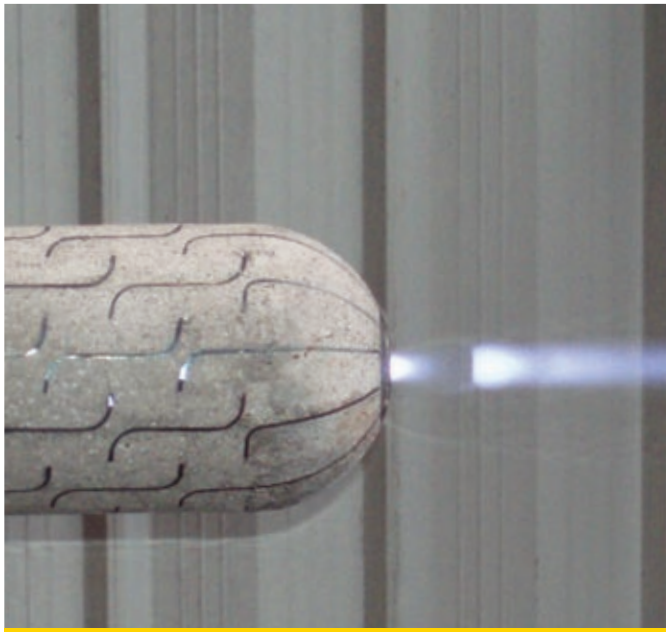
PRAXAIR CONOX TECHNOLOGY

Shell Global Solutions (US) Inc. and Praxair, Inc. are introducing an innovative solution designed to reduce carbon monoxide (CO) and nitrogen oxide (NOx) emissions from fluidised catalytic cracking (FCC) units

Shell Global Solutions



The CONOx technology uses an oxygen injection lance that is placed in the hot flue gas duct leaving the regenerator.

AT A GLANCE

Customer driver: Legislative constraints (permits/licence to operate, fuel specifications); margin improvement (optimised production, efficiency and availability)

Solution: FCC regenerator NOx and CO emissions reduction technology

Value delivered: 10–30% FCC capacity increase and reductions in NOx, CO_2 and CO emissions

Proof point: Capital cost can be an order of magnitude less than conventional CO and NOx technology solutions

CO and NOx emissions regulations continue to tighten in many parts of the world, and refiners are under significant pressure to find cost-effective solutions to meet them. These solutions are especially important for the FCC regenerator, which is the main source of a refinery's NOx emissions.

Praxair, Inc., which has a long history of helping refiners to address clean fuels challenges and environmental regulations, expand crude oil selection flexibility and optimise operations, has developed an innovative solution – CONOx technology.

Unlike technologies such as CO thermal oxidation, selective catalytic reduction, CONOx technology tackles both CO and NOx to provide a robust solution at a much lower capital cost: typically an order of magnitude less.

ABOUT THE TECHNOLOGY

The CONOx technology uses an oxygen injection lance that is placed in the hot flue gas duct leaving the regenerator. It is based on a technology that has been used successfully in the steel and utility industries, and uses preheated oxygen to destroy CO and NOx precursors with little or no NOx generation.

CONOx technology can:

- complement other NOx control technologies;
- be used with other low-capital technologies for high-level NOx control; and
- be installed with the FCC unit in operation.

PROCESS DESCRIPTION

The CONOx lance injects reactive oxygen into the offgas duct between the regenerator and the CO or heat recovery boiler. The key to the technology is the high-velocity jet of heated oxygen that rapidly mixes with the process gases.

The lance also creates high concentrations of free radicals to provide rapid reactions at flue gas temperatures. The mixing characteristics of the jet and the free radicals produced with the CONOx technology make it significantly more efficient than a standard oxygen jet.

PERFORMANCE DATA

When operating in a full-burn regenerator, CO concentrations of typically 50 ppm can be achieved (Figure 1). This is achieved without generating additional NOx, and the technology is indifferent to inlet CO concentrations.

Shell Global Solutions will be involved in marketing CONOx to customers through its worldwide sales force and will work with Praxair, seeking to update and improve the technology.

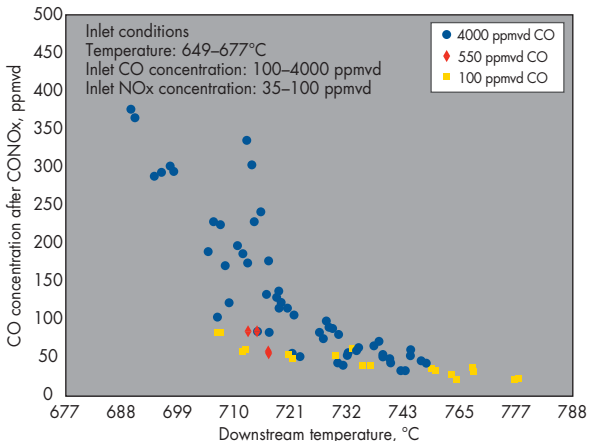


Figure 1: CONOx technology facilitates operation at lower excess oxygen, which reduces the NOx leaving the regenerator.

BUSINESS VALUE

CONOx technology can deliver value by:

- unlocking FCC margin improvements: 10–30% capacity increases are possible; and
- helping operators to safeguard their licence to operate. It can reduce NOx, carbon dioxide and CO emissions.

In partial-combustion FCC units, CONOx technology reduces NOx precursors and may enable FCC unit operation at higher CO levels while maintaining low NOx emissions.

In full-combustion units, the CONOx technology enables FCC unit operation at low excess oxygen to achieve low NOx levels while maintaining low CO emissions. The approach has achieved 20 ppm NOx in the flue gas. Moreover, higher levels of NOx reduction are possible if CONOx technology is used in conjunction with other control methods.

HAVE YOU CONSIDERED HOW YOU CAN

- meet your FCC operating targets and maintain environmental compliance?
- enhance the operating costs of your existing emissions control technologies?
- reduce or eliminate CO boiler supplemental firing?

PROOF POINTS

FCC operating in partial burn

A refiner wants to run its FCC unit deeper into partial burn but is constrained by the level of NOx leaving the CO boiler and the CO boiler's ability to destroy the additional CO. CONOx technology enables the regenerator to be pushed deeper into partial burn by reducing both the CO and the amount of NOx precursors entering the CO boiler. Feasibility studies suggest the total installed cost to be substantially less than $4 million. The energy saving achieved through less CO boiler supplemental firing will cover all the operating costs associated with the operation of the CONOx lance.

The refiner cannot increase the FCC charge rate but the lower regenerator temperature will enable the catalyst-to-oil ratio to be increased, reducing slurry production. Studies suggest that the resultant yield improvements would provide a one-year payback.

FCC operating in full burn

An FCC unit faces the need to curtail operation in order to meet an annual NOx emissions or CO emissions limit. CONOx technology's ability to destroy CO without increasing NOx will enable the regenerator to be operated in a mode that meets the yearly NOx limits without reducing the FCC rate. This mode results in higher CO concentrations leaving the regenerator; CONOx technology is then used to reduce the CO to an acceptable level.

Engineering studies indicate that the total installed cost for CONOx technology, including modifications to the ductwork required for the CONOx lance installation, to be an order of magnitude less than the other options. In partial burn applications the operating cost is low, as the cost of the oxygen used by the CONOx lance is offset by a reduction in the oxygen required.

GS33321110 En(A)