**CATALYST**

33. How much gasoline sulfur reduction can be achieved with the use of additives? Have you seen sulfur reduction in the LCO fraction? How well do these additives perform? Where does the sulfur end up?

a. Grace Davison gasoline sulfur reduction applications provide 20%-35% gasoline sulfur reduction commercially. Current customers have been applying this technology for an average of 2.5 years, including one refiner who has been benefiting from Davison gasoline sulfur reduction for over seven years now. Neptune™ catalyst, our most recent step-out GSR® technology, has commercially lowered gasoline sulfur by 45%.

b. In some applications, sulfur reduction has been seen in the LCO cut, but only for lower boiling point LCO fractions. Grace Davison GSR® products are designed to reduce sulfur species from the gasoline boiling range. If the IBP of the LCO is low, there may be gasoline sulfur species in the LCO stream, and therefore sulfur reduction will occur.

c. The sulfur that is removed from the FCC gasoline boiling range is converted to H₂S in the reactor. This equates to an increase of approximately 1%-2% overall H₂S generation from the FCCU.

**PROCESS TECHNOLOGY**

37. What are the typical sulfur contents of FCC products for various FCC feed types and sulfur levels?

Sulfur content of FCC products is derived from the sulfur present in the FCC feed. Gasoline sulfur typically contains 2%-10% of the FCC feed sulfur, but there are additional variables that can affect the level of sulfur in the gasoline. Those variables include the selectivity of the feed to crack into gasoline range sulfur species, the FCCU operating conditions, FCC catalyst properties, and the gasoline cut point in the main fractionator. One FCC feed type can result in different gasoline sulfur levels in different FCC operations.

Additionally, two different feeds with the same sulfur content can yield different gasoline sulfur levels in the same FCC unit, due to differences in the sulfur selectivities of the feeds.

In Grace Davison GSR® product applications, FCC feed sulfur levels have varied from 0.15% to 2.40% feed sulfur, while gasoline sulfur reduction levels remain consistent at 20%-35% sulfur reduction. Based on a range of data and experience, Grace Davison has not found a direct correlation between FCC feed sulfur content and gasoline sulfur content or gasoline sulfur reduction levels.

Grace Davison GSR® catalysts and additives are successfully used in several different FCC unit operations, in conjunction with a variety of FCC catalyst types and FCC feed types, to provide 20%-45% gasoline sulfur reduction.

**GSR®-5 Reduces Gasoline Sulfur by More Than 40% in India**

In two recent applications of Grace Davison’s gasoline sulfur reduction additive, GSR®-5, in India, gasoline sulfur was reduced by more than 40% without affecting activity and conversion.

GSR®-5 additive can be used with any base FCC catalyst. Typically, GSR®-5 additive is used in place of 25% of catalyst additions. There have been more than 85 worldwide applications of Grace Davison’s gasoline sulfur reduction catalysts and additives since the technology was first introduced to the market in 1996.