

## LOADING, SULFIDING, REGENERATION/REACTIVATION

### CATALYST HANDLING & LOADING

By dense loading 15-20% more catalyst can be loaded in the same volume compared to sock loading. Dense loading results in better gas/liquid distribution in the catalyst bed and a 15-20% activity increase. Top layer catalysts are generally not dense loaded to maintain sufficient void/storage capacity for particulates, etc.

### SAFETY

If stored for a long time or at elevated temperatures, STARS catalyst may emit a small amount of carbon monoxide. Please read the safety instructions before handling.

### SULFIDING OF STARS CATALYSTS

STARS catalysts have unique Type II Active Sites, which accept sulfur quite easily. The catalyst activity of STARS catalysts after feed-only presulfiding is equivalent to the activity obtained with DMDS presulfiding. STARS catalysts can be successfully sulfided with feed only, without use of spiking agents. Of course, when desired, the catalyst can also be successfully presulfided with spiked feed.

Feed-only presulfiding saves costs and avoids handling of bad smelling and dangerous presulfiding agents. In practice, a total presulfiding time of about 24 hours has been achieved with feed-only, which is close to the time normally required for spiked feed presulfiding. The feed should be a dry light LGO with an endpoint no greater than 380°C and a sulfur content of at least 0.8 wt%. If such a feed is not available, or if the presulfiding time is critical, a spiked feed presulfiding can be applied using e.g. DMDS or TBPS.

For spiked in-situ sulfiding we recommend applying a spiking agent such as DMDS. Generally we recommend ordering 15-30% more DMDS if :  
the start up feed contains less than 500 ppm sulfur  
H<sub>2</sub> rich gas is not recycled (once through)

### REGENERATION AND REACTIVATION

All our catalysts can be regenerated a number of times. The re-usability depends on factors like contamination, thermal history, mechanical wear, etc. We recommend ex-situ regeneration at Eurecat SA, due to better activity recovery. Our catalysts are typically re-used 2-3 times, although more some refiners have regenerated and reused our catalysts many more times. Part of our Technical Service is to determine the re-usability and make a recommendations of the catalyst for re-use.

The highly engineered Type II active sites on STARS catalysts require much more complex manufacturing processes than conventional hydroprocessing catalysts. In view of the manufacturing complexity, conventional regeneration processes result in a somewhat lower activity recovery than is observed with regeneration of conventional (Type I) catalysts. Modified regeneration methods improve activity recovery but it remains less than with



conventional catalysts. This however does not mean that these regenerated STARS catalysts cannot be reused. Commercial experience with regenerated KF-757 is very good (see also Catalyst Courier no. 47). Close to full activity recovery (> 90%) can be achieved by applying a reactivation process called REACT to STARS catalysts after regeneration.

#### **OPERATING GUIDELINES FOR DIESEL ULTRADEEP (UD) HDS**

The chemistry of producing ultra-low sulphur diesel (<10 or <50 ppm S diesel), dictates the removal of sterically hindered sulfur species present in the oil. Contrary to “easy” sulfur, the sterically hindered sulfur species can only be removed by first hydrogenating the aromatics ring. Therefore conditions and catalysts that promote aromatics saturation will favour the production of ultra-low sulfur diesel. Consequently the H<sub>2</sub> consumption is usually higher at UD HDS conditions, and the impact of H<sub>2</sub> partial pressure on catalyst performance increases. Therefore for ultra deep HDS, we recommend the following:

Monitor your H<sub>2</sub> purity carefully and maximize it as far as possible.

Maintain a maximum H<sub>2</sub> partial pressure and H<sub>2</sub>/oil ratio

Consider a special alarm for your operators in case H<sub>2</sub> purity, ppH<sub>2</sub> at reactor outlet or H<sub>2</sub>/oil drop below a minimum level. H<sub>2</sub>/oil ratio at least 4 times the H<sub>2</sub> consumption to avoid H<sub>2</sub> starvation.

Review your emergency shut down procedures. When make up and recycle gas compressors fail, the risk of H<sub>2</sub> starvation and catalyst deactivation are high. Ensure that the proper actions are taken (also see our technical information HPC12) to minimize the negative effects.