

Catalyst & Technology

February/March 2002

News

PS-40

Sales Accelerate

By

Sonny Phansalkar
Cesar Rocher
Stuart Gray
Dean Edgar

Criterion is a leading producer of reforming catalyst for fixed bed semi-regenerative and fully regenerative (cyclic) reformers. Our extruded catalyst is used worldwide in more than 200 reforming units of various licensor designs.

Criterion utilised its extensive manufacturing and commercial experience gained from the fixed bed market to develop an improved spherical catalyst for the moving bed segment of the market.

PS-40 is the latest in a series of spherical catalysts from Criterion Catalysts & Technologies aimed at the continuous catalytic regeneration (CCR) reformer. The original PS series (PS-10, PS-20) catalysts provided enhanced physical strength for a reduction in catalyst fines generation. Similar to PS-10 and PS-20 catalyst, PS-40 has excellent chloride retention leading to less chloride chemicals

usage thereby reducing unit corrosion and chloride salt deposition. The enhanced surface area stability of all the PS-series catalysts leads to longer total cycle life. PS-40, while continuing the improved physical properties, provides greater hydrogen and C₅₊ yield and lower coke on spent catalyst.

Since its introduction in 1998, PS-40's performance has established it as the industry benchmark. Thus far, eight refiners are operating with PS-40 in a CCR. PS-40 has been selected for two more CCRs awaiting start-up. With PS-40 catalyst, these refiners are able to increase feed rate at high-octane severity without having to modify the regenerator. Criterion CCR catalysts are loaded in twenty units and we have changed out five of these "on-the-fly" (while the unit is running) to maximise unit utilization and reduce the payback period.



CRITERION
CATALYSTS & TECHNOLOGIES

Table 1, provides a comparison of PS-40 performance to the previous catalyst loaded in the unit.

Figure 1, gives an example of catalyst fines reduction achieved in a CCR unit when switching to PS-40.

TABLE 1

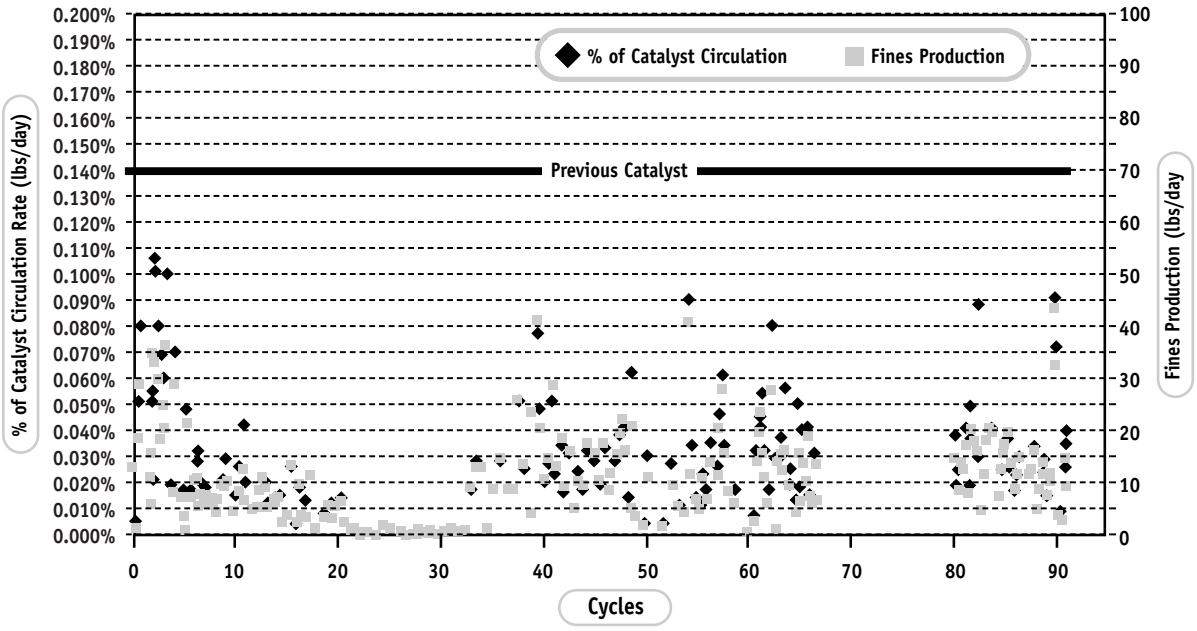
PS-40 vs. Previous Catalyst

| CONDITIONS: | Refinery A | Refinery B | Refinery C | Refinery D |
|--|---------------------|---------------------|----------------------|---------------------|
| Charge, BPSD (kL/day) | 22907(3642) Same | 14000(2226) +15% | 65000(10334) +30% | 14000(2226) +17% |
| LHSV | 1.6 | 2.8 | 2.3 | 2.2 |
| H ₂ /HCBN, molal | 1.6 | 2.1 | 2.7 | 2.5 |
| Avg. RX Pressure, psig (kg/cm ²) | 82(5.8) | 115(8.1) | 115(8.1) | 126(8.9) |
| RONC | 100.3 | 100 | 99 | 96 |
| Catalyst Circulation Rate, lbs/hr (kg/hr) | 1960(889) | 395(179) | 2000(907) | 450(184) |
| FEEDSTOCK: | | | | |
| API (Sp Grav) | 62(0.7313) | 55.2(0.760) | 57.5(0.7467) | 61(0.6991) |
| End Point ^{OF} (°C) | 325(163) | 389(198) | 365(185) | 360(182) |
| Composition, vol% | | | | |
| Paraffins | 66.93 | 45.5 | 61.5 | 72.0 |
| Naphthenes | 22.39 | 42.9 | 19.1 | 18.0 |
| Aromatics | 10.68 | 11.6 | 19.4 | 10.0 |
| PERFORMANCE: | | | | |
| C ₅ + yield (vol%) | +2 | + 1 | +1.5 | +2 |
| H ₂ yield SCFB (Nm ³ /kL): | +20% | +20% | +15% | +13% |
| Coke on Catalyst (wt%) | 20% less | 15% less | 30% less | 35% less |

FIGURE 1

Fines Production

Refinery C, Gulf Coast



Criterion's CCR catalyst

Historical Timeline

Market Milestones

| | |
|--|---|
| <ul style="list-style-type: none"> • 1991, First unit supplied (Phibro Texas City) | <ul style="list-style-type: none"> • 20 CCR units supplied, 13 of these have replaced R-134 • All units supplied have observed less catalyst attrition and decreased chloride consumption • Longest CCR catalyst cycle life > 8 yrs, still in operation • 5 units changed out on-the-fly (without a unit shutdown) • More than 2.5 MMLbs PS-40 sold ytd 3Q 2001 |
| <ul style="list-style-type: none"> • 1993, PS-10 exceeds R-32 performance | |
| <ul style="list-style-type: none"> • 1995, Introduces low Pt PS-20 catalyst and demonstrates it is equivalent in performance to R-134 | |
| <ul style="list-style-type: none"> • 1997, Develops PS-40 a unique low coke-high yield catalyst | |
| <ul style="list-style-type: none"> • 2001, PS-40 selected for the 10th unit | |

The following PS-40 Benefits Provide Rapid Payout

| | | |
|-----------------------------|-----------------|--------|
| C₅+ yield | 1.0 to 2.5 wt % | Higher |
|-----------------------------|-----------------|--------|

| | | |
|----------------------------|-----------------|--------|
| H₂ yield | 0.1 to 0.25 wt% | Higher |
|----------------------------|-----------------|--------|

| | | |
|------------------------|------------|--------|
| Feed Throughput | 15 to 30 % | Higher |
|------------------------|------------|--------|

| | | |
|-----------------------------|------------|------|
| Chloride Consumption | 10 to 30 % | Less |
|-----------------------------|------------|------|

| | | |
|-------------------------|------------|------|
| Make-Up Catalyst | 30 to 50 % | Less |
|-------------------------|------------|------|

| | |
|---------------------------|----------------------|
| Chloride Adsorbent | Longer catalyst life |
|---------------------------|----------------------|

Internal screen cleaning

less frequent and more days to perform maintenance while operating the reactor (due to lower build rate of coke)



CRITERION
CATALYSTS & TECHNOLOGIES

Worldwide Offices:

HOUSTON:

16825 Northchase Dr; Suite 1000
Houston, Texas 77060-6029
Telephone: (281) 874-2600
Facsimile: (281) 874-2641

CANADA:

Suite 810, Centre 104
5241 Calgary Trail Southbound
Edmonton, Alberta T6H 5G8
Canada
Telephone: (1) 780-438-4188
Facsimile: (1) 780-438-3473

UNITED KINGDOM:

1650 Parkway
The Solent Business Park,
Whiteley, Fareham,
Hampshire, PO15 7AH
England
Telephone: (44) 1 489-881881
Facsimile: (44) 1 489-881882

SINGAPORE:

298 Tiong Bahru Road
#07-03 Central Plaza
Singapore 168730
Telephone: (65) 276-3627
Facsimile: (65) 276-7455

LUXEMBOURG:

Route de Longwy, 420
L-4832 Rodange, Luxembourg
G.D. of Luxembourg
Main Tel#: (352) 502-454
Catalyst Regeneration Services
Main Fax#: (352) 502-996

Visit us on the web: www.criterioncatalysts.com

e-mail address: publicaffairs@criterioncatalysts.com



CRITERION
CATALYSTS & TECHNOLOGIES

Important: All information contained in this document is considered accurate at the time of the testing, based on the equipment, and specific conditions and other limitations during the testing process. It is being furnished upon the express condition that the user will make its own assessment to determine the accuracy and applicability for the user's particular purpose. Copyright Criterion Catalysts & Technologies, 2002