Article Abstract

Title:	**Evaluation of thermal characteristics of oscillating combustion**
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Abstract:	In view of the economy and environmental impacts of the energy utilization, most of the heat transfer industries such as steel mills, glass plants and forging shops, foundry process and furnaces are focusing on energy efficient strategies and implementing new technologies. Gas Technology Institute (GTI) and Air Liquide Chicago Research Centre (ALCRC) have applied Oscillating Combustion Technology (OCT) on high temperature forged furnaces and reheat furnace for melting steel. The oscillating combustion requires a new hardware to incorporate on the fuel flow ahead of the burner. Solid State Proportionate (SSP) valves were used to create oscillations in the fuel flow. Natural gas was used as fuel and the technology was applied with air-gas, oxygen-gas, and excess level of air during the oscillating combustion. The present work deals with the implementation of OCT on liquid fuels at ambient conditions for melting aluminum metal in a fuel-fired crucible furnace which is of importance to foundry. Also, carrying out a study over the enhanced performance characteristics of oscillating combustion and comparing its thermal effects with those of the conventional combustion mode. The oscillating device, developed by the author, unlike other oscillating valves used earlier is a cam operated electro mechanical valve cause oscillations on the fuel flow. Experiments were conducted at varying air-fuel ratio, aluminum stocks, frequency and amplitude of the oscillating valve. The results when compared to the conventional combustion led to low fuel and specific energy consumption, enhanced heat transfer rate, increased furnace efficiency with visibly low volumes of flue gases with reduced emissions. The increased heat transfer rate and furnace efficiency was found to be in agreement with the results of GTI and ALCRC experiments. The reasons for such improvements in performance characteristics were verified by conducting experiments in the furnace by measuring the temperature distribution at designated point and calculating the heat transfer rate both for conventional and oscillating combustion mode. The analyses presented in this paper are for two levels of air-fuel ratios above and below the stoichiometric ratio, three different loads at 10^0 & 20^0amplitude and 5 & 10Hz frequency of oscillating valve.
Keywords:	Furnace efficiency, fuel fired furnace, heat transfer, oscillating combustion, specific energy consumption