Development of a high performance regenerative burner injecting two-staged air and fuel

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The objective of this research is to develop a new burner to extend the service life of fuel nozzle and to lower NOx emission during regenerative combustion. A burner characterized with staging both fuel and air burner was proposed as the target model, and combustion tests for medium(~100,000 kcal/h) and full scale (~1,000,000 kcal/h) burners were performed. To prevent the fuel nozzle from thermal radiation, we designed the model burner to minimize the exposure to flame. A total of 6 model burners in medium scale were tested and the optimal combination of design guidelines were derived. It was found that the burner model could meet the target NOx emission of lower than 50 ppm under normal operating conditions. A flameless combustion mode could be achieved by a high speed air injection (e.g., air speed of 30m/s at room temperature basis), which was found to be very effective in the uniformity of temperature distribution in the furnace and in the reduction of NOx emission. On the basis of medium scale experiments, two prototype full scale burners were fabricated and tested to show similar results with medium scale model burners.