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Catalysts for FCC Pretreatment

Where Metals Capacity Counts!

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Reliable performance from the FCC Pretreater has always been an important issue for refiners because of the beneficial impact the Pretreater has on FCC bottoms conversion and FCC gasoline production. The 2004+ requirement for 30ppm-sulphur gasoline in the United States, as well as gasoline sulphur reductions around the world, add complexity to FCC Pretreater/ FCC economics as increased sulphur removal will be required and thus reliability problems will carry larger economic consequences. These changes will create even greater demands for consistent, reliable performance from the Pretreater/FCC complex. As a result, the Pretreater catalyst's ability to achieve the required performance over the planned cycle becomes an even more important factor in the catalyst selection process.

FCC Pretreater catalyst selection should consider all performance variables that impact FCC product properties and yields. The catalyst's nitrogen and aromatic saturation activity remains a key consideration for FCC yields, while enhanced desulphurization activity has priority for FCC product sulphur properties and SOx requirements. The future scenario, which will demand even better operation reliability, makes catalyst stability an even more critical parameter.

Typically, the FCC Pretreater feed will contain significant amounts of nickel and vanadium that originate from the crude oil and possibly other metals such as silica, sodium, and iron that usually come from upstream refinery processes. All of these can cause the Pretreater catalyst to have unexpectedly higher deactivation rates. This occurs from pore-mouth blockage, loss of active surface area, and interference with the promoter metals as the contaminant metals accumulate on the catalyst. Catalysts that do not have sufficient tolerance and capacity for these contaminant metals may not meet the future stability demands. In the past, metals tolerance of the FCC Pretreater catalyst may not have received as much attention as the other performance variables. However, it should now be a key part of the selection criteria given its impact on the reliability of the FCC Pretreater's operation.

Metals capacity is an important indicator of a catalyst's ability to tolerate contaminant metals and provide stable deactivation characteristics. Figure 1 demonstrates how the increased metals capacity of Criterion's DN-200 catalyst leads to improved activity retention. The Reference A catalyst, which has nearly the same initial activity as Criterion's DN-200 catalyst (Y1 axis), deactivates much more rapidly in this application because it has much less vanadium capacity than DN-200 (Y2 axis). Criterion has designed all of its current FCC Pretreater catalysts (DN-200, DC-200, DN-3110 and DC-2118) to provide high metals capacity for stable, reliable operation.

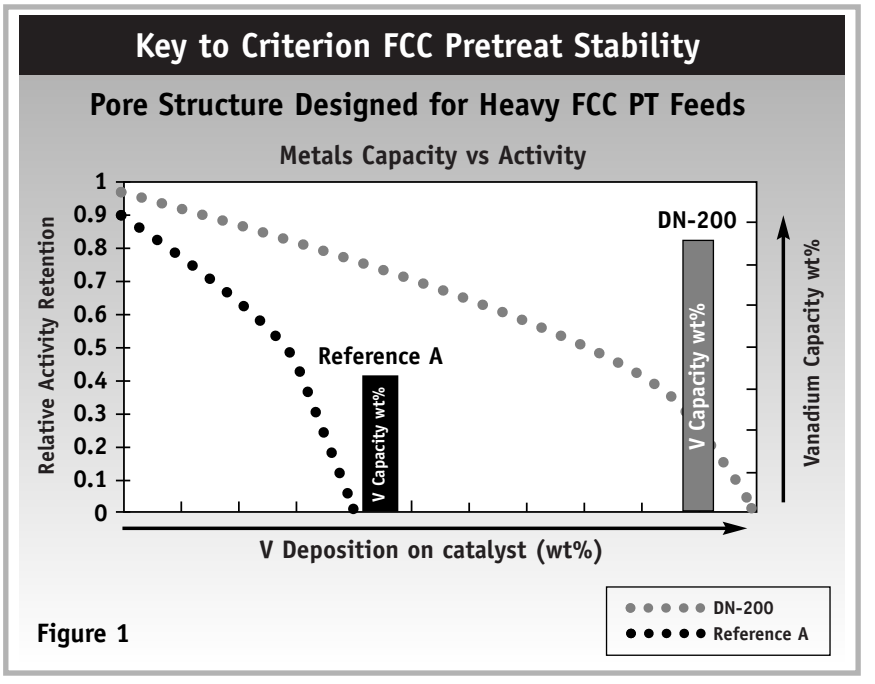


Figure 1

Metals capacities and metals tolerance of hydrotreating catalysts vary widely. Many of today's high activity FCC Pretreat catalysts lose significant activity once they have adsorbed 4 to 7 weight percent metals. On the other hand, catalysts designed solely for demetallization applications can hold up to

100 weight percent of metal contaminants, but they cannot deliver the high levels of desulphurization, denitrogenation and aromatic saturation that are needed for FCC pretreater operation.

Criterion closed this performance gap with the introduction of its DN-200 and DC 200 catalysts. The 200 Series, and the CENTINEL generation of FCC Pretreat catalysts that have followed, have been designed to retain their high activity while processing feeds with high metals content. The pore structure and promoter metal dispersion of these catalysts have been optimized to provide high activity plus 3-5 times greater metals capacity than other FCC Pretreater catalysts. Commercially, these catalysts have withstood as much as 35 weight percent metals accumulation (Figure 2). Criterion's design approach ensures reliable, stable performance in the toughest FCC feed environment, typically demonstrating 50% reductions in deactivation rate versus previous benchmark catalysts. As an example, the deactivation rates of an industry benchmark nickel-molybdenum catalyst and DN-200 over multiple cycles in a commercial FCC Pretreater are shown in Figure 3. The results clearly demonstrate the improved, reproducible benefits that the high metals capacity catalyst provides.

Figure 2

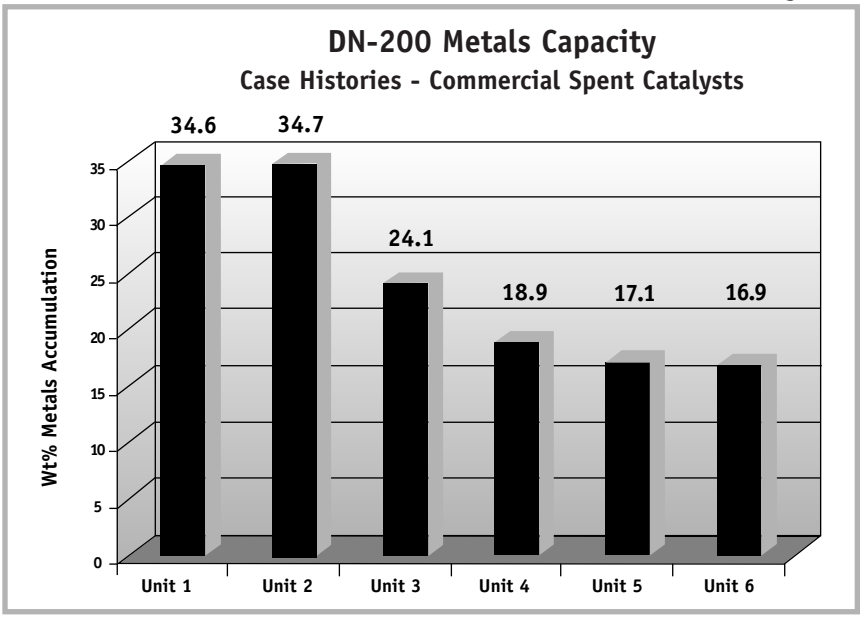
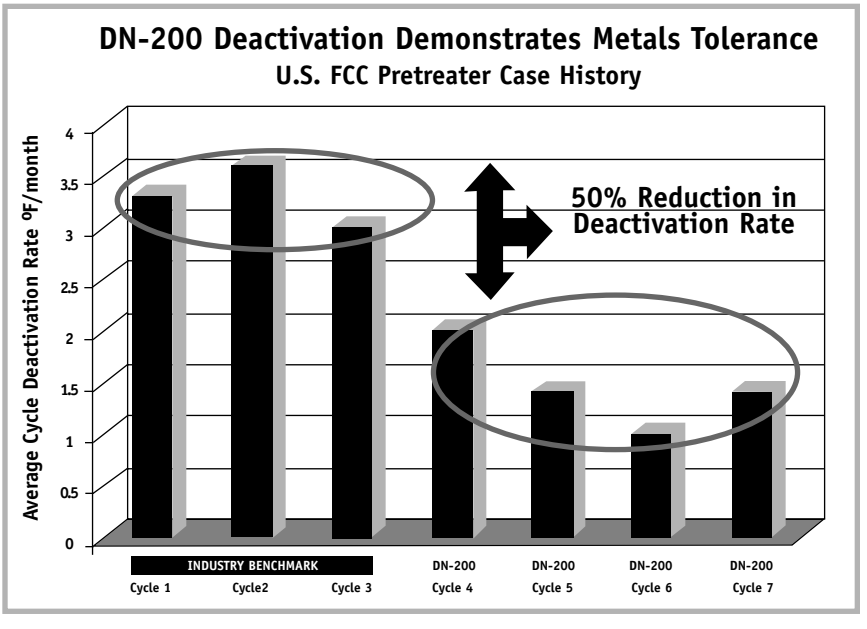


Figure 3



Worldwide, this new generation of catalysts (DN-200, DC-200, DN-3110 and DC-2118) has been installed in over 75 FCC Pretreaters. In all cases, deactivation rates have been significantly reduced compared to operation with the previous catalyst.

Please contact Criterion for additional ideas for increasing the performance of your FCC Pretreater.

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