

NOx emission characteristics of radiant tube burners

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This study has been carried out to develop a low NOx radiant tube burner by applying various low NOx principles to burner design. The state-of-the-art technologies for low NOx combustion were analyzed to design experimental burner models. Full-scale combustion experiments have been performed for several kinds of burners using appropriate experimental apparatus. It has been confirmed that the air-staged combustion is effective for reducing NOx concentration. However, the sole application of staged combustion itself was not satisfactory to suppress the NOx emission to an ultimate low level. Lowering the primary air fraction could improve the temperature uniformity on the radiant tube and the low NOx performance. The well-known low NOx mechanisms for direct firing burners, e.g. the fuel direct injection method, showed little effect in reducing NOx emission in case of radiant tube burners. Temperature uniformity and NOx emission were improved by adopting biased fuel nozzle and delaying air/fuel mixing based on the staged combustion. With appropriate combination of low NOx methods, NOx emission of less than 150 ppm could be accomplished at the furnace temperature of 950°C using coke oven gas as fuel.