature and first and second law efficiency. The temperature is decreased when reducing equivalent ratio. Finally, this research also provides the formula that can be used to determine the appropriate operation range in the term of A/F for the two-stage distributed combustion system conveniently applied to the single-stage available in the industrial.

Keywords: Distributed combustion, Thermal efficiency, Experiment