Delayed Coker is the second unit in this seven-step overview of Refining

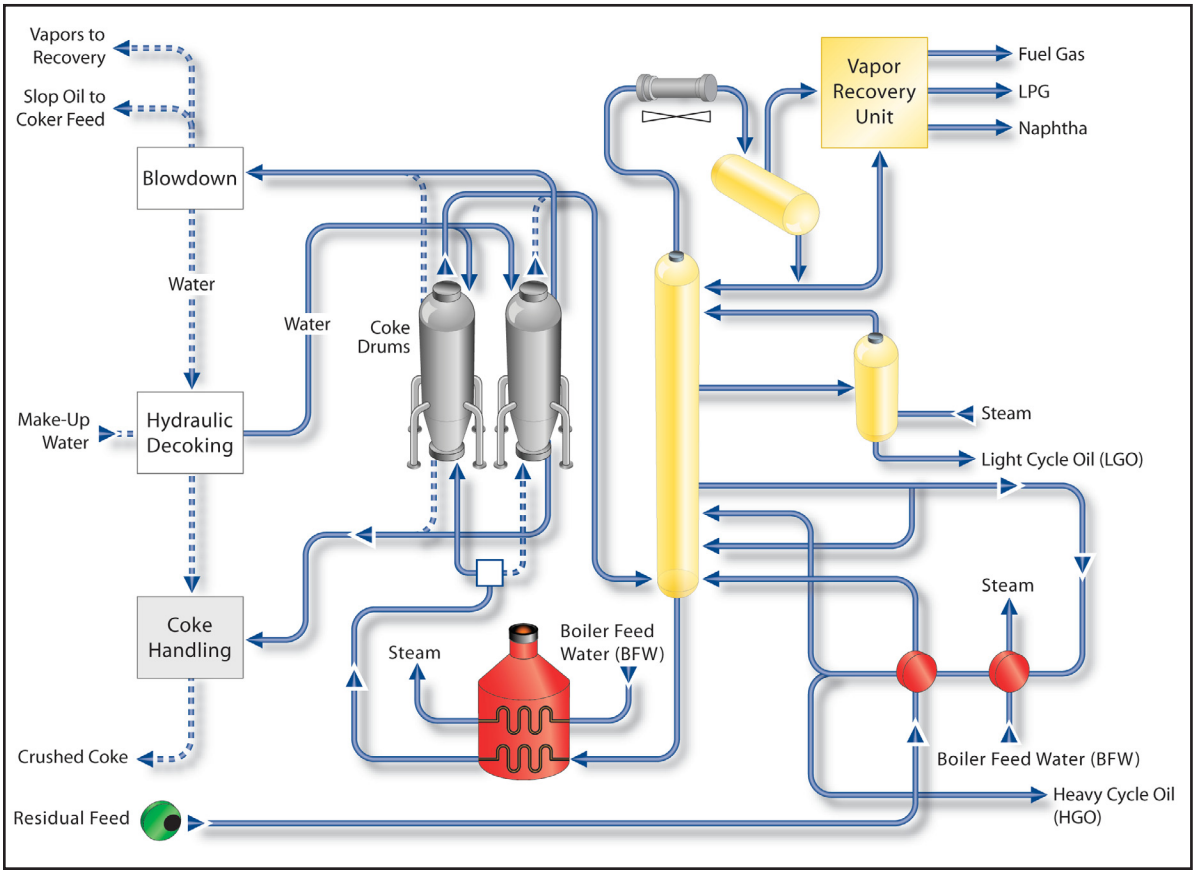
Overview of Delayed Coker Process

The delayed coker is one of the key processes in the refinery where heavier crudes are being processed. Optimizing this process is becoming increasingly important, and good measurement is a key factor to be able to effectively evaluate coker operations.

The most common method of upgrading the heavy, high sulfur, low quality "bottom of the barrel" is by converting it into lighter products in a delayed coker. The coking unit converts heavy feedstocks into solid coke and lower boiling hydrocarbon products which are suitable as feedstocks to other refinery units for conversion into higher value transportation fuels.

The delayed coking process is a thermal process and consists of fired heaters, coke drums and a main fractionator. The cracking and coking reactions are initiated in the fired heater under controlled time-temperature-pressure conditions. High velocities are maintained in the heaters in order to prevent significant coke formation. The reactions continue as the process stream moves to the coke drums. Being highly endothermic, the coking reaction rate drops dramatically as coke-drum temperature decreases. Coke is deposited in the coke drums. The vapor is routed to the fractionator, where it is condensed and fractionated into product streams – typically fuel gas, LPG, naphtha, distillate, and gas oil.

When one pair of coke drums is full of coke, the heater outlet stream is directed to the other coke drum. The full drum is taken offline, cooled with steam and water and opened. The coke is removed by hydraulic cutting. The empty drum is then closed, warmed-up and made ready to receive feed while the other drum becomes full.



Delayed Coker Process Diagram

The challenges to the Delayed Coker Process are detailed on the next page.

Customer Challenges

The delayed coker is a high maintenance process, and typically the "dirtiest" process in the refinery. Maintaining a safe, healthy environment around the coker is critical. Anything that can be done to increase reliability, lower maintenance costs, and enable higher on-stream time is highly valued.

The following customer challenges have been defined and Micro Motion offers integrated application solutions that provide everything needed to meet these challenges and improve quality, productivity, and profitability.

Customer Process Challenge #1 – Coker Furnace Reliability

Challenge: Coker furnace pass measurement is one of the very important flow measurements, but difficult with traditional dP measurement. dP measurement is difficult because of plugging impulse lines. If the measurement is unreliable, then the following conditions could occur:

1. Furnace tube rupture and unit shutdown – this is a serious safety issue caused by unreliable flow measurement. Assuming there is flow when there isn't actually flow can result in these safety consequences.
2. Decreased furnace run length between decokings – unbalanced flows through each of the coker furnace passes can lead to decreased run lengths between decokings with large financial implications.

Customer Process Challenge #2 – Coker Material Balance

Challenge: Getting an accurate and reliable material balance around the coker is very challenging. Accurately measuring the coke produced is not possible, so it is important to have accurate measurement of all the other streams around the coker, including the feed, recycle, and fractionator products in order to properly evaluate the operations for optimization purposes.

Customer Process Challenge #3 – Anti-foam Injection

Challenge: Anti-foam is a chemical which is used to prevent the coke drums from foaming over. Being a very viscous polymer, it is again difficult to measure with conventional technology.

Improving Coker Efficiency

Recommended Product Solution

Customer Challenge #1 - Coker Furnace Reliability

Control Point Challenge: Reliable coker furnace pass measurement ensures safety and improved run-length.

Solution: Because of the non-intrusive nature of the Coriolis meter, flow of feed through the furnace passes can be done reliably, even at elevated temperatures.

Key features of the new Micro Motion meters can benefit flow measurement include meter verification.

The meter verification feature of Micro Motion Coriolis meters could be of particular interest in this application because of the critical nature of the measurement and also because of the history in most plants of "distrusting" this measurement. Verifying the meter calibration is of value especially in terms of increased safety.

Competing Technology: Orifice dP, wedge meters.

Micro Motion ELITE High Temperature Meters CMF300A, CMF300E, CMF400A or CMF400E

Application

Coker feed furnace pass flows

ELITE High Temperature Meters -

CMF300A and CMF400A: rated to 650°F

CMF300E and CMF400E: rated to 800°F

Customer Challenge #2 - Coker Material Balance

Control Point Challenge: Getting an accurate and reliable material balance around the coker is challenging, making optimization difficult.

Solution: Direct mass measurement, which is independent of composition changes leads to very accurate and reliable measurement for all fluid streams around the coker, allowing for an accurate material balance.

Competing Technology: Orifice dP, wedge meters.

Micro Motion ELITE CMF300, CMF400 and ELITE High Temperature Meters CMF300A, CMF400A

Application

Coker feed, recycle, fractionator products

Customer Challenge #3 - Reliable Anti-foam Injection

Control Point Challenge: Anti-foam chemicals, used to prevent coke drums from foaming over, are difficult to measure with conventional technology.

Solution: Use of Micro Motion meters on the highly viscous anti-foam will insure reliable measurement verifying the flow of antifoam and preventing foaming problems in the coke drums.

Micro Motion offers a non-Newtonian meter sizing tool which is specifically designed for viscous, non-Newtonian fluids, helping to ensure proper sizing and performance of the meter.

Competing Technology: Metering pumps

Micro Motion ELITE CMF025

Application

Anti-foam chemical injection to the coke drums

Resources

Petroleum Refining, Technology and Economics, Third Edition

Refining Process Services, Introduction to Petroleum Refining Industry, prepared for Emerson Process Management, Nov. 2001

Hydrocarbon Processing Magazine, November 2000 issue, p.104

EMERSON™ Process Management

