ALBEMARLE®

REFINING SOLUTIONS

KETJENFINE RESID® KFR 95

Reduce Sulfur for Low Sulfur Fuel Oil and FCC Feedstock

Petroleum refining has become highly competitive. This environment is forcing refiners to look for superior means of improving refining margins. In addition, refiners also need to find solutions to stringent environmental regulations such as MARPOL for up-grading of heavy oils. Albemarle expects more stringent and challenging conditions for heavy oil hydrotreating especially for Residue Hydrodesulphurization (RHDS) operation in near future.

Over the last decade the RHDS feed metals contents have increased by about 30-50%, resulting in an increased slippage of metals to HDS zone catalysts. We have been continuously working to increase the metals tolerance of the HDS catalyst to tackle this problem. To do so, our research and development has been developing new and innovative catalyst technologies for designing new pore architectures of the catalysts for applications in specific zones in the reactors to improve the stability of the entire catalyst system. For the same, we have recently introduced our latest Hydesulfurization (HDS) catalyst, Ketjenfine® KFR 95, in the market. Ketjenfine® KFR 95 contributes to improving RHDS operation and refining margin by allowing refiners to process more difficult and heavier feedstock of lower cost.

Improved Activity and Stability

To increase the metals tolerance of KFR 95, we have optimized the pore structure of the catalyst for Hydrodemetallization (HDM), HDS and CCR conversion (HDCCR) resulting in longer cycle lengths at higher performance of the loaded total catalyst system.

Figure 1 shows that Ketjenfine® KFR 95 is more active for both HDM and HDS activities than its predecessors and delivers superior performance to the customers.

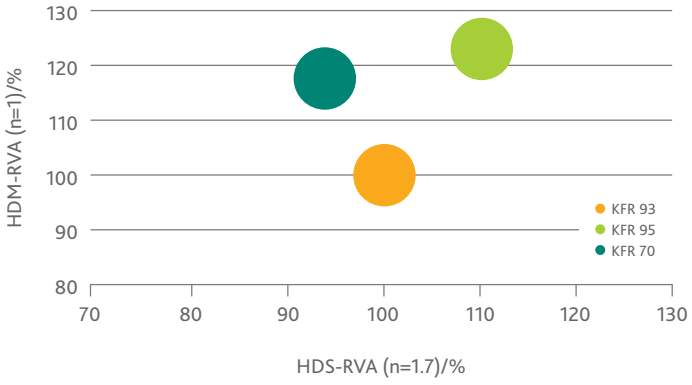

Figure 1: HDS and HDM RVA's of Ketjenfine® KFR 95 in comparison to its predecessors

In many cases, refiners' key objective is to ensure operational reliabilities for the entire cycle length. In order to prove a long-term operational stability and reliability of the newly development, Albemarle and its joint venture, Nippon Ketjen, will serve a rigorous longterm pilot testing program before its application in a commercial refinery unit. This minimizes the risk and the uncertainty for the refiner. Ketjenfine® KFR 95 is the result of the intensive and continuous efforts and has undergone the rigorous testing protocol at our state-of-the- art research facilities at in Japan.

It is a well-known fact that H2S formed in the RHDS process lowers the catalytic activity for hydrotreating reactions such as HDS and HDMCR in fixed bed residue hydrotreating units. The concentration of the H2S increases from the inlet to the outlet of the reactor due to increase in HDS reaction. It is also important to know that the refractory nature of the remained sulfur molecules increases with the increased conversion. Hence the catalyst in HDS zone has to function in such a high H2S treat-gas conditionsand still convert the refractory sulfur containing molecules of highly aromatic resin and asphaltene fractions. Therefore, it is extremely important to develop a catalyst with high H2S resistance. Ketjenfine® KFR 95 is such a solution.

Figure 2 shows the HDS and HDM Relative Volume Activity (RVA) of the newly developed Ketjenfine® KFR 95, showing the activity benefit compared to Ketjenfine®KFR 70 and Ketjenfine® KFR 93.

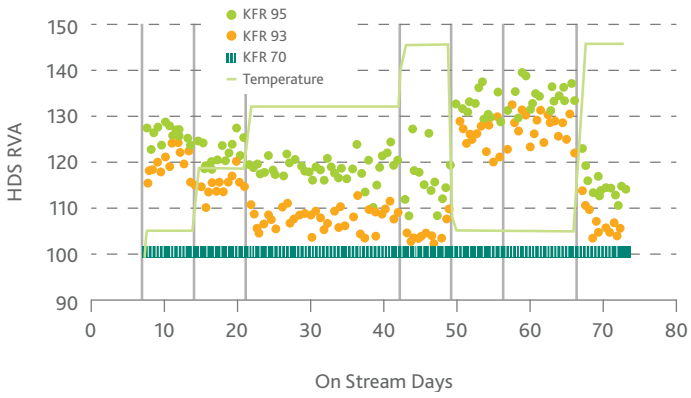

Figure 2: The HDS performance of Ketjenfine® KFR95 compared with Ketjenfine® KFR70 and Ketjenfine® KFR93 on effluent from HDM section as feedstock.

RHDS is one of the challenging processes in an oil refinery to upgrade low quality heavy oils to low sulfur fuels or to easily upgradable FCC feedstock. The complexity of such an operation is increased manifold with an increase in feed density and an increase in associated contaminants along with the constantly tightening pollution norms. This pushes the modern day RDS operation to look for a high activity catalyst system which can also provide increased stability.

Albemarle along with our joint venture partner NK is currently in the process of launching its next generation of RDS catalyst portfolio. To provide the petroleum oil industry with such solutions, we have been continuously developing RHDS catalysts as shown in Figure 3.

Albemarle has also developed a unique STAX modeling tool to help enable the catalyst loading optimization for meeting product specifications and cycle length. Albemarle and NK are ready to offer the best reliable catalytic solutions to the customers while leverage the latest catalytic portfolio and unique STAX modeling.

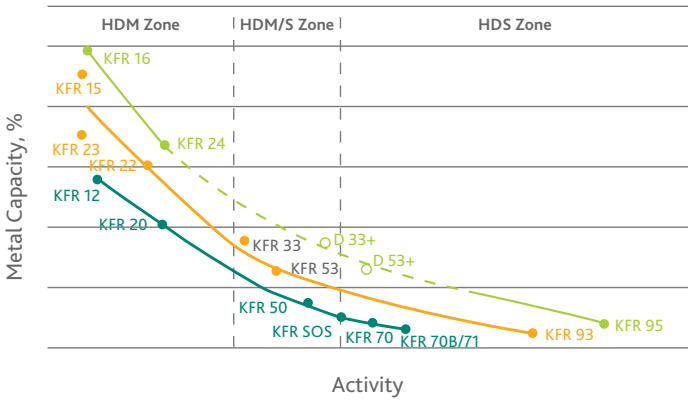

Figure 3: Different generations of KFR Catalyst Grades

Comprehensive support

Albemarle can design the best catalyst system with KFR series catalysts for your individual requirement and target. Please make contact to representative at your location or e-mail.

Albemarle also offers comprehensive technical support, such as assistance during start-up, regular unit monitoring and troubleshooting. With the expert support, refineries can continuously optimize unit performance by adapting processing conditions to meet variations in feed diet or in product quality driven by market needs or refinery optimization.

Table 1 below shows the typical properties of the Ketjenfine® KFR 95.

Typical product properties	
Catalyst name	KFR 95
Application	Resid HDS
Sock loading density, kg/m3	605
Dense loading density, kg/m3	710
Shape	1.3Q

FOR MORE INFORMATION ON THIS OR OTHER ALBEMARLE PRODUCTS AND TECHNOLOGIES, PLEASE CONTACT YOUR ALBEMARLE REPRESENTATIVE.

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