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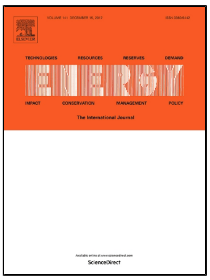

Control of Nitrogen Oxide Formation in Power Generation Using Modified Reaction Kinetics and Mixing

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Control of Nitrogen Oxide Formation in Power Generation Using Modified Reaction Kinetics and Mixing

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Abstract

This work presents a new method for reducing the formation of nitrogen oxide (NO_x) emission in power generation by varying the dominating NO_x formation reaction mechanism. A burner secondary oxidizer (BSO) injection is introduced in which a part of the required oxidizer for the reactions is distributed in a way to selectively increase the reactant radicals in an extended flame region. The modeling is validated using experimental results in a 300kW furnace with a non-premixed natural gas burner. While the NO_x emission level is the focus of this work, the effects of this new design on the flow streamlines and the fields of temperature and velocity are studied. The results show that the optimum case with minimum outgoing NO_x is the case with 25% BSO ratio associated with burner primary oxidizer equivalence ratio of 1.22. This optimum condition leads to 66% reduction of NO_x with only 8ppm of outgoing NO_x. The combustion in the furnace for the case with 25 % BSO reduces the NO_x formation mainly due to generating a larger fuel-rich area close to the burner compared to the typical burners leading to the change of the dominating NO_x formation from Zeldovich mechanism to prompt NO_x mechanism.

Keyword: Nitrogen Oxide (NO_x), Reaction Kinetics, Combustion, Emission Control, Burner, Furnace