Coal Gasification Efficiency and Energy Improvements Utilizing Advanced Process Control

Building on more than 70 years of gasification experience, Air Products has become a premier provider of turnkey solutions to convert hydrocarbon feedstock into synthesis gas for high-value products.

Client

A licensee of Air Products coal slurry gasifier technology which produces syngas ($CO+H_2$) to produce methanol used in chemical manufacturing.

Challenge

The client was seeking to improve the level of automatic control and plant stability while reducing manual operator assistance, leading to more efficient consumption of feed and fuel. Conventional PID control loops on the distributed controls system (DCS) layer (e.g., oxygen to carbon ratio) are difficult to operate in auto mode for many reasons, including interference among loops, and tuning limitations of PID parameters. In addition, some meaningful process variables (i.e., CH_4/CO_2) to gasification operation can't be controlled by the control scheme located at the DCS layer due to their large delay time.

Solution

Air Products implemented Advanced Process Control (APC). APC functions by modelling how controlled variables (CVs) are impacted by manipulated variables (MVs). This information is used to automatically modify manipulated variables in real time to achieve or maintain the desired controlled values.

By implementing APC in the gasification core process sections, the key process variables could be automatically controlled, especially in oxygen to carbon ratio related loops. In addition, APC implies the syngas compositions (CH_4, CO_2) are controlled variables which provided an intuitive and convenient optimization method for the gasifier's reaction temperature.

Result

Following the implementation of APC, the Client experienced a reduction in coal and oxygen consumption greater than 0.4% and 1% for the same effective syngas production respectively. The stability of key control values measured as standard deviations improved by greater than 40%. For APC loops, operator manual work was reduced by more than 70%.

Application

APC can be applied to any Air Products gasifier to improve stability and reduce feed usage while improving syngas yield.

Meet our Technical Staff

Wanghua Nie Sr., Instrument Engineer, has more than 14 years of experience with Air Products' Slurry Gasification on Process Design Package (PDP) design, commissioning, start-up, and troubleshooting, as well as supporting the marketing promotion and leading the execution of Air Products' APC project.

Wanghua graduated from Kunming University of Science and Technology in 2002 with a B.S. in Process Control.

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