



UPGRADER™ and UPGRADER R+™ – Improve your FCC unit’s residue feedstock processing and profitability

Unprecedented upgrading of residue in FCC

FCC units using conventional FCC catalysts are severely limited when diffusion constraints control conversion and bottoms upgrading, for example, in heavy-feed and/or short-contact-time operations. Even with high catalyst addition rates, bottoms conversion, catalyst activity and coke and gas selectivity suffer because of the inevitable mass transfer limitations. As a result, the total FCC product value and profitability are compromised.

Albemarle’s new UPGRADER family of premium residue FCC catalysts, which is designed specifically for heavy-feed and diffusion-limited operations, delivers significantly improved diffusion through unsurpassed accessibility, advanced matrix performance and more zeolite-based cracking, which all contribute to superior residue processing.

UPGRADER catalysts were developed through an innovative improvement to Albemarle’s TOPAZ™ manufacturing technology. One measure of UPGRADER’s unique performance is the proprietary Albemarle Accessibility Index (AAI), which directly measures the dynamic diffusion of high-molecular-weight molecules into an FCC catalyst particle and correlates with a catalyst’s ability to crack residue feedstocks. UPGRADER catalysts consistently record the highest AAI levels in the industry.

Albemarle’s latest residue catalyst, UPGRADER R+, takes advantage of the same technology as UPGRADER, but is further optimized for units requiring catalysts with even better coke selectivity characteristics through further adjustment of its metals resistance.

UPGRADER demonstrates AAI increase and record low slurry yields

The true test of a catalyst lies in a commercial FCC unit. Many cases have demonstrated the increase in AAI achieved with UPGRADER. Figure 1 shows that the Ecat AAI of UPGRADER is 2.5 higher than that of OPAL™ 787, Albemarle’s previous-generation high-accessibility residue catalyst.

UPGRADER: THE ULTIMATE RESIDUE CATALYST CRACKING FOR RECORD LOW SLURRY YIELDS

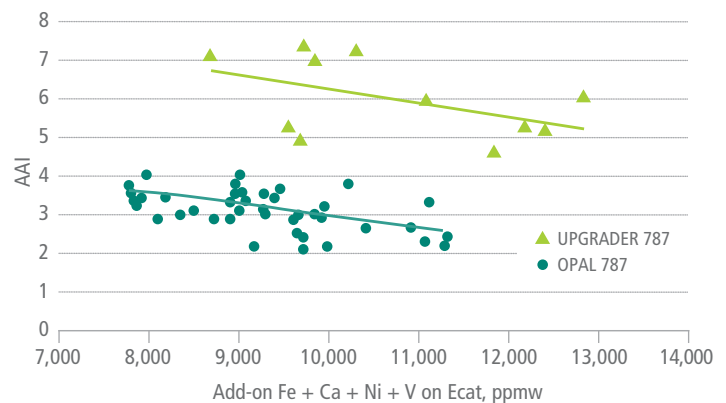


Figure 1: The Ecat AAI of UPGRADER compared with that of OPAL™ 787.

A second example in Table 1 illustrates the massive upgrading potential of UPGRADER in a residue FCC unit that is sensitive to the diffusion of large residual hydrocarbons. The refiner processes a feed with a density of 0.90, a Conradson carbon residue of 3.5 wt% and a total of 10,000-ppm nickel plus vanadium on Ecat. The refiner was using a competitor’s catalyst, but was unhappy with the high slurry yield and decided to replace its catalyst with UPGRADER. This catalyst reduced the slurry yield by an impressive 33%, thanks to the advanced matrix performance and the 50% higher catalyst accessibility (AAI).

	Competitor	UPGRADER
Yields		
Fuel gas, wt%	2.6	2.4
LPG, wt%	11.3	10.7
Propylene, wt%	2.8	2.7
Total C4, wt%	7.6	7.2
Gasoline (C5–221°C), wt%	41.4	44.0
LCO (221–400°C), wt%	26.2	28.4
Slurry, wt%	12.4	8.4
Coke, wt%	6.0	6.1
Conversion, wt%	61.4	63.2

Table 1: The upgrading potential of UPGRADER in a residue FCC unit that is sensitive to the diffusion of large residue hydrocarbons.

UPGRADER R+ demonstrates improved coke selectivity and lower slurry yield

Another example (Table 2) shows the potential of the technology used in UPGRADER R+. Here, UPGRADER R+ replaced Coral SMR™ in a UOP side-by-side unit processing a residue feedstock with density of 0.912, a Conradson carbon residue of 1.5 wt% and a nickel plus vanadium on Ecat totaling about 5000 ppm. UPGRADER R+ has better metals resistance to improve coke selectivity. This modification leads to a lower regenerator temperature (by 7°C) and a higher catalyst-to-oil ratio, which reinforces the conversion and cracking deeper into the bottom of the barrel by more than 3 wt%.

What this means for you

A higher quantity of valuable products, no matter what the quality of the feedstock, is the goal of every refiner. Albemarle's UPGRADER family of premium FCC catalysts delivers breakthrough performance for cracking residue feeds. UPGRADER and UPGRADER R+ deliver

- unsurpassed accessibility for better slurry destruction, which results in lower bottoms yield, reduced overcracking and, ultimately, higher LCO production for the diesel pool
- improved coke selectivity for increased throughput or processing of more residue
- greater catalyst activity and stability for enhanced cracking
- reduced hydrogen transfer, which results in higher olefinicity and octane combined with increased gasoline yield.

Get the most from your residue feedstocks with UPGRADER catalysts – only from Albemarle.

	CORAL SMR	UPGRADER R+
Yields		
Fuel gas, wt%	Base	-0.2
LPG, wt%	Base	2.0
C3=, wt%	Base	0.7
iC4=, wt%	Base	0.3
iC4, wt%	Base	0.5
Gasoline, wt%	Base	1.5
LCO, wt%	Base	0.2
Slurry, wt%	Base	-3.5
Coke, wt%	Base	0.1
Conversion, wt%	Base	3.3
Product properties		
C4 olefinicity	Base	0.02
MON	Base	1.0

Table 2: The commercial application of UPGRADER R+ demonstrates strong slurry destruction.

UPGRADER R+: COMBINES CRACKING THE BOTTOM OF THE BARREL WITH LOW COKE YIELD

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