PROJECT facts

U.S. DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

Advanced Research

09/2005

O_2/CO_2 Recycle Coal Combustion to Minimize Pollutants

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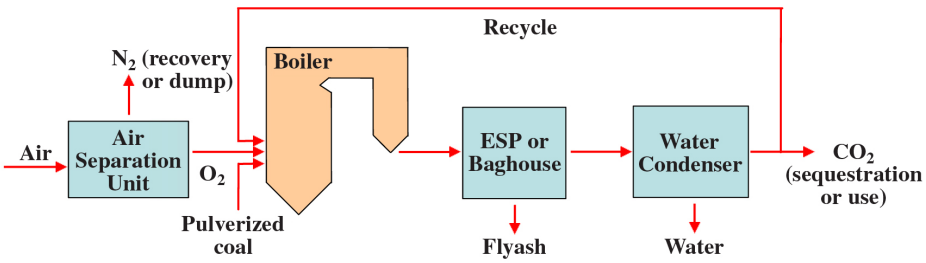
Description

O_2/CO_2 recycle coal combustion is a promising, retrofittable technique for electric power production, while producing a nearly pure stream of CO_2 for subsequent use or sequestration. Most pollutant emissions, including NO_x, are lower in this process, compared to conventional pulverized coal combustion. However, laboratory and pilot-scale tests to date have shown a wide variation in the fractional reduction of NO_x when adopting this technology, suggesting that further improvements in NO_x reduction are possible, given a better understanding of the dominant routes of NO_x production and destruction in these systems.

Goals

The goal of this project is to determine the relative influence of three different mechanisms likely to contribute to observed reductions in NO_x: reburn of recycled NO_x in the volatiles flame zone; reduced formation of thermal NO_x; and increased NO_x reduction on coal char. Once the dominant routes of NO_x formation and destruction are better understood in these systems, burner design and operation can be tailored to minimize NO_x emissions. This project will use both the Multifuel Combustor (MFC) and Char Combustion Laboratory (CCL) at Sandia National Laboratories, in addition to plug flow chemistry modeling and single-particle chemistry modeling to achieve this goal.



Schematic diagram of O_2/CO_2 recycle coal combustion system.

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PROJECT DURATION

October 1, 2004 –
September 30, 2006

PROJECT COST

$450,000

CUSTOMER SERVICE

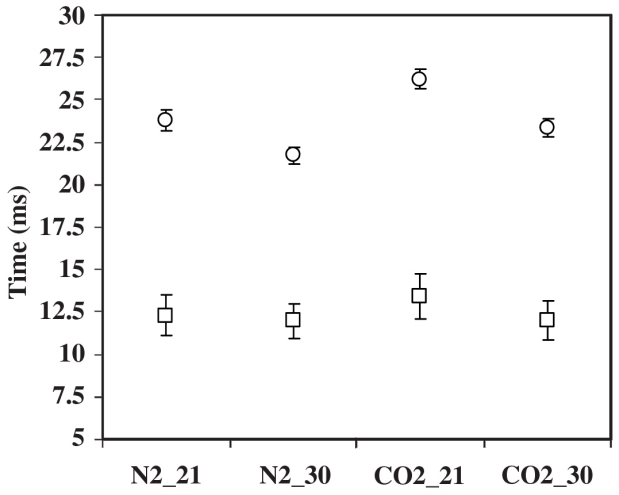
1-800-553-7681

WEBSITE

www.netl.doe.gov

Accomplishments

The gas supply and control system for the MFC has been modified to allow firing of the system in an O_2/CO_2 mode. In addition, measurements have been collected on the effect of elevated oxygen levels and the presence of CO_2 diluent on the heating and ignition of pulverized coal and char particles. These processes are important to thermal NO_x formation and NO_x reburn in the flame zone. Measurements have also been performed on the effect of CO_2 on the reduction of NO on char surfaces.



Measured mean coal particle ignition times (circles) and devolatilization times (squares) in 21% and 30% O_2, with N_2 or CO_2 diluent gas, for 115 µm particles of Pittsburgh seam coal in a 1,250 K environment.