

CORAL Improving Resid FCC unit performance

Mass transfer limitations

Many FCC units experience losses in conversion and bottoms selectivity as a result of mass-transfer limitations. These are due to the problems that high-molecular-weight, sterically hindered feed molecules experience when diffusing into catalyst particles.

Catalyst particle diffusion limitations typically have multiple root causes. The most common causes include short-contact time operations in which the oil riser residence time is less than 2–3 seconds; running heavy feedstocks; and high concentrations of contaminant metals on the equilibrium catalyst.

High concentrations of contaminants such as iron, calcium, nickel, and vanadium form deposits on catalyst particle surfaces, which result in blockage of entrance pores. A few extreme cases have been observed in which eutectic melts have formed glazed surfaces. These deposits form barriers to the diffusion of the high-molecular-weight, sterically hindered feed components into the catalyst particle and result in reduced heavy oil conversion.

Empirical observations consistently demonstrate that many refiners experience a critical accessibility level. This critical level is extremely unit specific and is a function of feed quality, feed-catalyst contact efficiency, riser residence time, equilibrium catalyst metal levels and regenerator conditions. Operating with accessibility levels below this critical point results in conversion losses and reduced motor fuel production together with increases in slurry yield.

Figures 1 and 2 show the presence of an inflection point in the accessibility curves. These yield shifts are consistent for all mass transfer-limited operations. The absolute value of the inflection point differs unit by unit, but the trends are consistent.

Enhanced Accessibility Technology

Albemarle offers a breakthrough catalyst named CORAL designed for resid FCCUs. CORAL has been designed to deliver a high level of particle accessibility by utilizing a novel catalyst assembly technology for enhanced catalyst accessibility.

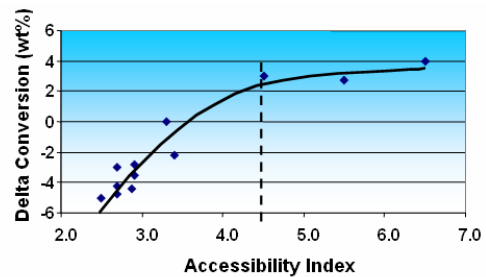


Figure 1: Delta conversion vs. Accessibility

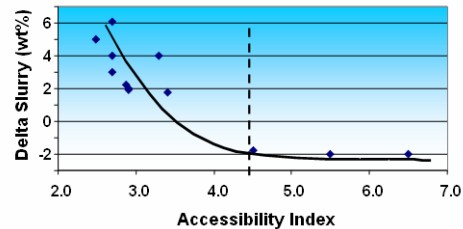


Figure 2: Delta slurry vs. accessibility

CORAL is specifically designed for moderate to high total equilibrium metals and for mass transfer limited resid operations. Furthermore it provides greater resistance to metal poisoning than any other competitor's catalyst. As metals loading on equilibrium catalyst increases the higher accessibility of CORAL provides substantially more capacity to absorb metals without pore blockage. The conclusion is simple: higher fresh accessibility translates into higher metals tolerance, including iron tolerance.

Commercial Results

The commercial data in Table 1 demonstrate the bottoms destroying capability of CORAL.

	Base	CORAL
Operating Conditions		
Feed Density, kg/dm ³	0.9436	0.9438
Basic Nitrogen (ppm)	1032	1128
Feed Rate (m3/day)	Base	Base
RXT (C)	545	548
RGT (C)	705	710
CAR (tpd)	Base	0.73*Base
Yields (wt%)		
Dry gas	4.4	4.2
LPG	14.9	14.7
Gasoline	42.6	44.8
LCO	17.9	17.9
Slurry	14.5	12.8
Coke	5.7	5.6

Table 1: CORAL increased gasoline yield by 2.2 wt% while the catalyst addition rate is reduced by 25 wt%

Figures 3 to 5 give another commercial example of the capability of CORAL to enhance profitability by upgrading bottoms into gasoline at constant feed quality.

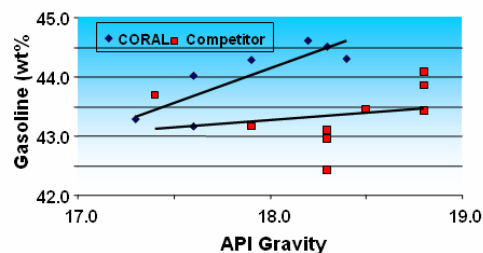


Figure 3: CORAL enhances gasoline yield

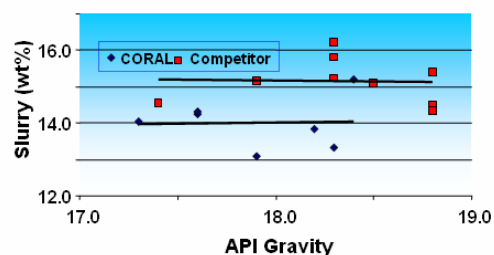


Figure 4: CORAL upgrades slurry

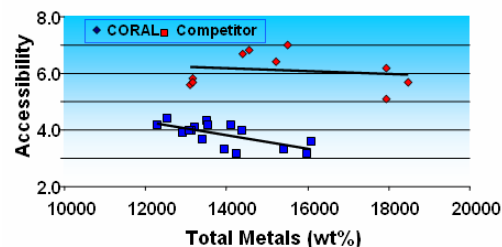


Figure 5: CORAL features enhanced metal tolerance

Let our ingenuity and developments in heavy feed cracking work for you. CORAL catalyst is a proven catalyst featuring excellent metals tolerance and is designed for premium performance in resid operations.

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