

TOPGUN

RESEARCH | TECHNOLOGY | CATALYSTS



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How to optimise your sulphuric acid plant

The performance of a sulphuric acid plant is affected not only by the operating conditions imposed on the plant and the activity of the catalyst installed but also by the mechanical state of equipment such as heat exchangers and the converter itself. Tracing leaks in the mechanical parts and estimating catalyst activity by conventional analyses are difficult and encumbered with considerable uncertainty.

TOPGUN

Since 1997, Topsøe's Portable Gas Analysis Unit (TOPGUN) has proved an extremely efficient tool in assisting sulphuric acid producers in troubleshooting and optimisation of plant performance, and in providing a solid basis for planning of turnarounds.

TOPGUN is a gas analysis unit combining infrared measurement of SO₂ and electrochemical measurement of O₂. The fully portable unit is equipped with a built-in calibration cuvette which eliminates the need for calibration gasses on site. Gas samples are taken with special Topsøe-designed sample equipment.

TOPGUN service

The TOPGUN service is teamwork between the customer and Topsøe's service engineer. All equipment required for executing the TOPGUN service will be provided by one of Topsøe's experienced engineers whereas requirements to the plant in connection with a TOPGUN service are accessible and functioning sample points, some assistance during gas sampling and access to operation data.

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A TOPGUN service will typically include SO₂ and O₂ measurements made simultaneously on the inlet and the outlet of the catalyst beds and of all heat exchangers as well as collecting of actual and historical operating data and information on catalyst loading.

The results of the gas analyses and the plant operating conditions are used as input to Topsøe's proprietary simulation program which provides an accurate and reliable simulation of the actual plant performance. This detailed simulation yields valuable information for troubleshooting and optimisation such as:

- identification of gas leaks and by-passes
- evaluation of catalyst bed activities
- catalyst management
- planning of turnarounds
- basis for studies to reduce SO₂ emissions
- basis for studies to increase capacity

The ease of sampling and high speed of analyses enable a full 4-bed converter and heat-exchanger system check within one or two days, provided the plant is running at steady-state conditions. All gas analyses together with our findings, conclusions and recommendations are presented in a comprehensive report shortly after the visit.

Case story

A 3+1 double-absorption sulphuric acid plant treating off-gas from a metallurgical plant had been forced to reduce the production rate due to an unfortunate operating event that resulted in increased SO₂ emissions from the plant, even with a tail-gas scrubber unit running.

To troubleshoot the catalyst and plant performance a TOPGUN service was requested before the next turn-around. Topsøe's TOPGUN service revealed the following:

- the measured SO₂ concentration at outlet last pass was 1500 ppm, corresponding to an overall conversion of only 98.8%
- part of the feed gas was leaking into the second pass
- low catalyst activity in the second pass
- both heat exchangers reheating the gas from the IAT to the inlet of the fourth pass were leaking
- the fourth pass was not operating efficiently due to equilibrium constraints, occurring as a result of a high inlet temperature and SO₃ entering the last pass

The TOPGUN findings proved extremely valuable to the reconditioning of the plant. Partial replacement of the catalyst in the first and second passes with fresh VK38, 12 mm Daisy was done as well. This had as results:

- the SO₂ emission was reduced to normal levels
- the performance of the first and second pass catalyst improved significantly
- the stack SO₃ plume disappeared
- operating the tail gas scrubber unit was rendered superfluous due to improved converter performance

Besides a significant cost reduction in operation of the tail gas unit, the acid production rate could be boosted by 5%.

