MESSER
Gases for Life

Refineries.

Oxygen for the Claus process.

Background

Most refineries operate at least one Claus unit for desulfurization of gas streams rich in H_2S. Not seldom, gas from a sour water stripper (SWS) unit, containing considerable amounts of ammonia (NH_3), is admixed into this feed. If this feed component is not effectively destroyed in the Claus furnace, it tends to build up solidified ammonia salts in colder areas within the process gas path. Especially in the long run, these deposits can cause plugging and corrosion – which in turn considerably jeopardize a reliable Claus operation.

Gas application

O_2 enrichment for Claus process stabilization

Effects of O_2 enrichment

The addition of oxygen into the combustion air leads to an increased O_2 content in the gas stream. This so-called O_2 enrichment – among other benefits – allows for operation with a significantly increased H_2S capacity. It also increases the temperature in the first Claus step, a furnace. This allows for a more effective destruction of NH_3 within this thermal section, thus contributing to the long-term stabilization of the Claus operation.

Situation on site in 2003

In order to comply with regulations which were to become valid in 2005, one customer was looking for an environmentally friendly way of SWS gas treatment.

There were basically two options to deal with the task:

1. Erection of a new process unit treating SWS gas for separation and subsequent destruction of NH_3 (a high-investment measure)
2. Utilization of the existing Claus unit by adding SWS gas into the corresponding feed stream

In view of the notorious effects of ammonia salt deposits, O_2 enrichment appeared to be the most cost-effective method of NH_3 removal.

Measures since 2003
In the summer of 2003, tests with O_2 enrichment were performed at the Claus unit to confirm the expected effects. The test results gained in close cooperation with Messer clearly confirmed that NH_3 destruction within the Claus furnace is substantially more effective when additional oxygen is being used than with routine air-only operation.

As a consequence, it was soon decided to use the Claus unit for SWS gas processing and to implement the supporting O_2 enrichment technology as a flexible minor-investment solution.

Claus capacity (air-only mode)
5 tons/day of elemental sulfur

Tail gas treatment applied downstream of the Claus unit
Catalytic hydrogenation and H_2S scrubber ("SCOT-like")

H_2S in the feed stream
Approx. 90 volume percent

NH_3 in the feed stream
A few percent, due to SWS gas processing

Main purpose of O_2 application
Optimization of NH_3 destruction for enhanced reliability of Claus operation

O_2 content of the O_2-enriched combustion air
26–28 volume percent

O_2 trials in coop. with Messer
08/2003 (duration: 4 days)

Contributions to the O_2 trials
Messer provided substantial support by services (e.g. calculations and NH_3 determination) and hardware such as the appropriate measurement and control device (OXYBOOST™ flow control skid) for O_2 dosing. Please note: No third party had to be involved in the trial execution.

Start-up
Routine operation with O_2 since 04/2005

Mode of O_2 supply
Liquid oxygen (LOX) to tank/vaporizer system

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