Performance

Performance Flexibility Results

Our Organisation

Customer Testimonials

Performance

As a leading automotive supplier, you must react fast to market changes and customer requests in order to stay ahead in terms of flexibility and efficiency. To stay competitive, you need to be agile and innovative in order to achieve the best possible results.

Flexibility

Flexibility is our response to market challenges. It is the ability to react quickly to changing market conditions and customer demands. By constantly adapting and improving our processes, we ensure that we remain competitive in a fast-paced industry.

Benefits

Zülfikar's flexible and efficient processes enable us to react quickly and effectively to changes in the market. Our customers can trust us to deliver high-quality products and services on time.

Zülfikar's dedication to excellence in customer service and product quality sets us apart from our competitors. We are committed to providing our customers with the best possible solutions.

Customer Testimonials

"The outcome of the optimization study has brought important benefits in terms of higher performance. We are getting a higher efficiency compared to our previous business model in this respect." - Zülfikar Amine, Plant Manager, GEC Energy, Iran

"Zülfikar's innovative support has always been an important factor for our company in maintaining high levels of service delivery. The positive results and improvements provided by the team are highly appreciated." - Y. Nakagawa, Associate President, JNC Corporation, Japan

"The Systel® package has outstanding benefits which are superior to similar systems. The improved efficiency and productivity are especially significant." - A. H. Qureshi, CEO, AHP Inc., United Arab Emirates

"The Xyzator® system has successfully contributed to our company's growth by increasing efficiency and reducing costs. We are very satisfied with the results." - J. K. Lee, President, KYN Corporation, South Korea

"The implementation of Zülfikar's solutions has significantly improved our production processes. We are now able to produce more efficiently and cost-effectively, resulting in higher customer satisfaction." - M. J. Kim, COO, MJK Corporation, South Korea

"The Zaftor® system has revolutionized our production processes, allowing us to achieve higher levels of productivity and efficiency." - E. J. Kim, CFO, EJK Corporation, South Korea
1. Aromatics Hydrocarbons processing

Transalkylation

ATA-11 and ATA-12 catalysts are used in aromatics complexes in the toluene disproportionation unit or transalkylation unit when conversion of toluene and C6 aromatics to mixed xylenes and benzene is required. Depending on the aromatics system in the transalkylation unit, the chemical equilibrium in the unit is shifted away from benzene production and towards xylene production. The transalkylation process provides a means of producing more mixed xylenes from low value toluene and heavy aromatics. The incorporation of a transalkylation unit into an aromatics complex can more than double the yield of paraxylene from naphtha feedstock.

Xylene Isomerisation - Ethylbenzene reforming type

Opars™ catalysts are used in aromatics complexes when conversion of ethylbenzene to xylenes is required in combination with isomerization of xylenes into the equilibrium composition. Appropriate process conditions can achieve very high ethylbenzene conversion levels while the approach-to-equilibrium for paraxylene is almost at the thermodynamic limit of 100%.

Owing to its very high activity and selectivity, Opars™ catalyst can be used for catalyst replacement when debockering and/or minimum benzene production is desirable.

Xylene Isomerisation - Ethylbenzene dealkylation type

Zataris™ catalyst can be used in aromatics complexes when conversion of ethylbenzene to benzene is required in combination with isomerization of xylenes into the equilibrium composition. This catalyst can be operated with ethylbenzene conversions of up to 80% while achieving low xylene losses.

Zataris™ catalyst is designed to operate at high activity and selectivity, and is suitable to be used for catalyst replacement when debockering.

2. Catalytic Dewaxing

Catalytic dewaxing is used to improve cold flow properties of diesel fuels and lubricating oils by selective hydroisomerization/hydrocracking of normal and slightly branched paraffins. SDD/SID series catalysts are suited for use in the following applications: [1] conventional diesel fuels dewaxing to deep dewaxing (Antic grade production) in 1st and 2nd stage applications, [2] in combination with high pressure hydrotreating or mild hydrocracking catalyst package, [3] in mild hydrocracker bottoms pour point reduction for storage and transportation and [4] to produce fuels of exceptional quality.

3. Paraffin Isomerization

Z-700A is used in refineries and petrochemical complexes where the isomerization of pentane and hexane is required to produce a high-octane gasoline blending component. Performance tests of Z-700A have demonstrated its resilience to sulphur poisoning and successful recovery from such incidents. Z-700A can be used in all reactor types utilized for this process: classical fixed bed reactors, radial flow reactors, etc.
1. Aromatics Hydrocarbons processing

- CS-C7 Extraction Unit
- Benzene
  - Tol column
  - Toluene to transalkylation unit
- C8+
  - PX
  - EB Isomerization
    - Onapsis™ Series
    - EB Dealkylation
      - Zetas™ Series
- OX
- Heavy Aro col
  - C9+C10
  - Toluene
  - Transalkylation
    - ATA Series
  - C10+

Reformate
- Reformate Splitter
  - PX
  - EB Isomerization
    - Onapsis™ Series
    - EB Dealkylation
      - Zetas™ Series

For more information on how Zeolyst International, Criterion Catalysts & Technologies and Shell Global Solutions can contribute to your operations, contact your nearest Criterion sales representative at www.zeolyst.com.

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Transalkylation Catalyst

The ATA series catalyst is our high performance transalkylation catalyst that utilizes a proprietary zeolite as the active material. Developed in the SK Energy and Zeolyst laboratories, it is especially designed for high conversion and feed composition flexibility.

ATA-11 catalyst was commercialized in 1999 and its performance was enhanced in 2002 leading to an improved ATA-12 catalyst. As per 2010, the ATA catalyst has 14 commercial references. Applying sophisticated catalyst manufacturing technology, the ATA catalyst combines a high activity for conversion of toluene and C9+ aromatics into benzene and low ethylbenzene-content mixed xylenes with superior catalyst stability and yields.

Applications

ATA-11 and ATA-12 catalysts are used in aromatics complexes in the toluene disproportionation unit or transalkylation unit when conversion of toluene and C9+ aromatics to mixed xylenes and benzene is required. Processing C9+ aromatics in a transalkylation unit shifts the chemical equilibrium in the unit away from benzene production and towards xylene production. The transalkylation process provides a means of producing more mixed xylenes from low-value toluene and heavy aromatics. The incorporation of a transalkylation unit into an aromatics complex can more than double the yield of paraxylene from naphtha feedstock.

Feeds

One of the major benefits of the ATA-12 catalyst is its feed flexibility. The ATA-12 catalyst can process feed compositions ranging from benzene-rich feedstocks or 100% toluene to 100% C9+ aromatics. This feed flexibility allows the user to optimize feed sources and effectively capture market price swings.

ATA-12 Advantages

1) Feed flexibility
100% C9/C10 fresh feed can be treated, which helps in the upgrading of lower value feedstocks into higher value products. By adjusting the toluene content in the reactor feed, the plant operator can maximize xylene yields as required. This flexibility allows our users to optimize the operational economics of the transalkylation unit.

Benzene and C9 aromatics yield on reactor feed at 45 wt% total conversion

Impure benzene/toluene can be treated through ATA-12, whilst still meeting the ex-specification benzene product purity.
High aromatics retention is achieved with the use of ATA-12 catalyst. The aromatics loss is very low, which results in very high feed efficiency.

Very little hydrogen is used for aromatics saturation, as it is utilized essentially for olefin saturation and non-aromatics hydrocracking, hence hydrogen consumption is low. This helps to reduce the operating cost.

<table>
<thead>
<tr>
<th>Aromatics loss (mol%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 25,000 hours</td>
</tr>
</tbody>
</table>

![Aromatics Loss Graph]

[3] Superb Product Quality
Benzenes purity is more than 99.85%, and no additional processing through an extraction unit is required.

Ethylbenzene in C8 aromatics is low, which helps to improve the paraxylene recovery in the adsorption/separation unit, or increase the feed load.

<table>
<thead>
<tr>
<th>Benzene purity and EB in C₈ aromatics (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 12,000 hours</td>
</tr>
</tbody>
</table>

![Benzene Purity and EB Graph]

[4] High Activity
ATA-12 catalyst can be operated at high weight hourly space velocity (WHSV) of up to 3.5hr⁻¹, with no significant changes on yields. Deactivation rate remains low. This allows the plant to reduce the amount of catalyst required. For a grassroots unit, this reduces investment cost.

[5] Low Hydrogen/Cohesive Ratio
ATA-12 catalyst can be operated at very low H₂/HC ratio with no significant changes on deactivation rate. This also reduces utility cost or investment cost for grassroots unit.

[6] Excellent Catalyst Stability
Based on our numerous commercial experiences, ATA-12 catalyst has proven to be extremely stable. A typical cycle-length is more than 4 years, and can be as long as 8 years.

The ATA-12 catalyst advantages can improve plant operations by increasing product yields at lower operating cost, throughout the entire cycle-length.

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Xylene Isomerization Catalyst - Ethylbenzene Reforming Type

Oparis™ series catalyst is a new generation xylene isomerization-ethylbenzene reforming type catalyst with a greatly improved paraxylene (PX) yield over other commercial catalysts. The catalyst combines high activity for conversion of ethyl benzene into xylenes with very low by-product make and superior stability. Approach to equilibrium for paraxylene is close to the thermodynamic limit.

Oparis™ catalyst was developed in the labs of IFP/Axens and is manufactured and marketed by Zeolyst International. Grassroots licences are available in conjunction with Axens.

This catalyst has been commercialized since 2001. To date, it has been applied at 14 commercial units, with multiple successful regeneration experiences.

Applications

Oparis™ catalysts are used in aromatics complexes when conversion of ethylbenzene to xylenes is required in combination with isomerization of xylenes into the equilibrium composition. Appropriate process conditions can achieve very high ethylbenzene conversion levels while the approach-to-equilibrium for paraxylene is almost at the thermodynamic limit of 100%.

Owing to its very high activity and selectivity, Oparis™ catalyst can be used for catalyst replacement when debottlenecking and/or minimum benzene production is desirable.

Ethylbenzene Isomerization to Xylenes

Xylene Isomerization

Feeds

Typical feeds processed over Oparis™ catalyst are Cs aromatic streams depleted of paraxylene, and sometimes also of ortho-xylene, usually effluent from a crystallizer or from an adsorption based paraxylene recovery unit.

When Oparis™ catalyst is applied, high concentrations of ethylbenzene in the fresh feed to the complex can be used because the high conversion limits build-up of ethylbenzene in the recycle. This gives the user the ability to blend in large amounts of Cs aromatics extracted from pygas streams that are high in ethylbenzene.

Oparis™ Advantages

1. High Selectivity
2. Improved Process Economics

Performance of Oparis™

Xylene loop PX Yield, %

Adsorption-based

PX Separation Recovery Rate, %

The PX yield achieved with an Oparis™ based xylene loop is significantly higher than previous generation catalysts, and improvements of more than 10% in yields can be achieved.
(2) Enhanced Isomerization Activity

As compared to previous generation catalysts, Oparis™ catalyst can achieve very high PX approach to equilibrium whilst maintaining low losses. This allows the plant to widen the operating window and optimize based on the various operation scenarios.

(3) Better Operational Stability

After the initial stabilization period, the catalyst activity is very stable. The 1st cycle length is typically more than 3 years.

The activity of the catalyst can be easily restored by a carbon burn-off, and this can be done either in-situ or ex-situ. Based on numerous regeneration experiences, close to fresh catalyst activity can be achieved after each regeneration.

OparisPlus™ - An Improved Catalyst

OparisPlus™ catalyst was developed with innovative improvements, resulting in an excellent catalyst performance.

Its catalyst activity is enhanced whilst overall Cs ring loss is reduced by 20% as compared to Oparis™. Moreover, there is a 30% drop in gas make, which significantly improves the operational economics.

Performance of Oparis™ vs. OparisPlus™

- 20% reduction in Cs ring loss, %
- PX approach to equilibrium, %

Performance of Oparis™ vs. OparisPlus™ in C7-C9 make

- 30% reduction in gas make, %
- PX approach to equilibrium, %

Intrinsic Catalyst Activity

- Cycle 1
- Cycle 2

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Xylene Isomerization Catalyst - Ethylbenzene Dealkylation Type

Zataris™ catalyst is the newest xylene isomerization-ethylbenzene dealkylation Zeolyst catalyst with improved paraxyylene yield and enables high benzene purity. The catalyst combines high activity for conversion of ethylbenzene into benzene with very low xylene losses.

Zataris™ catalyst was developed in the labs of Shell Technology Centre Amsterdam, leveraging on our experience from former generation dealkylation catalyst (the Z883X series) and other catalyst technologies. This catalyst is manufactured and marketed by Zeolyst International.

Applications

Zataris™ catalyst can be used in aromatics complexes when conversion of ethylbenzene to benzene is required in combination with isomerization of xylenes into the equilibrium composition. This catalyst can be operated with ethylbenzene conversions of up to 90% whilst achieving low xylene losses.

Zataris™ catalyst is designed to operate at high activity and selectivity, and is suitable to be used for catalyst replacement when debottlenecking.

EB Dealkylation

Zataris Advantages

1. High Activity
   High EB conversion (EBC) of up to 90% can be achieved.

2. Low Xylene losses
   Very low xylene losses at high EBC can be achieved. Losses are primarily due to formation of toluene and C9 aromatics with minimal gas make, preserving the aromatics molecules.

3. High Benzene Purity
   On-specification benzene purity is produced using Zataris™ catalyst, which may help to relieve any bottleneck in the sulfonate extraction unit.

4. Stable Catalyst Activity
   Zataris™ catalyst is developed from proven technologies. Even under severe operating conditions, minimal deterioration in catalyst activity is observed. Catalyst cycle length is expected to be at least 4 years.

Feeds

Typical feeds processed over Zataris™ catalyst are Cs aromatic streams depleted from paraxyylene, usually effluent from a crystallizer or from an adsorption paraxyylene recovery unit.

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Paraffin Isomerization Catalyst

Z-700A is a pentane/hexane isomerization catalyst based on the HYSOMER catalyst technology. Applying sophisticated catalyst manufacturing technology, Z-700A is specifically designed for isomerization of pentane and hexane to high octane number branch chain hydrocarbons and combines additional functionality for the saturation of benzene.

Applications

Z-700A is recommended for use in refineries and petrochemical complexes where the isomerization of pentane and hexane is required to produce a high-octane gasoline blending component. Performance tests of Z-700A have demonstrated its resilience to sulfur poisoning and successful recovery from such incidents. Z-700A can be used in all reactor types utilised for this process: classical fixed bed reactors, radial flow reactors, etc.

Z-700A Advantages

1. Enhanced activity
   The improved activity of Z-700A allows plants to operate at higher throughput. Alternatively, there is an option to operate at a lower temperature with the same throughput. The ability to operate at lower temperature is advantageous as the thermodynamics favor the formation of more branched paraffins with a higher octane number.

2. Good selectivity
   Z-700A selectivity is high and will produce a high octane-barrel liquid yield.

3. Catalyst robustness
   Z-700A catalyst is robust. The average catalyst life is typically more than ten years. Top bed catalyst in heavy feed and high sulfur content can last more than three years, while a bottom bed catalyst in a clean feed service can reach a twenty-year life.

Regeneration

During operation, the catalyst activity slowly declines mainly because of coke lay-down. The activity can be restored to a large extent by carbon burn-off. This can be done in-situ, however, ex-situ is preferred because of better temperature control.

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Are you a research institute or other organisation that wants to commercialise a new catalyst?

Do you have a catalyst patent but lack the expertise and experience to commercialise the product?

Zeolyst Specialty Catalysts, a division of Zeolyst International, can help you to promote your technology to the rest of the world. We are continually looking for new partners to bring new, technically superior zeolite catalysts to market.

The Best of Both Worlds

Zeolyst Specialty Catalysts combines the product development and manufacturing expertise of zeolites and catalysts from its partners, PQ Corporation and the Shell Global Solutions affiliate Criterion Inc., into a single source that can handle the entire development and commercialisation of zeolite catalysts.

Our potential partners will benefit from PQ’s long history in producing zeolite powder. The company keeps up to date on the latest developments in zeolites. Catalyst manufacturing technology and marketing support comes from Criterion.

It is through this exclusive position within the Zeolyst partnership, that Zeolyst Specialty Catalysts can offer a unique value proposition that complements potential partners wishing to develop, produce and commercialise their zeolite catalysts.

Our reputation for being a trustworthy partner in developing and producing high-purpose and robust catalysts has already resulted in successful alliances. The Oparis™ catalyst has been brought to market through working in close cooperation with IFP/Axens, and, by collaborating with SK Energy, we have developed and commercialised the AIA catalyst series.

The Best of Both Worlds

Once fundamental catalyst research and development has resulted in a new breakthrough catalyst technology, Zeolyst Specialty Catalysts offers the following steps for commercialising your product:

* marketing;
* sales;
* production and supply chain;
* after sales customer service and onsite technical support;
* and
* customer feedback to support the development of better generations or new zeolite catalysts.

Through this business model, Zeolyst Specialty Catalysts can provide tangible value to partners in terms of profits, product development and improvements. They will benefit from our market intelligence, global sales network, production experience, best practices and knowledge and technology transfer. Together, we can strengthen our reputation for quality by producing zeolite catalysts that meet our customers’ requirements and by providing services that fulfill their expectations.

“We are pleased to have Zeolyst Specialty Catalysts as our partner for the manufacturing and supply of our Oparis™ ethylbenzene reforming catalyst technology. Over the years, Zeolyst has always provided excellent value to the Oparis™ users by manufacturing high quality catalysts and offering strong technical support. This experience has been an important element in defining the development objectives of our latest generation ethylbenzene reforming catalyst, OparisPlus™.”

Jacques Rault,
Product Line Manager,
Aromatics Technologies, Axens, France

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