

## TK-558 BRIM™

FCC pretreater unit (E: Germany)

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After very thorough considerations, a major European refinery installed the cobalt molybdenum based catalyst TK-558 BRIM™ in their large-size FCCU pretreater in June 2008. The full loading of TK-558 BRIM™ was replacing a competitor nickel molybdenum based catalyst.

The FCC pretreater is of modern design and was commissioned in 1997. It has two reactors, where the first is a single bed and the second holds two beds. The unit's nameplate capacity is 11,000 tons VGO per day. The pretreating reactors are operated at semi-high hydrogen partial pressure of up to 85 bar. The unit is typically run in high-severity mode to produce low sulphur fuels and to obtain conversion of VGO into middle distillates.

When this European refiner chose catalyst for the 2008 cycle, emphasis was put on having a treating catalyst that would deliver maximum HDS activity, but without losing any HDN activity compared to the old NiMo catalyst. After running dedicated pilot plant tests on different catalyst options, it was clear that the CoMo based catalyst TK-558 BRIM™ would be an outstanding candidate for this type of feed and process conditions. The main feature of TK-558 BRIM™ is that it provides the same HDN activity as conventional NiMo catalysts, while the HDS activity easily can be 30-40% higher than that of a NiMo catalyst.

The processed feed includes light and heavy vacuum distillates and also some visbreaker fractions. The crude source is mainly Russian Export quality and occasionally opportunity crudes from the spot market.

During the elapsed cycle the unit has been operated in high-temperature mode, i.e. 370-390°C, mainly to satisfy the need for low sulphur FCCU feed but also to boost the production of diesel at the refinery. The unit is actually net producing 10 wt % of LSD (30-70 wt ppm S) along with the high quality FCCU feed production (figure 1).

Also, the removal of basic nitrogen from the VGO is important, because it strongly improves the performance of the FCC catalyst and thereby increases the yield and quality of FCC gasoline. So far, TK-558 BRIM™ has been able to denitrificate the VGO to a nitrogen content as low as 400-800 wt ppm. The feed content is slightly above 2,000 wt ppm. This means that a cobalt molybdenum based catalyst of this type is able to deliver a degree of HDN of 60-80%, which is very impressive (figure 2).

The current cycle with TK-558 BRIM™ has so far lasted 17 months. In that period, the average deactivation has been close to 1°C/month – that is exactly what was predicted before the cycle started (figure 3). The high stability of TK-558 BRIM™ is partly described to the catalyst's unusual high tolerance towards heavy metals. Compared to traditional hydrotreating catalysts the BRIM™ catalysts are less affected by metals captured in the catalyst pores. They will exhibit full activity even after significant contamination due to the unique design of the pore system.

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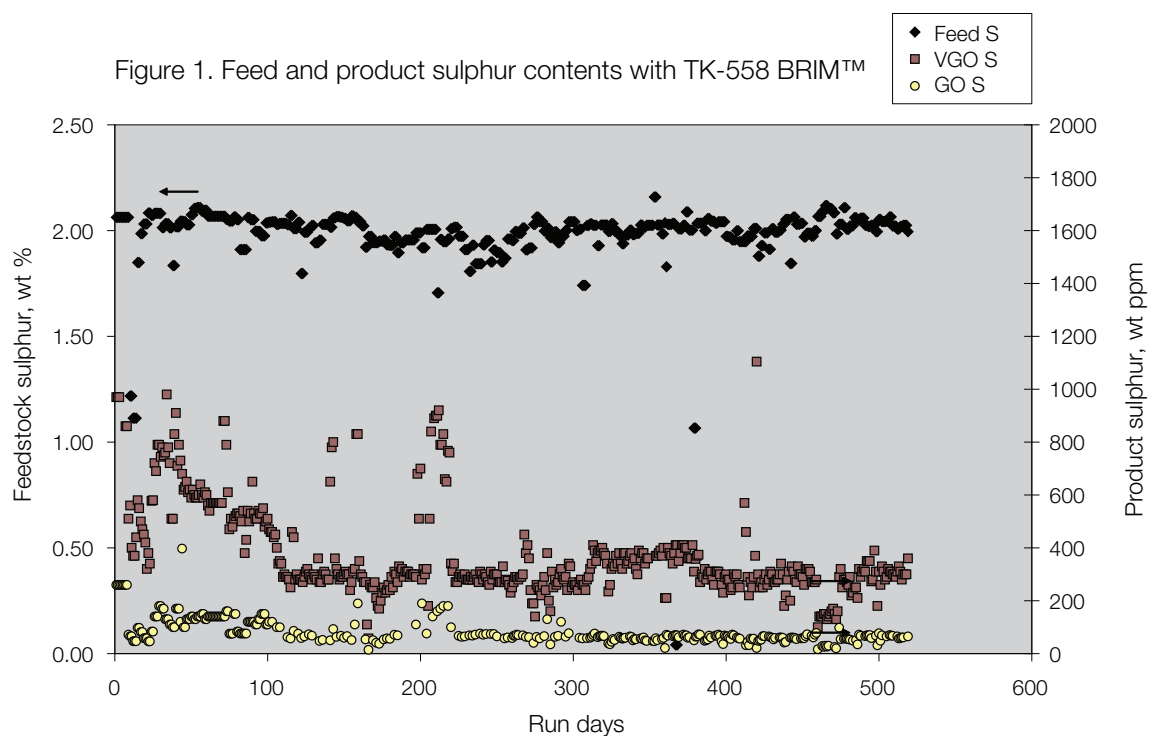
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The feed has the following properties:

Table 1	
Feed type	Light and heavy VGO + VB distillate
Density, kg/m <sup>3</sup>	930
Sulphur content, wt%	2.0
Nitrogen content, wtppm	2,100
Distillation (D-1160), °C	
10%	375
90%	550

The unit is operated at the following conditions:

Table 2	
LHSV, hr <sup>-1</sup>	1.0
Hydrogen pressure, bar	83
Hydrogen to oil ratio, Nm <sup>3</sup> /m <sup>3</sup>	400



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