Oxygen Fuel MILD Combustion by Reactant Injection Conditions

Pil Hyong Lee[a], Chun Loon Cha[a], Ho Yeon Lee[a] and Sang Soon Hwang[a*]

[a] *Incheon National University, Incheon 406-772, Korea*

Abstract

The oxygen fuel MILD combustion has been considered as one of the promising combustion technology for flame stability, high thermal efficiency, no visible flame, low noise, low emissions and improved productivity. Normally MILD combustion takes advantage of dilution effect of oxygen, fuel and product gas by internal recirculation under above ignition temperature. The internal recirculation forms volume combustion with relatively uniform and low temperatures region and leads to very low CO and NOx emissions.

In this paper, the effect of fuel and oxygen injection velocity, injection position of fuel and oxygen nozzle and distance between fuel and oxygen nozzle condition on formation of oxygen fuel MILD combustion was analyzed using three dimensional numerical simulations. The numerical simulation model is based on Semi-Implicit Method for Pressure Linked Equation Consistent algorithm using segregated solver of Ansys Fluent. And heating capacity of oxygen fuel MILD combustion system in this study is set to $2MW/m^3$.

The results show that the peak temperature region and the average temperature was decreased due to increase of product gas internal recirculation ratio when oxygen velocity is faster. The peak and average temperature was also affected by depth of fuel and oxygen nozzle positions. As depth of fuel and oxygen nozzle positions were increased, peak temperature, average temperature were decreased and uniform temperature region became much wider due to higher turbulent mixing of oxygen and product gas. Dilution effect which is very important to MILD combustion was greatly affected by oxygen and fuel velocity, distance between oxygen and fuel nozzle and depth of fuel and oxygen nozzle position respectively. Through the results of the numerical analysis, possibility of oxygen fuel MILD combustion was confirmed and the optimum conditions for oxygen fuel combustion system could be obtained by maximizing the dilution effect of oxygen and product gas.

Keywords: MILD Combustion, CO, NOx, Internal Recirculation, Numerical Simulation

*Corresponding author email: hwang@inu.ac.kr