**Custom catalysts: Even greater flexibility in the manufacturing process**

Whatever joint development of customized solutions or toll manufacturing – Evonik will offer its customers even more options in the future.

For over 80 years, Evonik’s customers who use fixed-bed catalysts in their processes and facilities have had the option of taking different roads to success. While some customers supply a complete catalyst production formula and raw materials to set up a long-term provider relationship with Evonik for “their” catalyst, others discover the advantages of permanently transferring their catalyst production to Evonik while bridging a bottleneck in their in-house production. A third type of customer might provide a laboratory formulation and rely on the know-how and experience of Evonik in the scale-up and large-scale production of the newly developed catalyst, while a fourth may want to develop an optimized catalyst jointly with Evonik for a completely new process. ▶▶▶
Editorial

Dear readers,

The chemical industry is once again experiencing a profound change. While the subject of globalization dominated the chemical industry in previous years, mergers and acquisitions are now taking over the headlines. Companies are buying their competitors at record levels. Since the Americans have been promoting the production of shale oil and gas on a large scale, chemistry has experienced a revival in the United States. Low prices for oil and gas are also changing the chemical industry landscape elsewhere. Falling revenues are forcing oil producing countries to increase output, especially in the Middle East, and to expand the value chain in the direction of chemicals. A third of all chemicals are now produced in China, however, growth has been slowing there. The investment drive in recent years has led to considerable overcapacities, margins which are under pressure with Chinese companies now looking abroad to chance their luck.

In the long term, how can companies succeed in this increasingly aggressive competitive environment? In addition to gaining access to inexpensive raw materials, efficient and resource-saving processes with high yields are more important than ever before. In this context, catalysis as a key technology for sustainable manufacturing processes in the chemical industry is still of great importance. To this end, Evonik can make many contributions, which we would like to share with you in this issue of “Catalysts Insight”. For example, we have expanded our capacities and competences for the production of tailor-made fixed bed catalysts. With our Aerolyst® series, we offer high-quality carrier systems for the most demanding catalyst systems. For precious metal powder catalysts, which we produce in Asia, Europe and North America, we offer, in close collaboration with our partners, the entire precious metal management and closed precious metal loops. Finally, we would like to show you how the properties of polyethylene and polypropylene can be determined by the particle morphology of the catalyst support used.

Many thanks for your interest.
We look forward to hearing from you.

Dr. Steffen Hasenzahl
Senior Vice President
Head of Catalysts Business Line
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"We develop and supply suitable catalysts for our customers’ production processes so they can focus on their core business, manufacturing chemicals,” says Tim Busse, market segment manager Industrial & Petrochemicals within Evonik’s Catalysts Business Line. “Thanks to the recent capacity expansion at our German catalyst production site in Marl (North Rhine-Westphalia), which was completed last summer, we now have much greater flexibility, not only for the manufacture of proprietary catalysts and the development of customized systems, but also for completing contract orders at greater speed. Since our customers need to respond promptly to changes in the marketplace, we must offer shorter and faster evaluation and set-up processes for catalyst projects as well. To meet its leadership claim in the area of custom catalysts, Evonik implements regular optimizations and investments."

Every catalyst and catalyst support comes with customized quality controls, which are frequently negotiated in detail. Analytical services, logistics, start-up descriptions for using a catalyst as well as technical assistance for filling the reactor and initiating the system complete the services offered following the actual catalyst production. In the case of precious metal catalysts, Evonik also offers recycling at the end of the lifecycle and precious metal management for the required re-charge catalyst.
Custom catalysts:

Even greater flexibility in the manufacturing process

Over the years, Evonik has scaled up many laboratory formulations to large-scale technologies, either at customer locations or in close cooperation with customers. Depending on the distribution of roles and tasks, this involved finding and applying suitable business models for both partners.

Cooperation based on trust is the basis for the successful implementation of joint catalyst projects involving customers and Evonik. Both sides must ensure that the respective partner will protect the existing know-how (background know-how) and that proper regulations are in place for handling know-how resulting from the cooperation (foreground know-how). Such know-how can pertain to the catalyst material, but also the catalyst formulation or, if necessary, the ultimate application. Evonik Legal Services assists with the generation of non-disclosure agreements and cooperation contracts to transparently define the rights and obligations of both partners.

PROVEN CATALYST COMPETENCE IN MARL AND HANAU, GERMANY

One of the first catalysts manufactured at the Marl, Germany site, almost 80 years ago, then part of Chemische Werke Hüls, involved a catalyst for the production of butadiene, an important raw material for the production of synthetic rubber. In the 1950s, the Marl site developed into a petrochemicals plant for the production of plastics, surfactants and solvents. It eventually became an industry park for various chemical companies and today is a flagship Evonik production site with the largest number of bulk chemical plants and approximately 10,000 employees.

Working in close cooperation with customers, the site not only produces many specialty items such as high-performance polymers, coatings raw materials and crosslinkers, additives for agrochemicals and polymers as well as plasticizers, but also processes intermediates and develops procedures for recycling valuable raw materials. From this center of innovation and tradition, the workers of the catalyst production in Marl today cover the entire process chain from research and development, scale-up, production, quality control, supply chain and logistics as well as application technology. The expertise of the Marl-based colleagues is not only in demand among customers within the Group, but has been held in high esteem in many production processes of globally active chemical companies in America, Asia Pacific, the Middle East and of course, Europe, for over three decades. Specially assembled teams ensure professional project management for any given task to meet the frequently demanding development targets and time schedules of cus-
customers. This could take shape in the development of oxidic catalysts for a novel method to produce ultrapure isobutene or in the continuous further development of a titanium silicalite catalyst for the synthesis of propylene oxide to support the growing demands our customers face with regard to profitability and environmental protection. Thanks to the expansion of the Marl production plants, Evonik is now in an even better position to implement projects at the triple-digit metric ton scale. The plant was upgraded with additional forming capabilities for granulation, extrusion, and tablet manufacture. The Marl-based catalyst production also includes mixing stations for solids and liquids, specially designed extruder lines, a continuous drying system, and rotating kiln for calcination at temperatures up to 950 degrees Celsius. Moreover, a newly constructed building now houses a research and development unit, where employees test new formulations at the laboratory scale before transferring them to large-scale production.

The site in Hanau (Hessen), also located in Germany, is a perfect complement to the expertise of the Marl team. The Hanau-Wolfgang Industrial Park has a workforce of approx. 5,300 people, including some 3,500 employees of Evonik Industries. The Catalysts Business Line produces a comprehensive portfolio of chemical catalysts in this location. In addition to precious metal powder and activated metal catalysts, which are primarily used in the manufacture of pharmaceutical and agrochemical intermediates and final products, Hanau also produces, among other products, mixed oxide and zeolite catalysts. To this end, it features specialized production technologies such as precipitation procedures, hydro-thermal synthesis, spray drying, and various impregnation methods. Noblyst® E39 catalysts, which have been established for many years for the selective hydrogenation of acetylene to ethylene in the hydrogen chloride recycling stream associated with the production of vinyl chloride monomer (VCM), are typical product examples. Ethylene is recycled back to VCM, which not only improves efficiency, but also the quality of the resulting polyvinyl chloride in the long term.

**SUCCESS STORY CALVERT CITY, USA**

Since flexibility is critical for Catalyst projects, the unit has developed a number of cooperation models for Evonik and its customers. One such project has been in effect in Calvert City, Kentucky (USA) for over 15 years, where Evonik manufactures so-called hydro-treating (HDS) catalysts on behalf of an international catalyst company. The product is used to remove sulfur and nitrogen from crude oil and fuels. For our partner, this has the advantage that the catalysts required in North America can be produced locally. As the trend to greater regulation of sulfur in fuels continues, the Organization
of Petroleum Exporting Countries (OPEC) expects an expansion of desulfurization capacities to up to 4 million barrels per day by 2021 and a further 14 million barrels by 2030. That will ensure future growth opportunities for the partnership in Calvert City in the production of HDS catalysts.

Evonik increased sales considerably by 19 percent to €3.68 billion in the first three months of 2017. The main growth drivers were higher demand, which boosted sales volumes, and the first-time inclusion of the Air Products specialty additives business.

“The successful start to the year shows that we are on the right track with our growth strategy,” said previous Chairman of the Executive Board, Klaus Engel. “The combination of organic growth and strategic acquisitions has strengthened the company. We are on the road to becoming less vulnerable to economic cycles and having a more balanced portfolio. Demand for our specialty chemicals such as silica, coating additives and pharmaceutical ingredients boosted quarterly earnings.”

Adjusted EBITDA rose 8 percent to €612 million in the first quarter driven by improved results in the Resource Efficiency and Performance Materials segments.

Net income was €160 million, about €80 million less than last year. The decline was primarily due to one-time effects tied to the acquisition of the Air Products specialty additives business.

Outlook confirmed
Evonik is confident of achieving its forecast to grow sales and operating earnings in 2017 and expects adjusted EBITDA to increase to between €2.2 billion and €2.4 billion (previous year: €2.165 billion). The growth segments Nutrition & Care and Resource Efficiency will benefit from the integration of the Air Products specialty additives business.

A good start for Evonik to fiscal year 2017
Both Ziegler and Ziegler-Natta catalysts have been used for the production of polyethylene and polypropylene since the mid-1950s. Today, these catalysts are used to manufacture approximately 56% of the globally produced polyethylene and 95% of the polypropylene. About 20% of Ziegler or Ziegler-Natta catalysts are based on magnesium alkoxides, especially magnesium ethanolate. These can then be suspended in hydrocarbons and reacted with titanium tetrachloride (TiCl₄). As far back as 1953, Evonik has supplied magnesium ethanolate to catalyst manufacturers.

The needs of customers have always been our top priority. Evonik’s product portfolio, which has been marketed under the brand name Catylen® S 100 since 2008, features various qualities of magnesium ethanolate, which differ, e.g., with respect to purity, particle size distribution and content of fine particles. Based on the catalyst being produced and the targeted polymerization process, the customer is able to select the optimal raw material for their system. Evonik also offers Catylen® S 200, a 30-percent solution of magnesium ethanolate and titanium tetra-n-butanolate (Mg₂Ti(OR)₄) in hexane. It is used, for example, for the production of polyethylene using slurry technologies.

Catylen® S 300: Customized supports for Ziegler and Ziegler-Natta catalysts

Catylen® S 300 for the first time provides the manufacturers of Ziegler (polyethylene) and Ziegler-Natta (polypropylene) catalysts with a support material that is made in the exact particle size needed for each process. With this option, the Evonik product eliminates a complex and costly production step.

In the past, the process chain included few choices. Support materials for catalysts were shipped in a defined shape to catalyst manufacturers. The raw material then had to undergo a complex process before it could be used further. Evonik is now turning this principle on its head: Catylen® S 300 is the first support material made of magnesium ethanolate (Mg(OC₂H₅)₂) that can be produced in exactly the right particle size for each catalyst manufacturer.

Evonik’s Catylen® S 300 for the first time offers catalyst manufacturers a support material based on magnesium ethanolate, which is generated in precisely the particle size required for a specific process and thereby eliminates a complex production step. The microparticle size can be freely chosen within a range of 18 to 80 micrometers, which means they are up to 20 times smaller than the support material of the Catylen® S 100.

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series brand (about 650 to 700 micrometers). The narrow particle size distribution of ±1 micrometers is an optimal prerequisite for a uniform final product.

Catalysts play a special role, particularly in the polymerization of polyolefins, since polymer particles adopt the shape of catalyst particles. This so-called replica effect ensures that the shape and size of particles as well as the particle size distribution of the catalyst is directly reflected in the polymer.

The polymerization reaction takes place at the active centers that are distributed over the entire catalytic particle, both on the surface and in the interior. Since particles have to fragment and expand evenly in all directions, no uncontrolled breakup of catalyst particles must occur during this step. After all, unintended fragments would ultimately have the effect of additional nucleation sources for new polymer particles, which would significantly interfere with their particle size distribution. Given the daily capacity of around 1,000 metric tons of polymer in modern facilities, the resulting system downtime would be extremely costly.

The products of the Catylen® S 300 brand now provide catalyst manufacturers with support substances that can be custom-tailored to every process. The technology underlying the manufacturing process combines a number of special chemical and engineering details to ultimately generate magnesium ethanolate support materials in the highest quality with narrowly defined production tolerances.

FULL RANGE OF COMPONENTS FROM A SINGLE SOURCE

Catylen® S 300 can be seen as the core element of a catalyst toolbox, as Evonik has continuously optimized its facilities for the production of magnesium ethanolate and adapted them to market needs. In addition to the support materials, Evonik also supplies a variety of organo silanes, which are indispensable as external donors in polypropylene production. They help to control molecular weight, molecular weight distribution, and tacticity – in other words, the integration of monomers into the polymer chain. ■
Aerolyst®: Catalysts on an

A catalyst can only be as good as its support. That’s why Evonik develops and produces durable and custom-tailored shaped catalyst supports for continuous liquid and gas phase processes.

Mineral oxides such as silica (SiO₂), titania (TiO₂), or alumina (Al₂O₃) offer very different support options for catalysts: They serve as a solid phase that supports the active metal or metal mixture, turning the catalyst into a manageable, stable, and accessible shape for the reaction to be catalyzed. Moreover, the size of the pore volume is proportional to the coating surface for the active metal. Some oxidic supports also have catalytic activity of their own or impact the effectiveness of the metal. For example, a high concentration of acidic sites is not suitable for certain reactions because it can promote the formation of undesirable byproducts.

In reactors, catalyst supports must be able to withstand extreme conditions. They reach the necessary hardness and strength through calcination in a precisely defined temperature range. The supports of the Aerolyst® series are calcined in a temperature range that is close to the sinter limit of the corresponding oxide. That is quite a challenge: If the temperature is too low, hardness and strength do not reach their optimum level, but if it is slightly too high, the specific surface or pore volume decreases, which translates into a loss of activity. Ultimately, the balance between high strength and large pore volume depends on the corresponding application.

Impregnation is the most important step for the effectiveness of a catalyst system. It involves a permanent coating of the oxide pore surface with active elements such as copper, nickel, palladium, or mixtures of various metals. Evonik uses various processes for impregnation, which can be used for manufacturing all types of supported (precious) metal catalysts. The oxides

As a specialist in catalysis, Evonik has been active in the development of support materials for decades. The Aerolyst® brand includes close to a dozen variants made from silicon dioxide, aluminum oxide or titanium dioxide (as well as zirconium oxide for special applications) with a diameter ranging from 1 to 8 mm and a length of 2 to 15 mm. The supports, which are typically extruded, owe their excellent properties to special raw materials. They are based on ultrapure fumed silicas and metal oxides, which are also produced by Evonik, to rule out interfering impurities such as sulfur or alkaline earth metals. The special properties of these raw materials also ensure a defined surface chemistry and narrow pore size distribution in the mesoporous area.

View of extrusion die plate

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optimum basis

are coated either evenly across their entire volume or within a narrow, active peripheral zone. It is essential that the supports do not break or cause abrasion in spite of the mechanical stress associated with the rotation of the coating drums. Accordingly, the material must be very hard and solid, yet sufficiently porous and finely fissured to offer a maximum surface area for the metal. The essential know-how of process developers is to achieve the perfect balance of both requirements.

Evonik either supplies its customers with the extrudate in the desired dimension or the entire catalyst system with the corresponding metal impregnation. The company’s German production is situated at the Marl and Hanau sites, with an annual capacity of several hundred metric tons. The main application area for fixed-bed catalysts is the large-scale manufacture of bulk chemicals in continuous liquid and gas phase processes. The supports of the Aerolyst® brand are impregnated with palladium, for example for hydrogenation of C=C-double bonds or chemical rearrangement reactions. C-O double bonds or nitro groups can be hydrogenated using copper as an active metal, but oxidations are also an option.

The development of catalysts is never finished: While well-known processes can be made more economical with optimized catalysts, new procedures for the production of chemicals frequently need completely new catalysts of their own. Accordingly, the development of oxide supports is an ongoing process as well.

Evonik is currently working on new shapes and sizes of supports, which are custom-tailored depending on reaction speed, thermodynamic limitations, solvents, and reaction phases. For example, variants in tablet or spherical shape are particularly suitable for certain applications – provided the pressure drop, abrasion, and pore volume are optimally adjusted. Other catalytic processes require particularly thin or thick formed shapes. Options in addition to classic cylinders also include hollow cylinders and three or four-leaf (trilobe and quadrilobe) shapes.

Experience has shown that it is worthwhile for every user to pay the same amount of attention to the support as to the active catalytic component. Although the catalytic elements for many processes are known and proven, they may not be paired with an optimal support or the best shape. In those cases, the oxide utilized in the process can cause the formation of undesired byproducts. This problem can be solved by changing the specification or choosing an alternative shape to increase the profitability of a process. In those cases Evonik always works closely with the customer to adjust the type and performance of the catalyst system.

The simple rule is this: Active catalytic metals can only reach their full potential with the right substructure support to increase the profitability and sustainability of established as well as new processes. Thanks to its high purity and selectivity and its defined pore size and distribution, unpleasant surprises are virtually impossible with Aerolyst®.
Some chemicals are suitable as indicators of wealth. Vinyl acetate monomer (VAM) is one such chemical: VAM is used to manufacture polymers and copolymers, which are required primarily for car paints, adhesives and building materials, packaging, and special plastics for polyvinyl modules – these are products for which there is strong demand in prosperous countries. The global market for vinyl acetate monomer in 2013 was US-$6.8 billion and, according to estimates from the CE&H Marketing Research Report (2015), this figure will increase to US-$9.5 billion by the year 2020.

In particular, in Asia and the USA, the demand is rising by 4.5 percent and 3.0 percent respectively each year. To meet this growing demand, several new plants are planned.

The producers of VAM use various procedures which vary with respect to the process used and the starting materials required. Typically, vinyl acetate is produced as a result of the reaction of ethylene and acetic acid with oxygen in a continuous, heterogeneous catalytic gas-phase process. For more than 25 years, Evonik has supplied catalysts for the manufacture of the monomer. These are oxidation catalysts from the Noblyst® product family.

The Noblyst® catalyst, which has been specially developed for selective oxidation, consists of millimeter-sized silicon-dioxide spheres that are impregnated with palladium and gold. Evonik works with different impregnation methods and can distribute the precious metal particles specifically to the carrier – either uniformly across the entire volume or, as with the VAM catalyst, in a thin layer on the outer zone. Potassium acetate is used as a co-catalyst to improve the space-time yield and the selectivity of the catalyst.

The manufacture of VAM is a process that has been known for a long time but is very difficult to control. The highly exothermic reaction takes place at between 140 and 180°C and at pressures of 5 to 12 bar. The usage concentrations of oxygen and ethylene are limited by two factors: The oxygen by the explosive limit of the gas mixture, and the ethylene by the heat development during the reaction. Excessive ethylene concentrations lead to rising process temperatures which promote the undesired oxidation of ethylene to carbon dioxide. Also, manufacturers compensate for the decreasing activity of the catalyst over time with higher process temperatures. For this reason, in large-scale processes, highly efficient heat dissipation and sophisticated heat management are critical factors.

It is not only the chemistry; the raw material prices also influence the process and the catalyst. In countries with low raw material costs such as the USA, manufacturers focus on highly active catalysts. In Asia, in contrast, its selectivity is decisive in order to convert the expensive ethylene as efficiently as possible. For Evonik, this means adjusting the specification and performance of the catalysts until they optimally meet the specific requirements at the site.
Even small changes can lead to noticeable improvements in the catalysts. In the case of shell-type catalysts, which are only impregnated in the peripheral area, the thickness of the precious metal layer is a critical parameter for activity and selectivity. The optimal catalyst, for the material-transport-limited reaction in VAM manufacturing, has a very thin, easily accessible and homogeneous impregnation with palladium and gold. Metal that is distributed deeper in the pore structure is wasted since the diffusion of the reactants is significantly slower than the oxidation reactions in the gas phase. Evonik therefore optimizes the dimension and composition of the shell. New formulations lead to thinner layers of precious metal. This increases the activity of the catalyst – with the same amount of metal. Simulations show that even minimal decreases in the shell thickness are significant.

A second important lever for optimized VAM catalysts is the fixing of the metals. The distribution and positioning of palladium and gold are critical for performance and lifetime of the Noblyst® catalysts. The precious metals on the carrier are not fixed, they can move – for example, deeper into the pore structure where they are then inaccessible for the reaction. Through migration, the concentration profiles and quantity proportions of the gold and palladium change, and this also has a negative effect on the activity. For this reason, Evonik has developed catalyst variants where the metals are fixed in the shell as a result of changed manufacturing formulations. This new generation of VAM catalysts features continuously high activity and especially long-term stability. For customers, this means longer lifetimes and improved efficiency in production.

New variants are subjected to comprehensive tests under real-life conditions to prove their performance capacity. The catalyst research unit in Hanau, Germany, commissioned a test unit in 2015 where such tests can be carried out very efficiently, with a high degree of automation, and with very meaningful results. The plant has five parallel fixed-bed reactors with multiple sample points and sensors, coupled with a modern analytical and process control system. It enables extensive examinations of the performance parameters of the VAM catalysts and it can map heat and material transport processes of highly exothermic reactions exactly as they occur in the process.

Most importantly, the plant enables Evonik to assist customers with application technology and to support them in all phases of their process, and over the total runtime. The Evonik test facilities also support the scale-up of new catalyst formulations which ensure that the optimal performance of the catalyst is achieved not only for lab samples but also on a pilot and production scale. The scale-up is also very important for the accuracy of new developments. Evonik now has three different manufacturing technologies for VAM catalysts. This means that it has a range of variants available which ensure efficient VAM production and which enable Evonik to respond quickly and with flexibility to customer requests in the various markets.
Closed-loop for precious metals
Evonik and Heraeus agree on partnership to recycle Evonik precious metal powder catalysts in the USA and EMEA.

Approximately 600 metric tons of palladium, platinum, ruthenium and rhodium are required worldwide each year; five percent of this goes into the production of chemical catalysts. When precious metal catalysts are at the end of their lifecycle, almost all of them undergo a refining process due to the high precious metal value they still retain. Depending on the precious metal and its concentration in the spent catalysts, and due to the optimized, highly developed refinement procedures, the precious metal recovery rate in the processing of precious metal powder catalysts can reach 92 to 99%. “These factors clearly illustrate how important a reliable, efficient and responsible recycling of used catalysts. The customers get both from a single source. In this way, the Catalysts Business Line makes a valuable contribution to resource efficiency and sustainability.”

“Our core business is the development and manufacture of catalysts”, says Diaz.

Evonik produces precious metal powder catalysts in Germany, China, Japan, India, and the USA. Once a catalyst has been used, Evonik takes it back via its partners and recycles the precious metals at local production and refine-
ment sites in compliance with strict safety and environmental requirements. The ultra-pure metals recovered become the feedstock for specific precious metal compounds and then used to manufacture fresh catalysts. Almost all customers have a precious metals account at Evonik where their precious metal stocks are managed, accurate to the gram/troy ounce. After all, palladium, platinum, ruthenium, rhodium, just like gold and silver, are the property of the customers. For the customers, the entire process is transparent. Via an internet-based calculation program, each customer can accurately calculate the catalyst costs for their product, including precious metal refining costs and interest charges. In addition, Evonik offers an SAP-based precious metal forecast which calculates the precious metal requirement of the customers based on existing catalyst and refining orders. This way, the customer knows quickly and with certainty whether their stock of precious metal is sufficient for any possible follow-up order or if additional precious metal must be purchased or leased from Evonik.

“Many years of experience in precious metal trading and solid relationships with the major raw materials suppliers, precious metal trading houses and banks worldwide enable us to manage on behalf of our customers the purchasing and financing of the precious metals required for the catalysts,” says Diaz. “We purchase, lease and exchange precious metals at competitive market rates for our customers’. The employees of Evonik’s Customer Service unit handle all precious metal transactions, from purchasing to financing, including precious metal logistics – it’s one-stop shopping.” This way, our customers can concentrate on their core businesses.

When purchasing raw materials for catalysts, the technical, commercial and qualitative criteria are important but there are other aspects which need to be considered. For instance, Evonik adheres to strict compliance rules such as the American Dodd-Frank Act, which forbids the use of minerals originating from conflict regions. This closes not only the loop of precious metal purchasing, processing and refining, but also that of sustainability, quality, responsibility and efficiency.
Evonik has produced precious metal powder catalysts under the Noblyst® trademark at its site in Shanghai Xinzhuang since 2010. Xinzhuang is not only a commercial production facility but has grown to become a site for the development of new catalysts. The site, which is still relatively new, has made great progress in a very short amount of time. In June 2015, it commissioned a pilot plant for precious metal powder catalysts that can produce kilo-scale quantities of existing formulas or samples of new developments. Its design, is similar to existing commercial facilities.

With its facility in Shanghai, Evonik now offers the full range of sizes for supply quantities of precious metal powder catalysts under the Noblyst® trademark, from laboratory samples, through semi-industrial quantities, all the way to commercial scale. The technology transfer has thus far spanned Germany and Japan, crossing international borders, language barriers, and various technology standards. For customers, the investment in China primarily means greater flexibility, shorter lead times, and cost advantages. Not least, it also means in many cases the elimination of high customs duties for precious-metal catalysts.

With the expansion of its activities, Evonik’s catalysts laboratory in Shanghai Xinzhuang offers not only excellent technical service but targeted product development on site. An ever-growing share of the samples analyzed in the laboratory come from these product developments, which are already being manufactured and optimized in the laboratory under conditions similar to actual production. As a result, the new products can be transferred particularly quickly from small-scale to technical-scale, and then to commercial-scale production. This means that Chinese customers receive their individually tailored specialty products without long wait times. Especially in the early stages, customer projects often require smaller quantities. Evonik now offers all of this from a single source in Shanghai, and is therefore a reliable on-site partner from an early stage of development.

With its investment in China, Evonik’s Catalysts Business Line is continuing to expand its existing portfolio and offering even better, faster service. Precious-metal powder catalysts are used primarily in the region’s fine chemicals, pharmaceuticals, and agrochemicals industries. In China, these markets continue to offer enormous growth potential.

In order to meet the special needs of our Chinese customers over the long term, we are planning to further expand our technical service for the entire product portfolio, as well as testing for catalysts in customer-specific reactions.

Research and development in China for China
Evonik has significantly expanded its development activities for catalysts in Shanghai Xinzhuang.
In order to harmonize our product nomenclature for consistent branding across each of our product groups we will be changing the name of our supported precious metal catalysts produced at our site in Dombivli India (formerly Monarch). The new names will incorporate our Noblyst® brand which represents our catalysts containing precious metals on various support materials. Evonik has extensive expertise in the manufacture of precious metal catalysts and provides a full service package including precious metal management and precious metal recovery from spent catalysts.

There will be no changes to the production process and we would like to emphasize that the described changes will not affect the specification and quality of our products. In the coming weeks we will be contacting each of the customers in India who will be affected by the name change which will take place in the fourth quarter of 2017.

Noblyst® brand for India

Supported precious metal catalysts produced in India to be sold under the Noblyst® brand.
EVENTS & FAIRS 2017

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<td>JSPC 2017 Summer Symposium</td>
<td>August 03 – 04</td>
<td>Osaka, Japan</td>
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<td>CPhI Korea</td>
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<td>Specialty &amp; Agro Chemicals America</td>
<td>September 06 – August 08</td>
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<td>The Brazilian Catalysis Congress (CBCat)</td>
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<td>Advances in Polyolefins 2017</td>
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<td>EPCA - European Petrochemical Association</td>
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<td>CPhI worldwide</td>
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<tr>
<td>4th International Congress on Catalysis for Biorefineries, Catbior 2017</td>
<td>December 11 – 15</td>
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We would be happy to send Catalysts Insight to anyone you know.

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