INVESTIGATION OF OXYGEN-ENHANCED COMBUSTION METHOD ON COMBUSTION CHARACTERISTICS IN NON-PREMIXED GASEOUS FLAMES

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The aim of the present study was to experimentally investigate and compare the characteristics of two oxygen-enhanced combustion methods, namely the premix enrichment (shortly PE) and air-oxy/fuel combustion (shortly AO). As for the PE method, the oxygen was injected into the incoming combustion air stream through the diffuser that was inserted in the air supply duct before entering the burner. In the AO method, the oxygen was injected directly into the flame through the nozzle head that was inserted in the center burner pipe. The combustion tests were performed with the experimental low-NO_x two-gas-staged burner at the large-scale burner testing facility. The total oxygen concentration in the incoming air was varied from 21 % to 46 %. The combustion tests were carried out at the burner thermal input of 750 kW for two combustion regimes – one-staged and two-staged combustion. The oxygen concentration in the flue gas was maintained in the neighborhood of 3 % on dry basis.
The main results can be summarized:

1. As for the PE tests, NO_x emission increased more than 40 times and by 20 times if one-staged and two-staged combustion regime was used, respectively. Significantly better results were obtained during the AO tests, especially when the fuel was staged. Then the NO_x emission was below 120 mg/m_N^3 at all oxygen flow rates.
2. The radiative heat transfer was enhanced as the oxygen concentration was increased. The available heat at 46 % O_2 was higher by 20 % compared with that at 21 % O_2.
3. The produced oxygen-enhanced flames were stable and more luminous than the air/fuel flames.

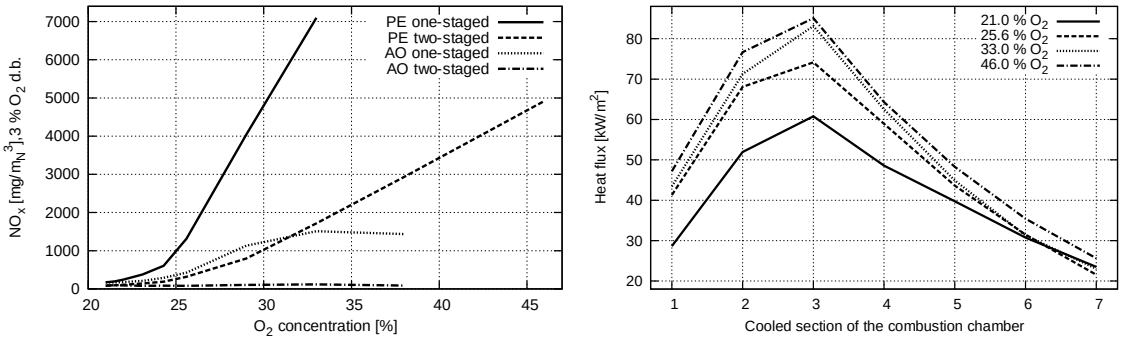

Figure 1: Effects of oxygen concentration on NO_x and heat flux profile for PE two-staged regime.

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