



## ACTION

# Catalysts that raise the octane value of FCC gasoline with minimal loss of volume

### Taking advantage of new zeolite technology

The chances are that 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 more efficient car engines, the almost worldwide ban on the use of lead as a gasoline additive and the pressure on a key blending component, MTBE.

The problem is unfortunately compounded by the drive to ever lower sulfur specifications, since most post-treatments designed to remove sulfur from gasoline inevitably also reduce its octane level.

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 now 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, Albemarle scientists came up with an entirely new zeolite technology – ADZT-100, which has a high silica-to-alumina ratio and consequently excellent stability.

The new zeolite, when formulated into an FCC catalyst, shifts the balance between isomerization and cracking toward the former – isomerization.

What you see, 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.

And, as an added advantage of this new technology, any LPG that is 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 high-stability ADZT-100 zeolite to formulate two main types of single-particle FCC catalyst.

#### ACTION LV

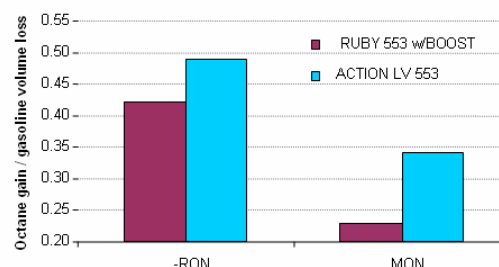
Formulated for refiners seeking maximum liquid volume from their FCC units (gasoline and LPG), these catalysts have a high zeolite-to-matrix ratio.

#### ACTION BC

For refiners needing outstanding bottoms cracking performance, these catalysts have a lower zeolite-to-matrix ratio than their LV counterparts and higher accessibility.

### Laboratory performance

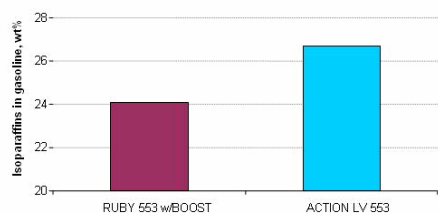
The following charts contain the results of laboratory tests in which ACTION LV 553 was compared with an Albemarle high-quality, conventional FCC catalyst, RUBY 553, and also with RUBY 553+BOOST, the same catalyst containing a ZSM-5 additive.



Octane gain/gasoline volume loss – ACTION LV 553 and RUBY 553+BOOST compared with RUBY 553.

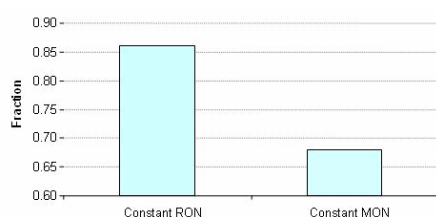
The principal benefit of ACTION catalysts is their ability to raise octane while minimizing gasoline volume loss. In our tests, octane gain per unit gasoline loss was significantly higher for ACTION LV

553 than for RUBY 553+BOOST. The difference was particularly marked in the case of MON values.



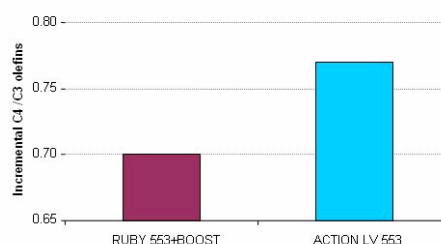
#### Isoparaffins in gasoline

ACTION LV 553 produced 11% more isoparaffins in gasoline than RUBY 553+BOOST.



Relative incremental LPG yield at constant octane – ACTION LV 553/ RUBY 553+BOOST compared with RUBY 553

At constant RON, the incremental LPG generated by ACTION LV 553 was about 86% of that produced by RUBY 553+BOOST. The difference was greater at constant MON; incremental LPG with ACTION LV 553 was 68% of that produced by RUBY 553+BOOST.



Incremental C4 olefin/C3 olefin – ACTION LV 553 and RUBY 553+BOOST compared with RUBY 553

Relative to RUBY 553, the ratio of incremental C4 olefin to incremental C3 olefin is 10% higher for ACTION 553 than for RUBY 553+BOOST. FCC catalyst,

**Improved economics-greater flexibility ACTION brings added value to you, providing the following benefits:**

- Increased gasoline octane – equates to improve profitability
- Isoparaffins mean sustainable octane – post treatment to remove sulfur dies not reverse the gain
- Minimal gasoline volume loss – better balance of octane and volume
- LPG gain reduced – important if you have wet gas recovery constraints
- More C4 alkylation feedstock – and so, ultimately, more octane

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