Ketjen

Unleash the Potential

ACTION® FCC CATALYSTS

Maximizing alkylation feed, transportation fuels and octane

Taking advantage of new zeolite technology

The chances are that maximizing transportation fuels (gasoline plus diesel/light cycle oil) and alkylation feed while raising the octane level of the gasoline produced in your FCC unit is high on your agenda.

Octane has become a key issue for many refiners with the advent of tight oil resulting in the production of more-efficient car engines, the almost worldwide ban on the use of lead as a gasoline additive, and continuing pressure on octane blending components. The problem is compounded by the drive to ever-lower sulfur specifications, as most of the post-treatments designed to remove sulfur from gasoline inevitably also reduce its octane.

Help is available in the form of alkylation and isomerization processes that yield clean, high-octane, gasoline-blend stocks. And, staying with the FCC process, which is still the mainstay of gasoline production, ZSM-5 catalyst additives are available with the proven ability to generate octane. But we thought there was more that could be done — you could say we issued a call for ACTION.

Back to basics

Following a detailed study of FCC reaction mechanisms, which crucially centered on the way that higher olefins are broken down, Ketjen scientists developed a new zeolite technology, ZT-400, which has a high silica-to-alumina ratio. ZT-400 provides unique cracking chemistry and, when used in combination with our high-accessibility catalyst technology enhances gasoline octane and butylenes while preserving transportation fuels.

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When formulated into an FCC catalyst, the new zeolite shifts the balance between isomerization and cracking toward the former. What occurs, therefore, is branching of the longer-chain FCC naphtha components, as opposed to cracking. The result is increased octane with minimal conversion of gasoline to LPG. Moreover, the isoparaffins that contribute much of the octane gain are unaffected by any post-treatment processes to remove sulfur.

Another key advantage of this technology is that any LPG produced tends to be richer in C4 olefins compared with the LPG produced using ZSM-5 additives; hence, it forms an ideal alkylation feedstock.

ACTION family

We have used the unique ZT-400 zeolite technology to formulate an FCC catalyst for two applications:

- ACTION for traditional FCC feedstocks ranging from gas oils to resids
- ACTION T for tight oil derived feedstocks

For all ACTION catalysts, the zeolite-to-matrix ratio can be tuned to target higher-liquid volume yields or maximum-bottoms cracking.

Proven performance

Figures 1-4 show the results of laboratory tests in which ACTION 553 FCC catalyst, which is designed for maximum liquid volume, was compared with a conventional Ketjen FCC catalyst denoted as RUBY™ 553 with ZSM-5 additive. All yield changes in figures 1, 3 and 4 are relative to RUBY 553 without ZSM-5 additive.

One benefit of ACTION catalysts is their ability to raise octane while minimizing gasoline volume loss (Figure 1). In our tests, the octane gain per unit of gasoline loss was significantly higher for ACTION 553 than for RUBY 553 with ZSM-5 additive. The difference was particularly marked in the case of MON values.

The tests also showed that ACTION 553 produced 11% more isoparaffins in gasoline than RUBY 553 with ZSM-5 additive (Figure 2).

At constant RON, the incremental LPG generated by ACTION 553 was about 86% of that produced by RUBY 553 with ZSM-5 additive (Figure 3). The performance was even better at constant MON; the incremental LPG with ACTION 553 was only 68% of that produced by RUBY 553 with ZSM-5 additive.

Relative to RUBY 553, the ratio of incremental C4 olefin to incremental C3 olefin is 10% higher for ACTION 553 than for RUBY 553 with ZSM-5 additive (Figure 4).

Most importantly, ACTION has been proven in more than 10 FCC units, and the count is growing, using a variety of feedstocks from tight oils to resids. Refiners have increased profitability by taking ACTION to optimize alkylation feed (butylenes), gasoline, light cycle oil and octane.

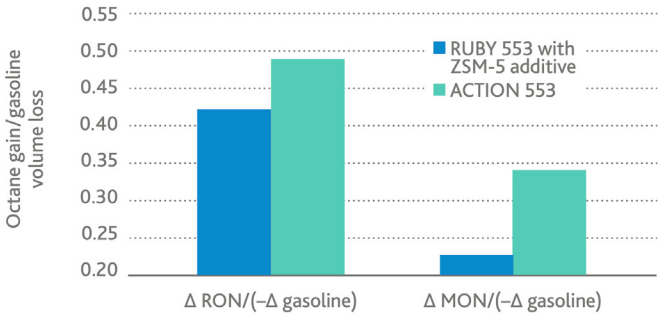

Figure 1: Octane gain/gasoline volume loss

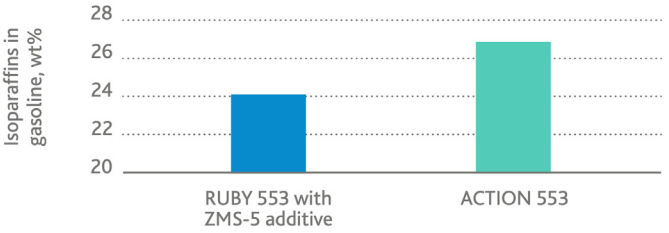

Figure 2: Isoparaffins in gasoline

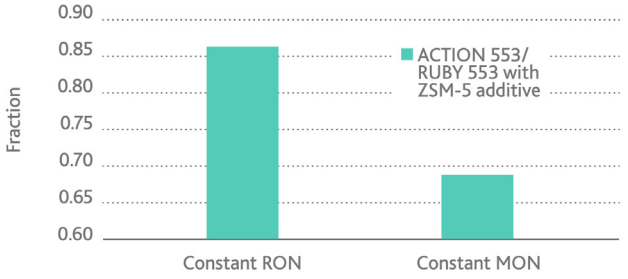

Figure 3: Relative incremental LPG yield at constant octane

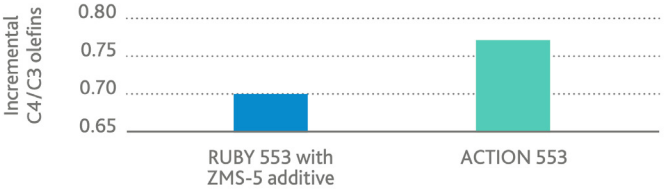

Figure 4: Incremental C4 olefin/C3 olefin

Improved economics, greater flexibility ACTION adds value through the following benefits:

- Added C4 alkylation feedstock, and, therefore, ultimately more octane
- Increased FCC gasoline octane and higher isoparaffins, which means sustainable octane; post-treatment to remove sulfur does not reverse the gain
- Balanced octane and transportation fuels
- Reduced incremental LPG per octane gain, which is important if one has wet gas recovery constraints

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

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