A Low-Temperature Light Naphtha Isomerization Process
Meeting Modern Requirements for Stable, Simple Operation
Isomalk-2<sup>SM</sup>: C<sub>5</sub>/C<sub>6</sub> Isomerization Process with Benzene Reduction

Isomalk-2 is a low-temperature isomerization technology that has been commercially proven in grassroots applications, revamps of semi-regenerative reforming units, and replacement of other isomerization technologies. This flexible process utilizes a robust platinum-containing mixed metal oxide SI-2 catalyst that works effectively at the low temperatures of 120-140°C (250-285°F), while delivering great stability against the influence of catalytic poisons. Isomalk-2 is a competitive alternative to the three most commonly used light gasoline isomerization processes: zeolite, chlorinated aluminum oxide and sulfated zirconium oxide catalysts, applicable for simple replacement of these catalyst types. This technology has been commercialized in all possible modes of configuration. By applying the full recycle configuration, an isomerate with a 92.5 RON value has been achieved in a world-scale reference unit.

Process Overview

Isomalk-2 offers refiners a cost-effective isomerization option that consistently demonstrates reliable performance with all standard process configurations, including:

- Once-through isomerization
- Once-through with pre-feed deisopentanizer
- Recycle of low-octane pentanes and hexanes
- Full recycle of all non-branched paraffins and pre-feed deisopentanizer

Each scheme generates different yield and octane results. The following examples are for a LSR (Light Straight Run) process stream, but may also be applied to a condensate stream or some LSR/condensate combinations.

Once-Through Isomerization

In a once-through isomerization process scheme, the LSR is mixed with hydrogen make-up gas. The mixture is then heated and enters a first reactor where benzene saturation and partial isomerization take place. The gas-product mixture exits the first reactor, is cooled and then fed to a second reactor to complete the isomerization reaction at chemical equilibrium. The product mixture from the second reactor is cooled and fed to a gas separator, where the mixture is separated from the excess hydrogen gas. Excess hydrogen is combined with make-up hydrogen and fed through the recycle dryers for blending with feed. No hydrocarbon feed drying step is required.

Saturated isomerate from the separator is heated and fed to the stabilizer. The stabilizer’s overhead vapors are cooled and fed to a reflux drum. Liquid hydrocarbons from the reflux are returned to the stabilizer as reflux, while uncondensed light hydrocarbons are separated and sent to the off gas system. The bottom product or isomerate is cooled and sent to gasoline blending.

Recycle of Low-Octane Pentanes and Hexanes

In an isomerization process scheme with recycle of low octane pentanes and/or hexanes, the isomerate is produced and then fed to a fractionation column(s). Overhead and bottoms isomerate streams are cooled and sent to gasoline blending. A low-octane C<sub>5</sub> and/or C<sub>6</sub> isomerate stream is recycled back to the isomerization reactor.

Prefractionation with Recycle of Low-Octane Hexanes

Prefractionation with low-octane recycle can utilize all the above methods: prefractionation, isomerization, and postfractionation. The prefractionation step consists of deisopentanization of the feed and/or C<sub>7</sub>+ separation. The postfractionation step consists of separating the high-octane portion of the C<sub>5</sub>-C<sub>6</sub> isomerate and recycling the low-octane C<sub>6</sub> isomerate stream.
Advantages
The SI-2 catalyst provides high conversion rates and a close approach to thermal equilibrium at low temperatures. Key to the technology is that the SI-2 catalyst exhibits superior activity alongside stability, simplicity and safety in operation. Features of the Isomalk-2 technology include:

- Process capability to produce 81-93 RON
- Low operating costs
- Regenerable catalyst with superior tolerance to process impurities and water
- No chloride addition or caustic treatment needed; no wastes produced

- Mass yield > 98%, volume yield up to 100%
- Up to 5-6 year cycles between regenerations
- Guaranteed service life of SI-2 catalyst 10+ years
- Reduced hydrogen consumption

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Process scheme with full utilization of the light naphtha feedstock.
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