CRITERION
CATALYSTS & TECHNOLOGIES

DIESEL DEWAXING CATALYSTS

Maximising middle distillate yields while maintaining excellent cold flow properties

In recent years, diesel dewaxing has emerged as a powerful technique for meeting product specifications and creating additional margin.

To avoid wax compounds crystallising out and causing engine problems, the cold flow properties of diesel fuels that are to be marketed in cold climates must meet stringent specifications. Dewaxing can be used to remove the wax for meeting the required values for cloud point, pour point and cold filter plugging point, and this can be often a better economic option than the alternative techniques, which include additivation and kerosene blending.

Criterion Catalysts & Technologies (Criterion), along with its affiliate the technology licensor Shell Global Solutions, has established an enviable track record of working with customers to design and implement value-adding dewaxing projects that meet their objectives.

CONFIGURATION OPTIONS

Criterion recommends two main process configurations for catalytic dewaxing, and offers a dewaxing catalyst for each (Figure 1). These configurations are:

- **single-stage dewaxing.** The dewaxing bed is part of the main hydrotreating section, and a base metal dewaxing catalyst (SDD-800) is used that can withstand the severe operating conditions that are encountered. This configuration can provide a low-cost and flexible solution.
- **second-stage dewaxing.** A dedicated second-stage reactor downstream of the hydrotreating reactor provides a cleaner environment (low sulphur and nitrogen) so that a high-activity noble metal catalyst (SDD-821) can be used. Investment costs may be higher with this configuration, but product qualities and yields can be maximised.

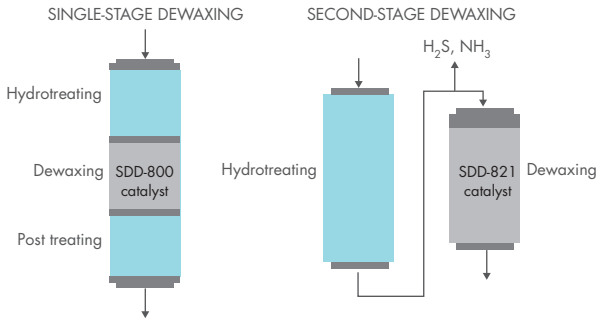

Figure 1: Single- and second-stage dewaxing configurations.

DEWAXING CATALYSTS AT A GLANCE		
Catalyst name	SDD-800	SDD-821
Application	First-stage dewaxing	Second-stage dewaxing
Chemistry	Base metal (Ni)	Noble metal (Pt)
Diesel yield	High	Very high
Hydrogen consumption	Low	High
Cetane boost	No	Yes
Hydrogenation	No	Yes

Performance level is a relative indication only.

BUSINESS VALUE

Catalytic dewaxing has helped refiners around the world to unlock substantial value by helping them to:

- maximise the yield of high-value distillates. The addition of kerosene to the diesel oil pool is a common solution for meeting cold flow specifications; however, that detracts from the bottom line.
- enhance margins. Diesel dewaxing avoids the need for expensive additives. In addition, it can facilitate the use of cheaper feedstocks that have a higher cloud or pour point, or more wax.

SDD-800 AND SDD-821 CATALYSTS WERE SPECIFICALLY DEVELOPED TO ENHANCE COLD FLOW PROPERTIES AND HAVE ESTABLISHED AN EXTENSIVE TRACK RECORD THROUGH HAVING MORE THAN 40 CURRENT OR IMMINENT COMMERCIAL APPLICATIONS.

ABOUT THE CATALYSTS

SDD-800 is a selective-cracking dewaxing catalyst specifically for single-stage dewaxing: it is very robust and tolerant to hydrogen sulphide (H_2S) and ammonia (NH_3). It has a proprietary formulation that minimises distillate yield loss in dewaxing mode, decreases by half the naphtha production compared with a conventional dewaxing catalyst and maximises the cycle length between regenerations (cycle lengths of up to seven years have been achieved). SDD-800 employs a base metal (nickel) that is suitable for operating under high concentrations of H_2S and NH_3.

SDD-821 is a state-of-the-art isomerisation dewaxing catalyst for use in a "clean" second-stage environment: the milder process conditions and the low levels of inhibitors that are present in the second-stage reactor enable the use of this high-activity noble metal (platinum) catalyst. Extremely high yields of dewaxed diesel can be generated.

Product distribution (wt%)	Single stage (SDD-800)	Second stage (SDD-821)
C1-C4	4.3	0.2
C5-177°C	9.2	5.9
177°C+	86.7	94.5
Total	100.2	100.6

Table 1: The difference in product distribution and yield between single- and second-stage catalytic dewaxing at a 20°C cloud point improvement.

PROOF POINTS

KREMENCHUG REFINERY

Kremenchug refinery in Ukraine selected Shell Global Solutions dewaxing technology and Criterion dewaxing catalysts SDD-800 for a 25,000-bbl/d hydrodesulphurisation (HDS)/dewaxing unit in a single-stage configuration. The dewaxing technology enables the refinery to produce ultra-low-sulphur diesel with a reduced cloud point.

NORTH AMERICAN REFINERY

A North American refinery revamped a two-reactor HDS/dewaxing unit with a history of rapid dewaxing catalyst deactivation that led to high-temperature operation and reduced diesel yields.

During the revamp, the refinery changed the service of the lead reactor to another application, leaving only one reactor for HDS and dewaxing. The main objectives of the new operation were to achieve the sulphur specification along with a minimum cloud point improvement of 14°C during the winter mode of operation (six to seven months per year).

The solution involved Shell Global Solutions dewaxing technology, Criterion's SDD-800 catalyst and a Criterion HDS catalyst (Centinel DN-3110). Six weeks after the unit's start-up, a performance test run in winter mode successfully achieved a feed rate 12% higher than design. At the end of the planned cycle, there had been minimal deactivation of the dewaxing catalyst and the refiner was able to reuse it without regeneration in the subsequent unit cycle.

CONTACT US

For more information about how we can help you to enhance operational performance, meet increasingly stringent environmental regulations and increase revenues, visit us at **www.criterioncatalysts.com.**