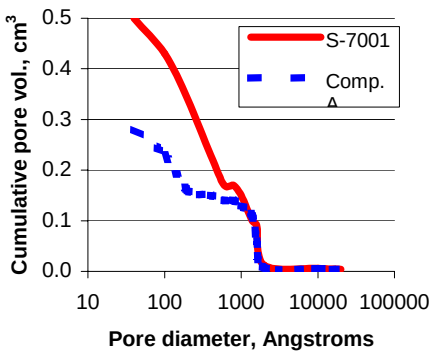
S-7001 ADVANTAGES

Conventional activated alumina Claus catalysts have high activity for converting H_2S and SO_2 to sulfur under most normal conditions. However, alumina has two serious limitations. The first is its limited ability to decompose COS and CS_2, and the second is the overall activity under severe sulfating conditions for even the H_2S/SO_2 reaction. In these two situations, the use of titania catalyst is recognized as the better solution because of its ability to give high conversion of all the sulfur species to elemental sulfur, even under conditions when alumina is deactivated from sulfation.

At the end of 2000, UOP and Euro Support introduced the new titania Claus catalyst, S-7001. Rather than using pigment-grade titania, S-7001 is produced from titania that is specially precipitated for catalyst applications. As a result, it is unique with its well-developed mesoporous and macroporous structure (Figure 1).

Fig. 1: Pore Volume Distributions, S-7001 & Competitor A



S-7001 has higher surface area, greater total porosity, and better thermal stability than have generally been associated with the standard titania Claus catalysts that were previously available (Table 1).

Table 1: S-7001 vs Competitive Titania

	S-7001	Comp. A
Form	Tablets	Extrudates
(mm)	5 x 5	D≈3.2
Surface Area (m^2/g)	>220	114-130
TPV (Hg) (cm^3/g)	0.50-0.55	0.28
TPV (N_2) (cm^3/g)	0.46-0.50	0.21-0.24
Bulk Density (kg/m^3)	700-750	960-1000

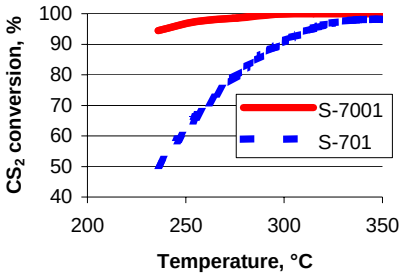
Together with the higher total porosity comes lower bulk density, which means that fewer kilograms are required to fill a reactor, thereby giving a cost savings to the end-user. In spite of this lower bulk density, the physical strength is higher than has been found for most other titania Claus catalysts. This higher strength is partially due to S-7001 being formed by tableting, rather than extruding and partially due to the self-binding characteristics of the catalytic-grade titania. No clay binders are needed or used in S-7001.

The primary reason to use a titania Claus catalyst is to achieve more complete conversion of CS_2 and COS over time than can be accomplished with conventional activated alumina Claus catalysts at normal or lower than normal first converter temperatures. Titania Claus catalysts are also used in the last Claus converter to maintain high activity where the low operating temperatures can make alumina catalysts more prone to deactivation from sulfate poisoning. When S-7001 was first being developed, its activity was tested by the independent company, GASTEC N.V. GASTEC N.V. is one of the developers of the SuperClaus process[1]. GASTEC's report concluded that

Euro Support B.V.
Korte Gracht 26, 3811 KH Amersfoort, The Netherlands
Tel: +31 (33) 4650465, Fax: +31 (33) 4650721, E-mail: eurosupport@eurosupport.nl

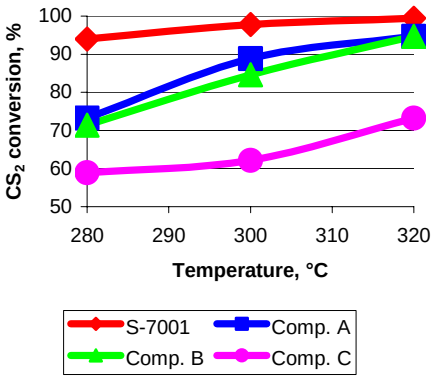
CS_2 was 100% converted at temperatures over 300°C, and COS hydrolysis was 100% at temperatures over 300°C. A plot of the CS_2 conversion results from GASTEC for S-7001 compared to CS_2 conversion results from the pilot plant of Kaiser/LaRoche at the same conditions for the old titania Claus catalyst S-701 is shown in Figure 2.

Fig. 2: S-7001 vs S-701
(GHSV=1200 hr^{-1})



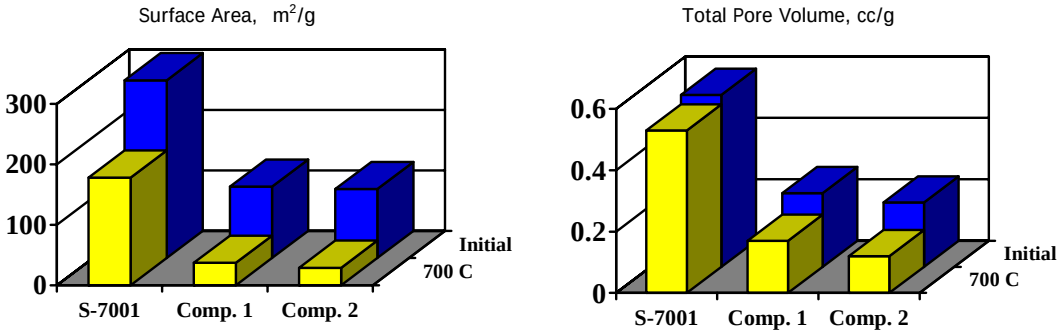
What is most apparent from this comparison is the much superior activity at lower temperatures of S-7001 versus the S-701. As development of the S-7001 continued, Euro Support built their own Claus pilot plant. In this pilot plant, S-7001 was compared to competitive titania Claus catalysts, and again this difference at lower temperatures was seen (Figure 3).

Fig. 3: S-7001 vs Competitive Titanias
(GHSV=2400 hr^{-1})



Not only is initial activity important, but long-term catalyst life is important also. Two of the major modes of deactivation of titania Claus catalyst are surface area and pore volume loss from thermal and hydrothermal aging and fouling from hydrocarbons, especially BTX. As a severe test of thermal stability, the surface area and total pore volume of a sample of S-7001 and samples of competitive titania catalysts were measured before and after treatment at 700°C for one hour. As can be seen from the bar charts in Figure 4, the S-7001 started with higher surface area and pore volume, and it retained higher levels of each after this thermal treatment.

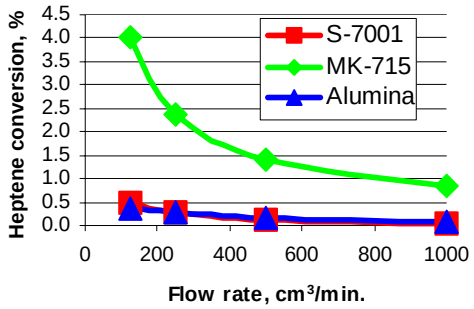
Fig. 4: Comparison of Thermal Stability between S-7001 and Competitive Product



Euro Support B.V.
Korte Gracht 26, 3811 KH Amersfoort, The Netherlands
Tel: +31 (33) 4650465, Fax: +31 (33) 4650721, E-mail: eurosupport@eurosupport.nl

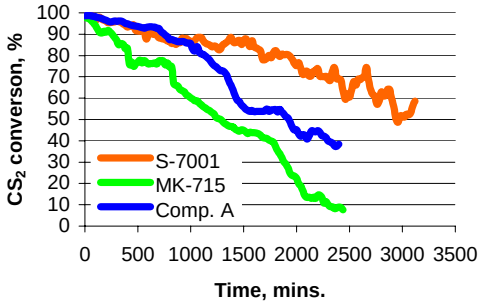
Titania catalyst can be more reactive with hydrocarbons than alumina catalyst. Figure 5 shows a comparison of heptene reactivity between an early developmental titania catalyst, MK-715, and S-7001 and a standard alumina catalyst. S-7001 has been modified so that its reactivity with heptene is at the same level as that of the standard alumina catalyst.

Fig. 5: Heptene reactivity at 425°C



In the paper, "Quantifying the Effect of Individual Aromatic Contaminants on Claus Catalyst", by Pierre Crevier, et al[2], xylenes were identified as the worst aromatic compounds to have in the process gas. For that reason, xylene was used in the feed gas to Euro Support's pilot plant to compare the effect of xylene on the CS_2 conversion activity of different titania Claus catalysts over time (Figure 6).

Fig. 6: Effect of xylene on CS_2 conversion



Again, comparative results are shown for MK-715, S-7001, and a competitive titania catalyst. Among these titania Claus catalysts, the S-7001 showed the lowest rate of deactivation from xylene.

The use of S-7001 has allowed an engineering company to guarantee a Claus performance level that would not have been guaranteed otherwise. There have been no complaints from any customer, and customers have commented that they want to install S-7001 in their other units when catalyst replacement is next required.

1. J.A. Lagas, J. Borsboom, P.H. Berben, and J.W. Geus, European Patent Application no. 0242006.

2. P.P. Crevier, N.I. Dowling, P.D. Clark, M. Huang, "Quantifying the Effect of Individual Aromatic Contaminants on Claus Catalysts", 51st Laurance Reid Gas Conditioning Conference, Norman, Oklahoma, Feb. 25-28, 2001.

Euro Support B.V.
Korte Gracht 26, 3811 KH Amersfoort, The Netherlands
Tel: +31 (33) 4650465, Fax: +31 (33) 4650721, E-mail: eurosupport@eurosupport.nl

There is a new king of the hill...

Still looking for the ideal titania Claus catalyst?

- High Porosity
- High Surface Area
- High Thermal Stability
- Low Density (lower fill costs)
- Exceptional crushing strength

S-7001 Titania Claus Catalyst

Within Europe
Euro Support B.V.
Korte Gracht 26
3811 KH Amersfoort
The Netherlands
Tel: +31 - 33 - 465 04 65
Fax: +31 - 33 - 465 07 21
E-mail: eurosupport@eurosupport.nl

Outside Europe
UOP LLC
25 East Algonquin Road
Des Plaines, IL 60017
USA
Tel: +1-440-734-0086
Fax: +1-440-734-1688
E-mail: Adsorbents@uop.com

euro support

uop™