



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, all which 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 a 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 equilibrium catalyst AAI of UPGRADER is 2.5 higher than that of OPAL™ 787, Albemarle's previous-generation, high-accessibility residue catalyst.

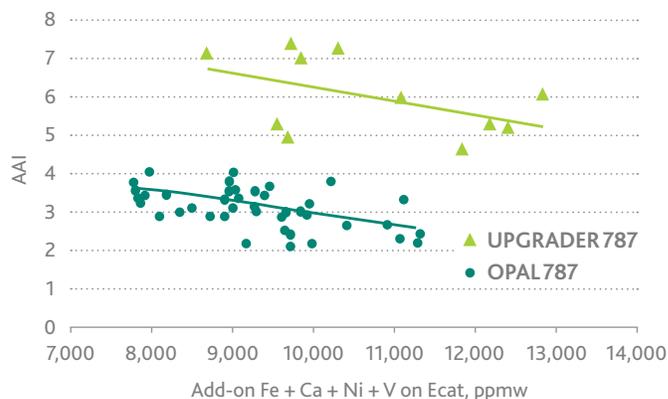


Figure 1: The Ecat AAI of UPGRADER compared with that of OPAL™ 787

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: the ultimate residue catalyst cracking for record low slurry yields.”

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 equilibrium catalyst 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.”

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

AMERICAS: 13100 Space Center Blvd • Houston, TX 77059 • USA • Tel: +1 281 480 4747 • Email: catmaster@albemarle.com

EUROPE AND AFRICA: Nieuwendammerkade 1–3 • 1030 BE Amsterdam • The Netherlands • Tel: +31 20 634 7300 • Email: catmaster@albemarle.com

MIDDLE EAST AND INDIA: PO Box 293774 • 6W Block A, Office 201, 2nd Floor • Dubai Airport Free Zone • Dubai • Tel: +971 4 701 7770 • Email: catmaster@albemarle.com

ASIA PACIFIC: Room #3202, Gopher Center • No. 757 Mengzi Road • Huangpu, Shanghai 200023 • China • Tel: +86 21 6103 8666 • Email: catmaster@albemarle.com

www.albemarle.com

The information presented herein is believed to be accurate and reliable, but is presented without guarantee or responsibility on the part of Albemarle Corporation. It is the responsibility of the user to comply with all applicable laws and regulations and to provide for a safe workplace. The user should consider any information contained herein, including information about any health or safety hazards, only as a guide, and should take those precautions that are necessary or prudent to instruct employees and to develop work practice procedures in order to promote a safe work environment. Further, nothing contained herein shall be taken as an inducement or recommendation to manufacture or use any of the herein described materials or processes in violation of existing or future patents.