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Growing earnings in times of change with the new high-performance Celestia™ hydrotreating catalyst

A white paper

Refiners face numerous internal and external challenges to maintain profitable operation. Key focus areas for refiners to remain competitive include: reducing feed costs, maximizing high value products, optimizing capacity, and meeting more stringent regulations. Optimizing supply and operation around these key factors is critical to achieving maximum profitability. Catalyst technology improvements help refineries deal with the challenges. If we consider a typical activity improvement of 10% versus a previous generation of catalyst from the same vendor, the value is limited to only one of the following benefits:

1. Feed rate increase or upgrading challenging feeds: assumes the refiner operates to a fixed run length, and processes higher feed rate or more difficult feed quality to produce constant product quality.
2. Cycle length improvement: assumes the refiner operates fixed feed rate and quality, initiates the cycle with lower WABT therefore allowing the unit to run to longer cycle length.
3. Product quality improvement: assumes constant feed rate and quality, fixed cycle length, but the refiner benefits from processing to an improved product quality.

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ExxonMobil and Albemarle launched the first commercial bulk metal catalyst in 2001. The commercialization of Nebula® catalyst represented a whole new class of hydroprocessing catalysis innovation, and one that reset industry expectations for activity advantage. For over 15 years, the higher activity advantage has led to Nebula catalyst being a proven commercial success, adding value for refiners across the industry.

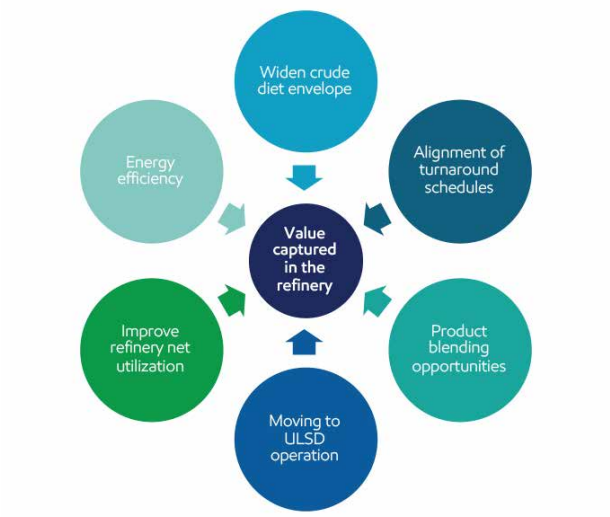
The exciting news, is that ExxonMobil and Albemarle have teamed up to develop and commercialize the Celestia™ catalyst - a second generation bulk metal catalyst offering even greater hydroprocessing margin potential. The new ultra-high activity catalyst is commercialized by ExxonMobil in distillate and hydrocracking pretreat units, and has demonstrated step-out activity and performance over Nebula catalyst! The Celestia catalyst has taken hydroprocessing activity and margin potential to new levels showing over three times higher activity versus leading NiMo conventional catalysts.

ExxonMobil has loaded the Celestia catalyst in stack loads with Nebula catalyst and conventional NiMo catalysts, benefitting from careful planning and intelligent loading schemes designed to maximize value potential. An illustration of the Celestia catalyst's impact can be seen from a heavy feed VGO hydrocracking unit, by incorporating a partial fill of Celestia and Nebula catalysts pretreat reactor, co-loaded with a leading NiMo catalyst, the unit gained a transformative activity boost, providing a platform for ambitious high margin process planning.

With Celestia catalyst ExxonMobil set about benefiting from all 3 margin opportunities – simultaneously achieving increased feed rate, cycle length, and improved product quality. In addition, the company achieved significant energy savings and improved yields.

The benefit was substantial rather than incremental

Fig 1. Value captured in the refinery:



The addition of the Celestia catalyst produced significant value to the VGO hydrocracker operation:

- The feed rate of a highly challenging coker VGO was maximized
- Significantly reduced Nitrogen slip
- Increased aromatic saturation and unit conversion with higher, diesel and jet yields
- Improved product quality, including diesel cetane and jet smoke point
- Hydrocrackate export quality improved, leading to higher profitability in an affiliate steam cracker
- Higher heat recovery leading to a reduction in furnace firing and significant energy savings

In summary, this groundbreaking hydroprocessing Celestia bulk metal catalyst offers refiners substantial opportunities for increased activity and value. ExxonMobil's experience proves that value can be simultaneously achieved from multiple sources. This enables a fast and effective payback within a few months as well as continued and enhanced profit contribution. The Celestia catalyst offers substantially higher activity enabling ambitious refiners to think about value differently, discover value beyond activity limitations, and accelerate profit maximization.

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