

LO-CAT[®] PROCESS

LO-CAT II PROCESS FOR CHEMICAL PLANT DESULFURIZATION



KRONOS' facility in Leverkusen, Germany produces titanium dioxide, the most important material used by the paints and plastics industry for whiteness and opacity. When new German guidelines set maximum emission limits for SO₂ in 1989, KRONOS was required to eliminate the COS from the off-gas at their titanium dioxide production facility to meet the new requirements. Complicating this application, the COS removal process that KRONOS needed had to be built in an area with other existing processes, so its design was quite intricate. Since plot space is limited at the Leverkusen site, the unit also needed to be placed on various levels of a building housing other proprietary processes.

Titanium dioxide pigment is a fine white powder used in paints, plastics or paper to provide for maximum whiteness and opacity. It gives paint high hiding power, meaning the ability to mask or hide a substrate. It does this more effectively than any other white pigment. Today, titanium dioxide pigment is by far the most important material used by the paints and plastics industry for whiteness and opacity.

Why is H₂S Removal Needed?

In the second to the last step of the off-gas cleaning process, chlorinators are used to make the TiCl₄, the precursor for pigment production. The off-gas product contains many harmful compounds such as COS, SiCl₄, and HCl. When the off-gas is sent to the thermal converter, the COS converts to CO₂ and SO₂. In 1989 German guidelines set maximum emission limits for SO₂ at 500 mg/m³. With this requirement, KRONOS was required to eliminate the COS from the off-gas.

Gas Technology Products

Merichem Chemicals &
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Options for COS Removal

KRONOS determined it had three options to remove the COS from the process gas:

- (1) Limestone scrubbing—resulting in the formation of gypsum that, based on German regulation, must be land-filled, a costly alternative.
- (2) Directly remove it with organic chemical scrubbing—a restricted process with tight specifications.
- (3) Convert to H₂S—the most logical solution. The requirement was a 98% removal.

There are a number of processes that can convert COS to H₂S; KRONOS evaluated 10 technologies and in 1991 LO-CAT was chosen as the best alternative based on:

- Technology reliability
- Sulfur product to be sold to nearby company for sulfuric acid.
- Flexible operation
- Recommended by Lurgi (licensor of LO-CAT in Europe at that time)

LO-CAT Unit Current Operating Conditions

The LO-CAT unit was custom designed to treat up to 4,500 m³/hr of off-gas per train at 100 mbar, containing up to 0.4 vol.% H₂S. Approximately 0.6 tons/day of sulfur are removed in the LO-CAT unit.

LO-CAT Process Flow

For H₂S removal and conversion to elemental sulfur, a Venturi Pre-Absorber and a Mobile Bed Absorber (MBA) are utilized. The Venturi removes approximately 60% of the incoming H₂S, while the MBA removes the remaining H₂S for an overall removal efficiency of 97.0%. The sulfur slurry that is formed in the absorption section flows into the oxidizer vessel.

The oxidizer vessel has several purposes: (1) Serves as the vessel

where regeneration of the spent catalyst takes place under the presence of air, (2) acts as a separator where the sulfur product settles out in the cone bottom, and (3) acts as a heater and/or cooler for the chemical solution.

For sulfur product filtration, KRONOS chose a compact centrifuge system based on their minimal space requirement, minimal manpower requirement, and sulfur quality acceptable for sale to end-use customers. It does not run continuously, as it depends on the sulfur load in the unit.



Centrifuge

The KRONOS LO-CAT unit was built in a limited plot space at the Leverkusen site, and so the LO-CAT unit is placed on various levels of a building housing other proprietary processes. Absorbers are near the top of the structure, the oxidizer a level or two below, and then the sulfur separation equipment is on the first floor and ground level to ease in sulfur product removal.



Sulfur Cake

According to Dr.-Ing Rainer Gruber of KRONOS INTERNATIONAL, Inc., "A real plus is the robustness of LO-CAT. Most of the time it requires very little attention and just does its job quietly. We like that very much."

Future Considerations

The LO-CAT unit has continued to operate reliably for KRONOS over the past 15 years. As local German environmental laws change, KRONOS will continue to work with GTP to assure the LO-CAT unit removes H₂S long into the future. Changes likely will be increasing H₂S removal ability in the absorption section to handle increased H₂S inlet concentrations.

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