BASF information

November, 2017

Cover story

Challenges and opportunities for China's automotive market

Feature

Collaborative innovation for personalized nutrition

BASF
We create chemistry

Eddie Lin from Performance Materials Asia Pacific, BASF and Liang Xue from Technical R&D Center, Asia Pacific discuss the lightweight solution for engines. Lightweighting is an important direction for China's automotive industry achieving green development.

20 The car industry is ready for the biggest revolution in automotive history and has been drawing closer to the IT industry for many years now.

25 Personalized nutrition is the practice of carrying out safe and efficient individual nutrition intervention so as to maintain health and effectively prevent and control disease.

38 Top athletes are improving their health and performance with active functional cooling clothing, while many companies also use it to protect their employees from the hazards connected with overheating and overexertion.

Contents

Foreword

Welcome to the new issue of BASF information.

China's automotive industry has developed rapidly in recent years that the country has become the largest automotive market in the world. However, this sector also faces challenges such as slowed growth, pressing environmental requirements and intensified competition. In addition, the emergence of new energy vehicles, intelligent driving and other new technologies has significant implications to the industry. The auto industry is one of the most important customer industries for BASF. As a preferred partner, BASF offers a comprehensive range of solutions along the auto industry value chain. How will China's automotive manufacturers address the changing market environment? What solutions can BASF provide? This issue's cover story focuses on the automotive industry and discusses the challenges and opportunities brought by these transformations.

Chemistry enables people to attain good quality of life and sustainable living. For example, the stable supply of electricity significantly improves the quality of life in areas prone to typhoons or with limited access to transportation: utility poles as the carrier of electricity play an important role. BASF has developed a strong yet lightweight polyurethane utility pole. Compared with traditional ones, this one can better resist harsh climatic conditions and help people maintain a comfortable life. You will read more about the technology and the applications in ***Composite utility poles: conquering the wind***. Another example, personalized nutrition that provides tailor-made nutrition solutions according to individuals' physical conditions, lifestyles and health needs is transitioning from a niche market to the mainstream. ***Collaborative innovation for personalized nutrition*** will tell you more about this trend.

All these examples are the epitome of our continuous innovation with partners to create a sustainable future. We will continue to work with stakeholders to provide more customized solutions to meet the challenges and opportunities of tomorrow.

Hope you enjoy this informative read.

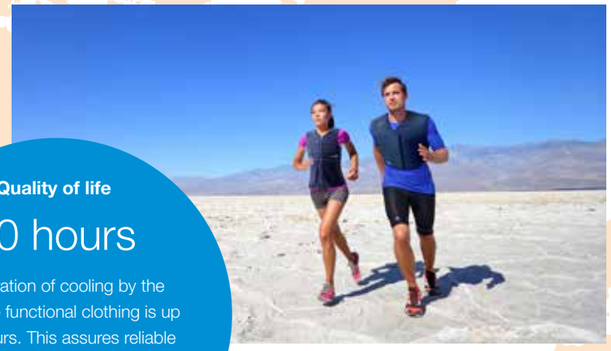
Sincerely,

Dr. Stephan Kothrade
President Functions Asia Pacific, BASF
President and Chairman Greater China, BASF

World in figures

75%

About 75% of the energetic processes in physical exertion are used for thermoregulation and therefore only 25% of the energy can be used for muscular processes such as sports or work performance.
See **Mobile air conditioner to wear** on page 38



Quality of life

20 hours

The duration of cooling by the innovative functional clothing is up to 20 hours. This assures reliable protection.

28 million

China's countrywide automotive sales broke through the benchmark of 28 million in 2016, globally ranking first for eight consecutive years.
See **Challenges and opportunities for China's automotive market** on page 8

Resources, environment and climate

€10 billion

The automotive industry is one of BASF's key customer industries. In 2016, BASF Group's total sales reached €57.55 billion, among which automotive driven sales totalled €10 billion – representing approximately 17% of BASF Group's sales.

Resources, environment and climate

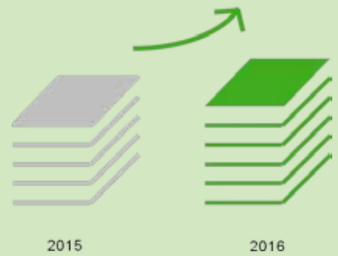
3 times

The market of connected car technologies is expected to triple from an estimated €40.3 billion in 2016 to approximately €122.6 billion in five years' time.

Innovation

21.5%

According to the statistics released by the State Intellectual Property Office of China in April 2017, 1.339 million patent applications for invention were submitted in the country in 2016, an increase of 21.5% over the previous year.



1/6

Weighting one-sixth of the traditional one, the composite utility pole is easy in installation; only two workers are needed to complete the entire process from transport to installation.
See **Composite utility poles: conquering the wind** on page 22

Quality of life

50 years

Moreover, the service life of composite utility pole can reach 50 years.

25 bars

Walter Reppe, a BASF chemist, discovered that acetylene could be processed safely under the pressure as high as 25 bars in 1920s. This discovery cleared the way for the modern processing of acetylene.
See **Acetylene: cornerstone of a firm foundation** on page 40

Innovation

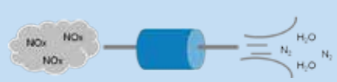
90,000 metric tons

BASF will start up a world-scale production plant for acetylene at its Ludwigshafen site in 2019. The facility will have the capacity to produce 90,000 metric tons of acetylene per year.

Resources, environment and climate

95%

BASF's Cu-SCR copper-based selective catalytic reduction catalyst adopts BASF's patented copper-based molecular sieve technology. It can reduce NOx emissions by up to 95% and it is of excellent durability and wide applicable temperature range.



BASF inaugurates new PVP production facility in Shanghai

BASF celebrated the opening of a new complex for the manufacturing of polyvinylpyrrolidone (PVP) located at the BASF site in Shanghai, China in September 2016. The new plant will produce PVP K30 powder, a polymer used as a base for several applications including pharma excipients, detergents, cosmetics and technical applications. The production of the new PVP plant expands BASF's reach to customers in Asia Pacific, especially in China, with continued reliable and high-quality supply.

In 2015, BASF announced plans for global investments into its NVP (N-vinylpyrrolidone)/PVP value chain of up to USD 70 million. The plans include the extension of capacities in Ludwigshafen, Germany and Geismar, Louisiana (USA), along with technology introduction in Shanghai, China. The state-of-the-art plant is equipped with sophisticated production facilities, including a high-quality control laboratory as well as substantial warehousing capacity.

BASF completes acquisition of Chemetall

In December, 2016, BASF completed its acquisition of Albemarle's global surface treatment business, Chemetall. Through this acquisition, BASF's Coatings division expands its portfolio. The combined businesses will benefit from each other's global infrastructure, scale and market access, driving new growth opportunities by offering an unmatched solutions competence to customers.

Chemetall develops and manufactures customized technology and system solutions for surface treatment. Their products protect metals from corrosion, facilitate forming and machining, allow parts to be optimally prepared for the painting process and ensure proper coating adhesion. These chemicals are used in a wide range of industries and end-markets, such as automotive, aerospace, aluminum finishing, and metal forming.

BASF pushes digitalization in research worldwide

At the Research Press Conference in Ludwigshafen in June, 2017, BASF provided insight into the digitalization of chemical research as well as its tools and applications. The new technologies include a new supercomputer that has been put into operation in Ludwigshafen, virtual and real-life experiments, targeted searching through data mining and an online application that helps farmers use available information more efficiently. In doing so, it will further enhance the key role that research and development plays in increasing innovative strength and competitiveness.

BASF inaugurates new plant for emollients and waxes in Shanghai

In June 2017, BASF inaugurated a new plant for emollients and waxes in Jinshan, Shanghai. The CNY 150 million project (approximately €20 million) is BASF's largest investment in emollients production in Asia Pacific.

The major applications of emollients and waxes are for skin care, hair care, sun protection, make-up, baby and child care, deodorants, and oral care. It complements BASF's current production of wax esters, emulsifiers and primary surfactant in Jinshan, and will further enhance BASF's local production and better serve the growing personal care market in China and Asia Pacific.

BASF and Dezhou City accelerate the city's development of modern agriculture

BASF and the Municipal People's Government of Dezhou City in Shandong Province, China signed a Memorandum of Understanding (MoU) to strengthen collaboration on sustainable agriculture in the city in 2016.

The two parties intend to set up a Sino-German Modern Agriculture Innovation Center in the Dezhou Economic and Technical Development Zone. The center will serve as an educational platform for students and farmers to learn more about research on biodegradation in soil, and the application and benefits of modern agricultural technologies.

In addition, the two parties will begin a number of projects, including a landmark project for the application of certified biodegradable mulch film made of ecovio®, with the aim to introduce some of the advanced technologies that can help enhance modern agricultural practices in the area. Both parties will also carry out a pilot project to evaluate the use of certified compostable waste bags made of ecovio for the collection of organic waste to generate compost as fertilizer.

BASF acknowledged as global leader in water management

In 2016, the international non-profit organization CDP (formerly "Carbon Disclosure Project") recognized BASF with top "A" ranking for sustainable water management. Of the 607 rated companies, just 24 received an "A" rating, including BASF. The CDP assessment for sustainable water management evaluates how transparently companies report on their water management activities and how they reduce risks such as water scarcity. Further, CDP assesses the extent to which product developments can contribute to sustainable water management on behalf of the rated companies' customers.

Efficient water use and the development of sustainable solutions for local water problems are important elements of BASF's water stewardship strategy. Here, BASF cooperates with other local water users, such as municipalities and companies operating in the same river basin district.

BASF launches new flooring structure for safer sports activities

BASF and DuBaiCheng Environmental Protection Engineering Company Limited (DBC) have launched a new polyurethane-based flooring structure containing a special grade of expanded thermoplastic polyurethane (E-TPU), Infinergy® SP.

BASF's Infinergy® SP combines the benefits of thermoplastic polyurethane with typical properties of foams. It consists of a closed-cell particle foam which absorbs little water, making it particularly suitable for sports flooring applications. Another main feature is its excellent recovery behavior, which improves safety in sports activities.

As this solution does not contain any heavy metal content or require solvent before or during the installation of the surface, it fulfills the increasing demand for sports surfaces that meets China's stringent national safety and environmental standards.

3-in-1 Basonal® Food Contact Board helps ensure packaging sustainability and food safety

BASF has launched the novel 3-in-1 Basonal® Food Contact Board (FCB) paper coating binder. The solution can be used in a wide range of food packaging applications, such as those for hamburgers, noodle boxes, popcorn buckets and sushi packages.

Basonal FCB minimizes the amounts of the key odor-causing components – 4-Phenylcyclohexene (4-PCH) and 4-Vinylcyclohexene (4-VCH) –to almost non-detectible levels. This low odor, low VOC product not only meets the food safety standard GB 9685 in China, but also enables excellent printability for complex shapes and high quality color printing.

Tinuvin® XT 100 light stabilizer increases durability of greenhouse film

BASF's plastic additive Tinuvin® XT 100 has been adopted by Yuxi Xuri Plastics Production Company Limited, a leading greenhouse film manufacturer in China, to make low density polyethylene (LDPE) film. The film is used to cover a greenhouse for growing grapes in Yunnan province in China.

Greenhouse films are susceptible to energy-rich solar radiation and thermal oxidation, leading to rapid and dramatic loss of physical, mechanical and optical properties which causes the plastic to become brittle. The hindered amines of HALS compounds, incorporated in Tinuvin XT 100, intercept the free radicals and make them harmless. With Tinuvin XT 100, it is possible for Yuxi Xuri to produce LDPE films that withstand even high agricultural chemical levels and assure a service life of up to two years, even under intense sunlight.

Spring / Summer 2019 Color Trend Forecast unveils

BASF has collaborated with the world's leading color expert, Pantone® Color Institute, to unveil Spring/Summer 2019 color trend forecast, *Ahead of Time*. BASF's 2019 Spring/Summer palettes are grouped into two collections: Haven and Masterpiece, each offering distinct inspirations.

The Haven collection for Spring is inspired by the often hyper pace of today's modern world. The collection features translucent gradients, prismatic aqua pearl sparkle, and metallic textures that add refined interest and built-in actives offer multi-functional benefits and protection against pollutants and allergies.

The Summer 2019 collection, Masterpiece, is influenced by the spontaneous meeting of art, nature and science, curated into surprising textural innovations. Effect pigments are inspired by natural textures like wood grains, glistening sands and raw minerals, as well as art materials such as cream paint, glass gel and ceramic glaze.

BASF provides child-friendly paint to create haze-free kindergartens

Green properties developer Landsea and BASF jointly initiated a kindergarten-renovation project under "Green Bud Action" in November, 2016. Ten kindergartens located in ten cities including Shanghai, Beijing, Tianjin, Wuhan, Hangzhou and Chengdu, among others, were selected for renovation. Through this project, the schools' facilities will be upgraded for better environmental performance, and a healthier lifestyle and greener construction techniques will be promoted.

Child-friendly paint from BASF was used for the project. This product was designed specifically for children's rooms, representing the latest achievements in environmentally-friendly coatings; no detectable VOCs, methanol or heavy metal pollutants and also without APEOs (alkylphenol ethoxylates). In addition, it has passed the highest grade of film mold-resistance testing and has strong stain and scratch resistance.

Challenges and opportunities for China’s automotive market

The photo was taken at Lujiazui Financial and Trade Zone in Shanghai, China.

“According to the green development targets and requirements proposed in the *Mid- and Long-term Development Plan for Automotive Industry*, the industry will be focusing on light-weighting, fuel consumption reduction and the development of new energy vehicles (NEVs).”

Xu Changming
Deputy Director of State Information Center and senior economist

China’s automotive industry has been growing rapidly and the country is playing an increasingly important role in the global automotive market. According to the Ministry of Industry and Information Technology (MIIT), China’s countrywide automotive sales have broken through the benchmark of 28 million in 2016, globally ranking first for eight consecutive years.

However, pressing environmental requirements and fierce outside competition are forcing China’s automotive industry to accelerate its innovation and transformation; on the other hand, trends such as consumption upgrades, rise of small towns and the integration of information and communication have complicated demands for automobile consumption.

Facing a rapid change in technology and the growing intricacy of an industrial environment, where will China’s automotive market go? What are the new opportunities?

Coexistence of challenges and opportunities

With the rapid growth of cars in China, vehicle emissions are becoming prominently problematic. *China Vehicle Environmental Management Annual Report 2017* showed that the emission from motor vehicles constitutes a major source of air pollution. Therefore, environment protection measures targeting motor vehicles have been taken.

In addition, energy consumption of the traditional automotive industry is relatively high. Xin Guobin, Deputy Minister of Ministry of Industry and Information Technology pointed out that China was lagging behind international standards in terms of passenger vehicle fuel consumption in 2016. China has made a commitment to the world to reach a carbon emission peak in 2030 and increase the proportion of primary energy to 20% (2016: 13.3%). However, based on the current development speed of the auto industry, it is difficult to deliver on this promise.

Energy conservation and emission reduction is the only way for China’s automotive industry to go forward. “According to the green development targets and requirements proposed in the *Mid- and Long-term Development Plan for Automotive Industry*, the industry will be focusing on light-weighting, fuel consumption reduction and the development of new energy vehicles (NEVs),” said Xu Changming, Deputy Director of State Information Center and Senior Economist.

“Traditional vehicles will still hold an absolute major share in China’s automotive market before 2030,” said Xu, “therefore, low carbonization is the inevitable trend for future vehicles.” In Xu’s view, there are three main ways to meet the stricter limit on fuel consumption: light-weighting, miniaturization and technological upgrade of the traditional engine, all of which need to be supported by advanced materials.

When it comes to new energy technology, the ratio of NEVs is climbing to total sales of new cars. Moreover, the government is actively pushing the development of NEVs with a series of measures. It is clearly stated in the *Mid- and Long-term Development Plan for Automotive Industry* that by 2020, NEV annual sales will hit 2 million and by 2025 over 20% of car sales will be powered by new energy.

The four main influencing factors for the development of NEVs are: the key technology maturity of battery and whole cars, sale price of a whole car, convenience of charging and the supply chain of NEV production. The introduction of new materials may be the breakthrough in current NEV technology. “Take the fast-growing electric vehicles segment as an example. Battery has been a pivotal difficulty for its production development. With the emergence of ternary cathode materials, the battery can achieve higher energy density than a lithium battery, and in this case, its life span increases. This is a new opportunity created by new materials,” Xu added.

In the consumer market of automobiles, with the development of China’s overall economy and the elevation of Chinese consumers’ purchasing power, an upgrade of consumption is under way.

“Take the luxury vehicle segment for instance. Consumers are changing their definition of ‘luxury’. Nowadays they not only ask for a car with a beautiful appearance, but are paying more attention to the functional performance and fun of driving,” Xu further explained.

Market segmentation and product customization brought by the consumption upgrade set higher standards for the model and interior design, appearance and environmental performance of the materials and coatings, and comfort of drivers and passengers. To meet these needs, an overall increase in research and development is required.

Sound and reliable solutions to facilitate the industry’s development

The automotive industry is one of BASF’s key customer industries. In 2016, BASF Group’s total sales reached €57.55 billion, among which automotive driven sales totalled €10 billion – representing approximately 17% of BASF Group’s sales.

“As the biggest supplier of chemical materials for the global automotive industry, BASF supports China’s auto industry to transform and upgrade with advanced materials,” said Dr. Zheng Daqing, Senior Vice President, Business & Market Development Greater China, BASF, “and we tackle challenges and seize opportunities together with the OEMs, auto parts suppliers and all partners along the automotive industry chain.”

Respond to policies positively and develop sustainable mobility

The mounting pressure of environmental protection in China has triggered a series of policies affecting the automotive industry. BASF strives to promote sustainable transportation with customers through multiple innovative solutions along the entire value chain of the automotive industry.

To reduce the impact to environment, BASF offers customers a series of innovative and effective solutions, including catalyst and coating solutions that help reduce emissions and energy consumption, interior and cabin air purification solutions that help reduce VOC (volatile organic compounds), automotive fluid management solutions that help increase power efficiency and fuel economy, among others.

Light-weighting is another important technical field for energy saving and emission reduction. BASF also provides diversified lightweight solutions, including composite materials, polyurethane systems, metal injection molding solutions, among others. These solutions help reduce weight as well as improve the strength and elasticity of structures and parts, realizing more unique designs.

BASF is also actively planning in the field of NEV. “Foreseeing China’s promising future with NEVs, BASF moved its global headquarters for the business unit of battery material to Shanghai in 2015,” Zheng points out. “In the field of the cathode materials of batteries, BASF products cover from LFP (lithium iron phosphate) materials, which is a major component in the market, ternary cathode materials including NCM (nickel cobalt manganese) to quite mature NCA (nickel cobalt aluminum) materials. To meet market demand, BASF will continue to invest in the R&D of innovative battery material and set to solving the cost and sustainability problems of cathode active materials as a core task.”

Light-weighting is also significant for increasing NEV’s overall performance. BASF is also developing new applications especially for NEVs. With its excellent resistance to high temperatures, Ultramid® polyamide engineering plastic is used in the connectors and wire harnesses in the electric car charging system. It can not only withstand the stresses of delivering high levels of electricity but also resist weathering conditions outdoors. Ultramid has been applied to electric cars of major Chinese OEMs. It is also used for e-motor mounts.

Follow consumption upgrade and support local innovation

As consumers’ demands become more sophisticated, creativity emerges as the key for automakers to make a difference in the competition in the marketplace.

Personalized design has become a decisive factor. As an innovative solution for car design, BASF’s transfer coating technology valure® can be applied to the surface of leather and many substrates (both natural and synthetic based) for auto interiors. It uses a laser engraved mold which can replicate natural surfaces, technical structures and complex designs and creates a soft touch. Integrating its broad portfolio of colorants and effect pigments, the newly established “Colors & Effects” brand further strengthens BASF’s expertise in the color design for automotive coating, in addition to other industries. It offers both car makers and car buyers a diverse selection.

Local OEMs are booming with their in-depth understanding of local consumers. “We now see that the demand from local OEMs for high quality and innovative materials is growing fast,” said Zheng. “And we collaborate with China’s major local OEMs to boost local innovation with the support of our global and local R&D networks.”

Energy conservation and emission reduction is the only way for China’s auto industry to go forward.

“As the biggest supplier of chemical materials for the global automotive industry, BASF supports China’s auto industry to transform and upgrade with advanced materials, tackles challenges and seizes opportunities together with the OEMs, auto parts suppliers and all partners along the automotive industry chain.”

Dr. Zheng Daqing
Senior Vice President, Business & Market Development Greater China, BASF

Currently, BASF has established a rewarding partnership with China’s main local auto companies like SAIC and Great Wall, providing innovative solutions for their needs.

To better serve its local customers, BASF has been strengthening its local R&D capacity. In June 2017, BASF announced its investment to build its first regional Automotive Application Center in Asia Pacific based at the BASF Innovation Campus Asia Pacific (Shanghai). The automotive business and R&D teams based at the same location will work closely with the BASF Global R&D center, developing solutions for automotive companies and component suppliers.

“Supported by strong local production and innovation capacity, BASF and its local partners, customers and suppliers will have more opportunities,” Zheng concluded.

BASF in cars

The automotive industry is one of BASF's most important customer sectors. The company generated around 17 percent of its turnover with products for the automotive industry in 2016.

By Raoul Schneider

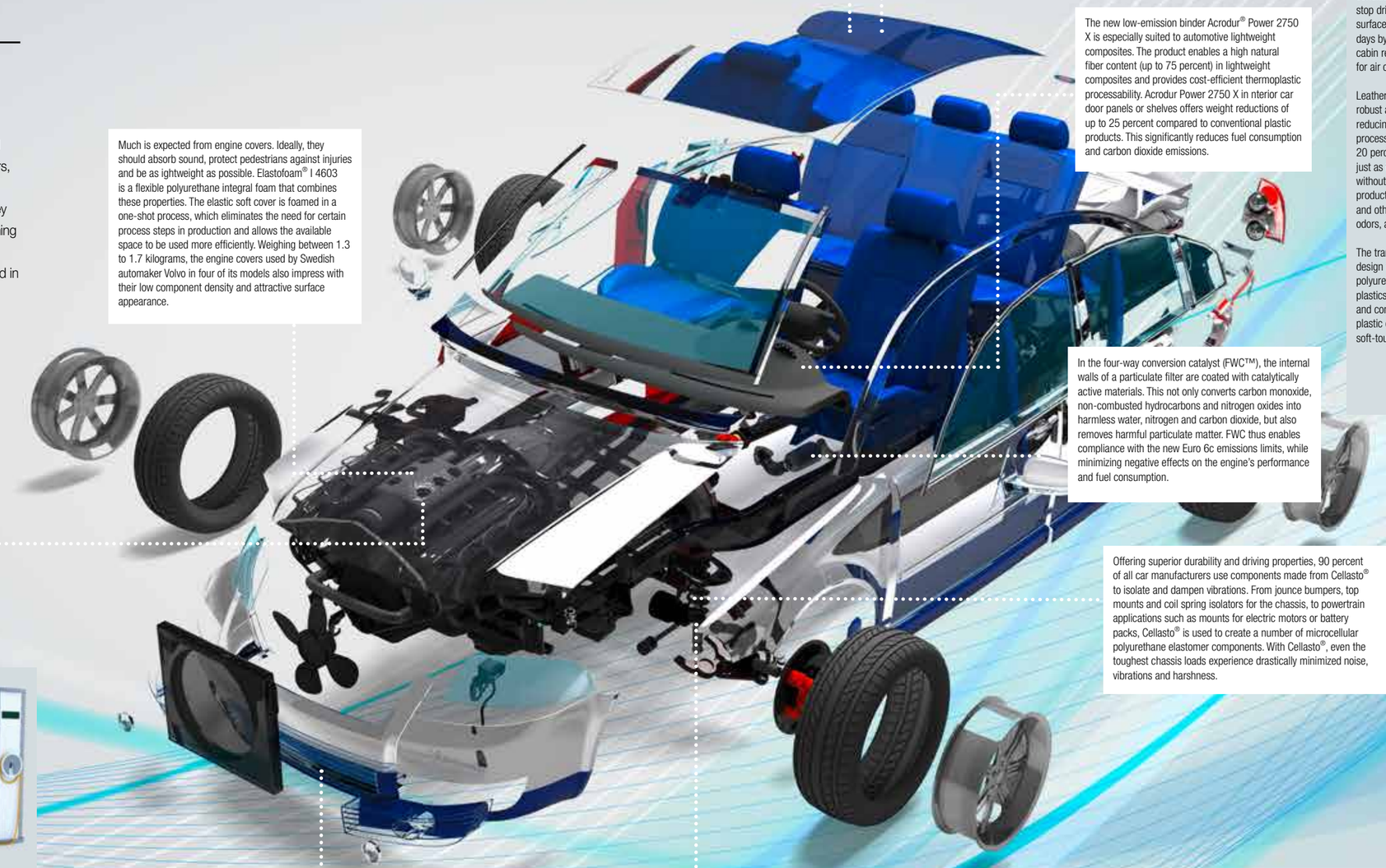
BASF is the leading chemical supplier to the automotive industry. There are approximately 1.2 billion cars on the roads around the world and the number is rising further. Even now, half of all cars worldwide feature a paint coat or plastic component from BASF, whose customers include all major manufacturers in the automotive sector. Among others, plastics, coatings, pigments, fuel additives and catalysts from BASF make automobiles more efficient and lighter; they reduce pollutant emissions and provide the basis for combining functional and appealing design. Our graphic provides additional information on some BASF products that are used in cars and how they perform.

BASF is constantly striving to optimize its coating processes. The goal is to make the processes even more environmentally friendly, while also reducing costs for the customer. The Integrated Process II (IP II) no longer requires a separate primer process, which also eliminates the need for a baking step. The primer protects the paint coat beneath it against short-wave UV radiation and stone chipping. These properties are already integrated into the basecoat through the Integrated Process II. The shorter process allows both energy costs and CO_2 emissions to be reduced by approximately 20 percent – so it is no surprise that many automotive manufacturers are already relying on this technology.

Cathodic e-coatings are the basis for resistant surfaces. CathoGuard® 800 is the first paint layer applied to the automobile body. It protects the metal's cavities, surfaces and edges against corrosion and provides an excellent base for applying the subsequent paint layers. E-coating is compatible with many types of metals, making it ideal for lightweight composites. It is also environmentally friendly and resource-efficient. The new generation of cathode e-coatings is low-solvent and contains no tin compounds.

The new low-emission binder Acrodur® Power 2750 X is especially suited to automotive lightweight composites. The product enables a high natural fiber content (up to 75 percent) in lightweight composites and provides cost-efficient thermoplastic processability. Acrodur Power 2750 X in nterior car door panels or shelves offers weight reductions of up to 25 percent compared to conventional plastic products. This significantly reduces fuel consumption and carbon dioxide emissions.

Much is expected from engine covers. Ideally, they should absorb sound, protect pedestrians against injuries and be as ightweight as possible. Elastofoam® I 4603 is a flexible polyurethane integral foam that combines these properties. The elastic soft cover is foamed in a one-shot process, which eliminates the need for certain process steps in production and allows the available space to be used more efficiently. Weighing between 1.3 to 1.7 kilograms, the engine covers used by Swedish automaker Volvo in four of its models also impress with their low component density and attractive surface appearance.



In the four-way conversion catalyst (FWC™), the internal walls of a particulate filter are coated with catalytically active materials. This not only converts carbon monoxide, non-combusted hydrocarbons and nitrogen oxides into harmless water, nitrogen and carbon dioxide, but also removes harmful particulate matter. FWC thus enables compliance with the new Euro 6c emissions limits, while minimizing negative effects on the engine's performance and fuel consumption.

Keropur® is a fuel additive that increases an engine's performance and life span by forming a protective film in the engine's intake system. This prevents the formation of deposits, thus reducing emissions and enabling a fuel saving of about two percent.

Offering superior durability and driving properties, 90 percent of all car manufacturers use components made from Cellasto® to isolate and dampen vibrations. From jounce bumpers, top mounts and coil spring isolators for the chassis, to powertrain applications such as mounts for electric motors or battery packs, Cellasto® is used to create a number of microcellular polyurethane elastomer components. With Cellasto®, even the toughest chassis loads experience drastically minimized noise, vibrations and harshness.

Electromobility

Battery technology is the heart of electric vehicles. Batteries need to be powerful, quick charging and affordable. This is a task for chemistry, because batteries are small power plants that convert chemical into electrical power. And this is one of the greatest challenges for the future. BASF primarily develops cathode materials and electrolyte formulations designed to improve the performance of existing battery systems. Other projects focus on researching materials and components for future generations of batteries that feature a higher storage capacity, performance and lifetime. The objectives are clear: Vehicles in the Bolt and Tesla class equipped with commonly used lithium-ion batteries currently have a range of 300 to 500 kilometers, so it is hoped that future battery generations such as lithium-sulfur systems will more than double the range affordably.

Ground-level ozone, the main component of smog, is particularly common in city centers. PremAIR® NXT is a catalytic coating that is applied to automotive radiators. As air passes over the radiator while the car is moving, the coating converts harmful ozone molecules into oxygen.

The engineering plastic Ultramid® A3WG10 CR establishes a trend in the chassis. The world's first plastic transmission crossbeam in the rear axle subframe in the Mercedes-Benz S-Class is made of this BASF plastic. Compared to die-cast aluminum beams, the crash-optimized polyamide offers weight savings of 25 percent, better acoustics and excellent mechanical properties. As housing, Ultramid® A3WG10 CR is now also combined with the PU elastomer Cellasto® in top mounts. Introduced at the International Motor Show 2015, this is the world's first top mount made completely from plastic connecting shock absorber and chassis. The top mount is approximately 25 percent lighter than comparable die-cast aluminum versions. The result is pleasant acoustics, vibration damping and a high level of safety and comfort.

Design

Besides functionality, design and form are decisive factors when it comes to cars. BASF products are not only functional – their beautiful surfaces and appealing haptics are also impressive.

The color is very important to many car owners, who are increasingly demanding greater depth and dimension in paints. The answer is the award-winning special-effect paint XSpark®, which was recently honored with the Red Dot design award. Its intense radiance, particularly in sunlight, is due to the integrated glass particles. The surfaces of dark-colored cars heat up considerably when exposed to sunlight.

Vehicle interiors can also become unbearably hot unless the air conditioning is working at full blast. Functional pigments from BASF stop drivers getting hot and bothered at the wheel. They ensure that surfaces coated with darker paints do not heat up as intensely on hot days by reflecting radiation rather than absorbing it. The passenger cabin remains significantly cooler, which reduces the energy needed for air conditioning.

Leather interiors represent elegance and exclusivity, but are also robust and easy to maintain. And leather can also contribute to reducing weight. Artiria leather from BASF is produced in a special process using Relugan® RE & RF and Densodrin® DP. The leather is 20 percent lighter than conventional leather used for car seats, but just as tear resistant. A light coating provides physical properties without negatively affecting the leather's natural characteristics. The products in the Astacin® and Lepton® ranges are free from solvents and other volatile organic substances; this prevents unpleasant odors, among other benefits.

The transfer coating technology valure® allows virtually unlimited design freedom in car interiors. The coating consists of water-based polyurethane dispersions that can be applied onto leather, textiles or plastics.The coating is microporous and offers enhanced breathability and comfort. valure® offers the possibility to equip seat covers or plastic components with leather structures, geometric designs or soft-touch effects.

Fotos / Grafik:
designed by Freepik.com, iStock, shutterstock

Innovative catalyst technologies for cleaner air

Roads within cities form a traffic network while the vehicles driving on them support economic development and people's lives. Vehicles including buses, trucks and long-distance coaches, among others, powered by diesel engines are a non-negligible part. While they do meet people's travel needs and carry cargo, they have also created problems such as traffic congestion, noise and exhaust emissions.

Stringent environmental policies challenge industry

It is an indisputable fact that diesel vehicles produce high emissions. In the *China Vehicle Environmental Management Annual Report 2017* released by the Ministry of Environmental Protection Department, statistics show that nitrogen oxide (NOx) emissions from diesel vehicles in the country accounted for nearly 70% of the total vehicle emissions, and the proportion of particulate matter (PM) exceeding 90%. A large number of fine particles floating in the air forms a smog. In addition, according to research results published online in the journal *PNAS* by the Wang Gehui Research Group of the Institute of Earth Environment, Chinese Academy of Sciences, nitrogen dioxide and liquid-phase oxidized sulfur dioxide found in atmospheric fine particles are a cause of the formation of sulphates during smog, and sulphates are one of the major components of PM2.5.

In the past, diesel fuel quality was poor and companies were afraid of losing cost advantages due to the price increase caused by technological upgrading. Diesel emission standards were not strictly enforced.

Over the past few years, the public call for a solution to the smog has been increasing and the government has shown its steadfast determination to solve the problem. In the past two years, the intervals of Beijing's issuance of motor vehicle emission regulations have become shorter and the standard requirements have been more tightening. Take the heavy-duty diesel vehicle standard in the China National Stage V emission regulation (NS V for short) for example. Compared with the China National Stage IV emission regulation (NS IV), the NOx emission standard is set to drop from 3.5 g/kWh to 2 g/kWh; by 2020 when the China National Stage 6 emission regulation (NS VI) is implemented, this value will drop to 0.4 g/kWh. In addition, emission requirements in actual on-road driving conditions tested by portable emission measurement system (PEMS) are added to the NS VI regulation, i.e. vehicle emissions should reach the standard under both laboratory conditions and actual normal driving conditions. It can be recognized that diesel vehicles have become the focus of China's vehicle emission treatment issue.

The new version of the Atmospheric Pollution Prevention and Control Law of the People's Republic of China (New Atmospheric Law for short) was formally implemented on January 1, 2016, and the status of the Ministry of Environmental Protection as the main body of regulating vehicle emissions has been defined. In terms of regulatory means, the government has transformed the former practice of focusing on examination and approval while neglecting supervision of the present practice of emphasizing supervision over permission. In the past, it was alright as long as the vehicles submitted for inspection were compliant, but now each should be compliant and reach the same standard as well as being subject to a spot check at any time.

In facing stringent emission standards and more elaborate and transparent regulatory means, the diesel vehicle industry is experiencing a vital battle. How can companies get through this siege? Product upgrading driven by innovative technologies may be the only way out. As a result, companies have had to change their approach and have begun to attach importance to policies and regulations, research trends and actively participating in technological and product upgrading. Forward-looking companies have already experienced competitiveness resulted by innovation from technological upgrading.

Leading innovative technologies with support from international suppliers

Founded in 1946, Weichai Power is one of the most powerful automotive and equipment manufacturing groups in China and a market leader in the development and production of high-powered engines. Its product development has been widely recognized by the industry.

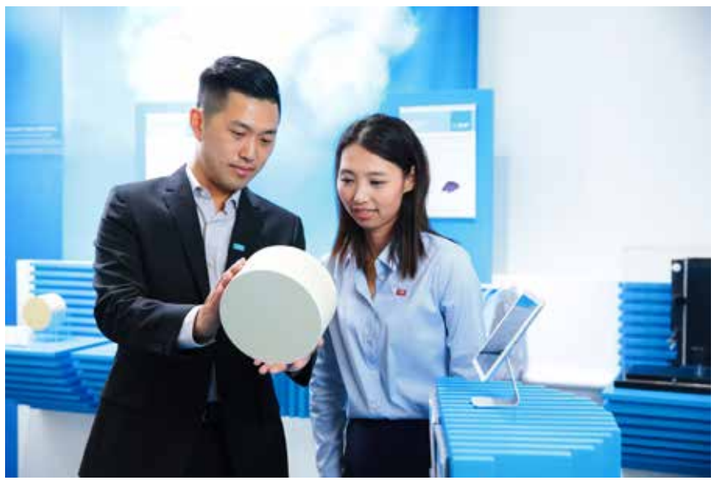
In the view of Feng Gang, Vice President of Weichai Power, technical strength is an important guarantee for the company to win the market. Reducing emissions has been a major focus of engine technology innovation. "Weichai is forward-looking regarding emissions in relevant areas. Since the issuance of the China National Stage III emission regulation (NS III) in 2006, it has been unswervingly implementing relevant national laws and regulations and developing appropriate technical routes."

With the continuous enhancement of emission standards, it becomes almost impossible to meet relevant requirements using in-engine purification technology improvements. To maintain its leading edge in technology, Weichai has been attaching great importance to cooperation with an "external brain".

"BASF is one of the closest partners of Weichai and we are willing to choose international suppliers with good reputation and technical competence as our partners," said Feng.

In 2005, BASF became the first catalyst supplier for Weichai's after-treatment system. The company also cooperated with Weichai in its R&D on engine after-treatment systems. It has addressed this challenge by installing a catalyst-equipped after-treatment system to the engine. "For more than 10 years, BASF has provided Weichai with technical support and new ideas regarding the after-treatment systems," said Feng.

During this period, BASF provided Weichai with a series of diesel vehicle emission control catalysts suitable for the NS IV and NS V emission regulations. For example, the WP10, WP12, WP7 engines of Weichai are the first to meet the requirements of



Dr. Zhang Jiadi from Environmental Catalysis Research, Asia Pacific and Tina Wu from Mobile Emissions Catalysts discuss BASF's copper-based selective catalytic reduction (Cu-SCR) catalyst.

"BASF is one of the closest partners of Weichai and we are willing to choose international suppliers with good reputation and technical competence as our partners."

Feng Gang
Vice President of Weichai Power

Weichai Group

Founded in 1946, Weichai is one of the biggest automobile and equipment manufacturing groups regarding comprehensive strength. Having more than 80,000 employees in the world, the group has achieved 134.1-billion-yuan sales income in 2016, ranked 155th of China top 500 enterprises in 2017. Weichai Group is an interdisciplinary, multi-industry international company that possesses automotive, construction machinery, powertrain system, luxury yacht and finance & services five business platforms. Take "Green Power, International Weichai" as the mission, Weichai Group will try to achieve the grand vision of becoming a sustainably developing world-leading international industrial equipment manufacturing group with core technologies, taking engines and vehicles as the orientation and powertrain system as the core.

“We are committed to developing innovative and cost-effective solutions to help our customers cope with the most stringent emission control regulations while improving their comprehensive product capabilities and achieving greater business success.”

Dr. Michael Baier
Vice President of Mobile Emissions Catalysts Asia Pacific, BASF

NS IV emission regulations. They are equipped with the after-treatment system that adopts BASF’s vanadium-based selective catalytic reduction (SCR) catalyst. This technology can transform NOx into water and nitrogen in the presence of a urea solution. Its advantages include a wide applicable temperature range, high durability and improved hydrocarbon poisoning resistance.

Through years of cooperation, Weichai has fully come to trust the reliability and support of BASF’s technologies, and the two sides have gradually formed a strong relationship. In 2008, BASF became the initial member of Weichai’s R&D Community. This community aims to invite relevant suppliers to collaborate and innovate on the same platform in the early stages of product R&D and project approval. This is undertaken to shorten the R&D cycle and reduce R&D costs. In 2015, by virtue of its after-treatment simulation software CatSim with independent property rights, BASF provided Weichai’s engine electronic control unit (ECU) control software with after-treatment system dynamics support.

To become a market leader, it is required to not only meet current standards but also look further afield. “When the NS V emission regulation was issued, Weichai’s laboratory standards had already been stricter than the national standards. We took full account of the oil quality after marketization, user maintenance and actual road conditions, and did a good job in developing technical reserves in advance,” said Lang Junyu, Deputy General Manager of Weichai Power Air Purification Technology Co., Ltd. These indicators were the issue to be considered in the national emission regulation setting process of the next stages.

In October 2015, the government issued a new regulation – the Special Beijing V emission regulation. This required that as of January 1, 2016, all new heavy-duty diesel vehicles should implement the fifth-phase emission standards. In addition, heavy-duty diesel vehicles used in the administrative area were recommended to adopt a Diesel Particulate Filter (DPF) with a high purification rate to ensure that the number of particulate matter (PM) was no more than $6x10^{12}$, which is stricter than the NS V emission regulation. Fortunately, Weichai had already started the technological R&D with BASF targeting the NS VI emission regulation. By the time the new regulation was issued, relevant products had already created a strong foundation and product upgrading could easily be conducted after debugging and matching. This helped Weichai to seize market opportunities.

When relevant national policies and regulations change, Weichai needs to re-evaluate the entire system. As the NS VI emission regulation incorporates a vehicle’s actual on-road emission (RDE) test results into the measurement system and requires the use of a portable emission measurement system (PEMS) for testing, the diesel vehicle emission limits are facing more stringent requirements. This means catalyst performance needs to be further enhanced. At present, BASF is working with Weichai to upgrade and improve after-treatment-related technologies. The WP10 engine series is one of Weichai’s engine products with the highest sales volume and has been popular since the NS III emission regulation was issued in 2011. BASF’s solutions can help this engine meet more stringent emission requirements under the premise of maintaining the original engine size, thus guaranteeing the vitality of the product. This program has taken the lead in passing the internal verification of Weichai. In addition, BASF’s products and technology can not only meet laboratory testing requirements but also reach emission standards under an aging state with outstanding stability. This is an important guarantee for the manufacturer to pass testing and maintain quality stability.

“We hope that with future cooperation, especially regarding the NS VI emission regulation, BASF can introduce foreign resources and experience into China, and meet the country’s actual road demands through innovative R&D for China,” said Feng. “This is the guarantee of meeting national emission standards as well as maintaining Weichai’s competition differentiation.”

As a global leader in the field of catalysts, BASF has not only one-sided industry experiences across regions but also a wealth of product lines. So far, the company has introduced multiple products targeting the upcoming NS VI emission regulation. For example, BASF’s copper-based selective catalytic reduction (Cu-SCR) catalyst has adopted BASF’s patented copper-based molecular sieve technology. It can reduce NOx emissions by up to 95% and it is of excellent durability and a wide applicable temperature range. SCR on Filter combines SCR catalyst with diesel particulate trap, realizing the removal of both NOx and particulate matter (PM) by using a single substract. While meeting relevant new emission requirements it saves more after-treatment system space, thus reducing the overall system costs.

“BASF owns a strong development competence in China and has maintained a long-term relationship with Weichai,” said Dr. Michael Baier, Vice President of Mobile Emissions Catalysts Asia Pacific, BASF. “We are committed to developing innovative and cost-effective solutions to help our customers cope with the most stringent emission control regulations while improving their comprehensive product capabilities and achieving greater business success.”

Haptex®, a polyurethane (PU) solution for synthetic leather is applied in the automotive instrument panel.

Design freedom: next stop of innovation

Today’s auto manufacturers regard car design as an important topic for research and development. For consumers, apart from vehicle performance, their perceived values, depending on the design and material properties, are becoming increasingly important. They will bring more ideas on car design and more space for innovative technology.

At the CHINAPLAS 2017 “Design x Innovation” event in May 2017, an automotive instrument panel prototype co-developed by BASF and Yanfeng impressed visitors.

Made with Haptex®, an innovative polyurethane (PU) solution for synthetic leather from BASF, the surface of the instrument panel features distinctive texture, special color and excellent haptics. Without the use of organic solvents, the product complies with the stringent volatile organic compounds (VOC) standards in cars.

Achieve design flexibility with materials

Yanfeng is one of the most important automotive component suppliers in the world. It provides products and services in automotive interior, exterior, seating, electronics and safety systems. Just like any other automotive interior designer, the Yanfeng designers face more restrictions than artists and fashion designers. Taking aesthetics into account, they have to pay extra attention to certain realistic issues – material properties such as water and stain resistance, feasibility in manufacturing and consistency in quality. Considering the high requirement in manufacturing and strict criteria on testing, many options are excluded from the material list. Automotive interior designers previously looked for corresponding materials and designs based on customers’ needs. In doing so, the limited choice in materials may lead to a convergence in design and brilliant design may be difficult to open up.

As the penetration of vehicles rises in China, consumers are becoming more demanding in both appearance and performance when they make a purchase decision, thus posing greater challenges for designers. For years, Yanfeng has been thinking about how to make breakthroughs in interior design through product innovation.

At BASF, there has already been solutions to address Yanfeng’s concern. As a leading chemical supplier in the automotive industry,

“Through the deep interaction among brand owners, designers and material suppliers, it brings out the material uniqueness from materials to product design, development and the finished end products.”

Yiwen Zha
IP & Operation Director, Yanfeng

BASF offers the broadest portfolio in advanced materials and relevant solutions to the auto industry. It helps designers to understand material features, to inspire them to break the existing design limitations and to achieve greater design freedom while meeting the multiple engineering requirements of lightweight, high fuel efficiency, low VOC, among others. Since the early 1980s, BASF and Yanfeng have established a long-term cooperation with mutual trust. The two sides listen to each other’s needs and carry out exploration on the application of advanced materials.

“Cooperation among brand owners, designers and material suppliers is essential because driving innovation is a multifaceted endeavor, from material selection to production and commercialization.” said Andy Postlethwaite, Senior Vice President, Performance Materials Asia Pacific, BASF.

When the material experts from BASF introduced Haptex to Kate Zhong, Senior Color and Trim Designer of Yanfeng, the new synthetic leather instantly attracted her interest. After a discreet study of Haptex, she found that it had many excellent features that were able to address market pain points and meet the potential demands of consumers.

For instance, the auto industry is paying more attention to the environmental performance of interior leather materials. Adhesives and chemical solvents, more or less applied during the conventional processing of genuine leather or artificial leather materials, brings odour or VOC into cars. However, Haptex is produced with no organic solvents. BASF has also eliminated the conventional wet process step and the use of adhesives in the dry process step. The synthetic leather, therefore, enables vehicles to meet stringent VOC standards in China and helps to make car indoor air healthier. In view of the increasingly strict environmental protection standards for vehicles, the feature becomes a highlight that appeals to designers.

In addition, when stretched, Haptex can maintain its texture unchanged, without any defect of color loss. As a result, the desired color and texture in design can be achieved during the actual manufacturing, where the consistency of material quality can also be ensured. Meanwhile, the performance of sewing is also optimized to prevent stitches from being broken, so as to perfectly present the effects expected by designers.

Furthermore, Haptex, as a decorative material, features the soft haptics as real leather but has a more outstanding look compared with traditional leather or plastics. It meets the demands of car owners for superior interior decoration while offering designers a higher degree of design freedom. “Haptex provides more diversified textures and colors to choose, which means more possibilities for designers,” said Yanfeng’s Zhong. For consumers, of course, this also indicates more or even customized car interior options.

In its discussion with BASF, Yanfeng applied Haptex in the automotive instrument panels – the best display scenario for interiors and an important indicator of future design trends. It successfully debuted at the CHINAPLAS 2017 after four months of design, development and production. In future, BASF and Yanfeng will also cooperate to promote the commercialization of this design.

BASF exhibited an automotive instrument panel prototype developed with Yanfeng at CHINAPLAS 2017.

About Yanfeng

Yanfeng focuses on automotive fields like interior, exterior, seating, electronics and passive safety, being dedicated to offer leading solutions for major automotive manufacturers all over the world. As a global company based in China, the overseas business accounts for nearly 30 percent. There are over 210 footprints worldwide, with total employees of 66,000 and engineers and designers of 4,000. Yanfeng constantly centers on automotive industry upgrade, pushing forward automotive evolution both for driver and passenger. Yanfeng will support automotive manufacturer to explore the future and to bring a better human-vehicle interaction for global automotive consumers by product innovation and foresighted research.

Yiwen Zha, IP & Operation Director, Yanfeng, calls design the essence behind a brand. Design, meanwhile, can accentuate the uniqueness of the material giving it meaning to its benefits. “Through the deep interaction among brand owners, designers and material suppliers, it brings out the material uniqueness from materials to product design, development and the finished end products,” said Zha. “The true meaning of such cooperation is to provide the best driving experience for consumers. In future, we will work together to explore more possibilities of innovative materials applied in auto components and meet the aesthetic and quality needs of the new-generation consumers.”

Steer to the future of car design with innovation

As a leading supplier in advanced materials, BASF values the crossover and integration of art and technology with which to assist designers in creation.

The designers of BASF’s Coatings division in China, Japan, the United States and Germany conduct extensive research and in-depth analysis every year. They uncover global trends and cultural shifts that will influence vehicle color choices three to five years from now, and issue global and local trend reports and color forecasts. Based on the report, the application team develops specific colors for customers.

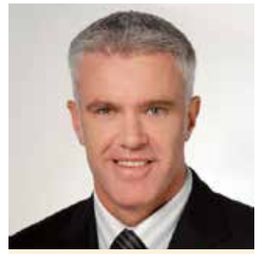
As a cross-disciplinary hub, the BASF Design Centre Asia Pacific, founded in 2016, is to embrace industrial designers from China and the Asia-Pacific region. It provides consultation service, R&D support and simulation and testing devices for them to narrow the distance between the material and design industries. Currently, BASF is cooperating with several auto manufacturers on car interior design, vehicle structure development and vehicle color under the Design Center.

For a long time, BASF has been fostering creative ideas among young designers through various car design competitions. In 2012, the company organized the first global design competition for car seats – ‘Sit Down. Move.’ – calling for car seat designs with emphasis on aspects such as comfort, ergonomics, safety and weight. In January, 2017, BASF sponsored the new "Innovative Use of Materials Award" at the Car Design Awards China 2017 to challenge young designers to tap into its portfolio of advanced materials to address global automotive trends. These included the desire for increasing design freedom, lightweighting, emissions reduction, heat management and fuel efficiency.

“Design is shifting China into a main force of originality worldwide, and also an innovation-driven society,” said Postlethwaite. “With our innovative materials, integrated design and R&D capability, BASF will continue to support excellent designs so as to meet consumers’ demands, as well as the latest regulations and standards.”

Advanced materials have already opened the gate for the future design freedom of cars. All will start right from here.

Haptex®, a PU based synthetic leather from BASF



“BASF will continue to support excellent designs so as to meet consumers’ demands, as well as the latest regulations and standards.”

Andy Postlethwaite
Senior Vice President, Performance Materials Asia Pacific, BASF

The car of the future needs more than an engine to meet the challenges of connected mobility. The car industry is ready for the biggest revolution in automotive history and has been drawing closer to the IT industry for many years now.

On the road to Mobility 4.0

The race for the car of the future is on. Self-driving cars promise to disrupt the industry just as Henry Ford's introduction of the first assembly line did more than a hundred years ago. People today expect tomorrow's cars to come with fully digitized mobility, information and communication platforms. The first generation of digital natives[1] wants their digital world to accompany them in the cockpit of their car, which makes software more important than ever before for automotive companies. Mobility is being redefined since digital innovations are not only bringing new products to market, they are also bringing new services. Connected vehicles deliver car manufacturers an excellent platform to develop new business models as providers of mobility services and to revolutionize how they interact with their customers.

The conjunction of cars and IT is transforming entire branches of industry. Germany has long been a global automotive industry leader, but competition never sleeps. Silicon Valley technology firms have their sights set squarely on car manufacturers: Google has been at the forefront with its driverless car division, while Uber, an online ride-booking service, is disrupting markets with a ride-sharing app. Not wanting to be left behind, the automotive industry is jumping on the bandwagon.

Collaboration is the key to success

Take Toyota, which is partnering with Uber to position itself as a mobility services provider. Daimler snapped up the MyTaxi app, Volkswagen is investing in Gett, Uber's Israeli-born rival. The Wolfsburg-based company makes no secret of the fact that the notion of robot taxis is what inspired the deal. The ride-sharing platform could "be a basis for developing workable models for on-demand operation of autonomous cars," company sources say. They have figures, too: The new mobility solutions division is projected to generate billions in sales by 2025.

Autonomous driving is the great vision that has been inspiring the automotive and IT industry to work on the technology for some time now, including in joint ventures. The latest example is BMW's team up with US chip manufacturer Intel, as well as the Israeli start-up and camera technology specialist Mobileye. The aim is to develop the technology for fully autonomous cars to go into mass production within the next five years. The technology in turn is to be the starting point for driverless ridesharing fleets of robot cars that pilot customers to their destination.

General Motors' ambition is to be at the forefront of the robot taxi trend. The US car giant partnered up with Lyft, another rival of thee-hailing leader, Uber. The partners plan to build up a network of "permanently available autonomous vehicles," the two companies announced. Uber in turn is collaborating with Volvo to develop proprietary technologies for robot cars. The Chinese web services company Baidu is also working to make the vision a reality. Expect autonomous cars to dominate our streetscape in five to ten years, the manufacturers say.

High-tech partnership with transportation

Meanwhile, the transportation manufacturing industry is poised to enter the digital era. Transport companies are taking things a step further by transforming themselves into suppliers of end-to-end solutions and mobility services. Trucks in the future will come equipped with their own drones, automated stacking systems that think ahead and place cargo in the right position all by themselves, as well as all sorts of software for digitally connected logistics systems. They will be smart data collectors as well. The technology promises to save time and boost efficiency.

On the logistics front, the first autonomous delivery robots are already taking shape. Postal services are introducing them step by step. Swiss Post has been testing autonomous delivery robots since September, 2016 and Hermes has announced plans to use mini-robots for parcel delivery in Germany. The industry wants to reach higher, too: with long-standing plans to use drones for deliveries. In fact, electronic retail company Amazon presented its second drone model for parcel transport last year. The Chinese e-commerce company Alibaba, Google, and logistics firms like DHL and UPS are working at full tilt to enable deliveries by drone.

[1] A digital native is a person born or brought up during the age of digital technology and so familiar with computers and the Internet from an early age.

Connectivity calls for traffic management

Collective traffic management systems are major contributors to tomorrow's mobility. These systems respond to the traffic situations by temporarily opening up emergency stopping lanes or adapting speed limits, while navigation systems help drivers to circumnavigate congestion and protect them with warnings of dangerous situations. WiFi is the technological basis for this communication. Environment sensors in the car, radar and cameras are the foundation of these assistance systems and show the way the future is likely to develop. A Connected Cars study by Pricewaterhouse Coopers gives an idea of the commercial potential of smart vehicles. The business consultants expect it to triple from an estimated €40.3 billion in 2016 to approximately €122.6 billion in five years' time. Urban trends like car sharing will play a major role in driving inter-vehicle communication, the experts predict.

Gearing up for e-mobility

Driverless is one megatrend. Electric is the other. E-mobility will be a key ingredient of a smart, resource-saving urban lifestyle in future, experts say. The International Energy Agency predicts the number of electric vehicles on the road worldwide will increase from 2 million today to 20 million by 2020, and to 70 million by 2025. The Chinese government is set on bootstrapping its car industry into the electric age with tax breaks, research subsidies, among others. And the UK, France, Norway, India and several other countries intend to go one better by phasing out petrol and diesel engines entirely in the coming decades.

None of this will be possible without a parallel revolution in the way we store and transport energy. Affordable, high-performance batteries are necessary for the expansion of e-mobility and the integration of renewable energy. The cathode material is a key, as it determines the key properties of the battery such as its energy content, safety and life span. BASF is now researching and developing high energy cathode materials to improve existing battery system as well as to explore future batteries with high storage capacity.

The lithium-ion battery is one of the major battery types for electric vehicles. For example, using lithium cobalt oxide for the cathode electrodes, it is high in energy density, but also very expensive. To make batteries more affordable, BASF replaces some of the cobalt with nickel, which is a fifth of the price. In some respects, nickel makes an even better cathode material because it has twice the energy density. But the oxygen in this mix can be released at a relatively low temperature, raising the risk of fire. The solution is to add another metal to stabilize the mix, usually manganese or aluminium, which are electrochemically less active.

Autonomous driving is the great vision that has been inspiring the automotive and IT industry to work on the technology for some time now.

Example of different cathode material for lithium-ion batteries under the microscope.

Lithium-ion batteries generate current through the movement of ions and electrons. Another crucial role of cathode material is to enable the flow of ions. To provide high power, a battery must move large numbers of lithium ions quickly from the anode to the cathode. BASF's researchers design cathode materials using small particles, which leave gaps for lithium ions to move in and out of quickly. It helps even more if the cathode material is porous: more holes means more space and greater ion flow. This kind of cutting-edge research should significantly lower the cost of batteries. Lithium-ion car batteries cost around $200 per kilowatt hour of energy.

Jeffrey Lou, who runs BASF's global business unit for battery materials, thinks improved technologies will help bring the cost down steadily. "Innovation will be key on new product development, on efficient production processes and on the recycling of used batteries," he says.

Electric highways

In the meantime, there has been exploration on a fossil-free transportation from an infrastructure side. In the north of Stockholm, Sweden, motorists can try out the world's first public electric highway courtesy of the Swedish government, Siemens and Scania, a truck manufacturer. Overhead power lines are mounted over the truck lane on a two-kilometer stretch of road. Sensors on the roof of the Scania truck recognize them as power sources. A power collector over the cab extends out and connects with the power lines. The truck switches automatically to electric power. Siemens says energy consumption is half that of conventional power propulsion systems – a powerful argument in the exciting race for the mobility of the future.

* The article is reprinted from "together"1/2017, the magazine of Supply Chain Operations & Information Services (FS), BASF, and has been slightly modified.

Composite utility poles: conquering the wind

Surrounded by peaks with steep rocks, Huangshan is a typical mountainous region in eastern China's Anhui province. The dangerous terrain makes it difficult to install utility poles. Dong Qiaonan, who had worked at Anhui Electric Power Design Institute for more than 30 years, deeply understood the challenges in it.

A traditional cement pole weighs 1,200 kilograms and requires dozens of workers to carry it up the mountain. The poles, which are more than 10 meters in length, have great tail beat amplitude when making a turn, which can easily hit those moving them. In addition, there has been a massive loss in young manpower in mountainous regions in recent years. Therefore, the installation work often faces difficulty in recruitment.

In severe winter conditions snow and ice on the wires can easily produce an unbalanced force that will break the traditional poles. "Due to difficulties in installation, the repair time is often long," said Dong. "Previously in Huangshan, power blackouts happened frequently for one week or so."

In addition to installation challenges and difficulties in repairs the cement poles do not have a long service life. In general, cement poles installed in a good environment can be used for 20 years. "At present, there are about 500 million to 1 billion utility poles in China, with up to 50% of them 'running sick'," said Dong. Cement is a brittle material that can easily crack at the surface after three to five years of high temperatures and cold weather. When the rain or snow penetrates into the poles and corrodes the internal steel bars, the cement poles easily collapse. In some extreme environments, such as saline soil or beach wetlands, the service life would be even shorter.

Co-innovation among upstream and downstream companies

To tackle the challenge, BASF has started to explore the application of polyurethane (PU) materials in the power industry since 2010. It was an innovation based on market demand and born in local R&D labs. Meanwhile, in order to understand the situation in the Chinese market, construction team of Performance Materials, BASF invited Dong Qiaonan, who has 30 years of industry experience, to become a project consultant. In Dong's view, the breakthrough of this issue lies in the development and application of new pole materials. Thanks to the accumulated experience of the R&D department in the field of polyurethane composites, BASF was capable of changing the industry. Therefore, Anhui Huike Hengyuan Composite Material Company Limited, founded by Dong, began cooperating with BASF on the PU composite utility pole project, covering aspects of R&D, production and marketing, among others. The cooperation allows high-quality and reliable products used in the power industry to safeguard the power supply.

The utility pole is made of the BASF PU composite material Elastolit® and its advantages are fully demonstrated in the actual use: it is of good rigidity and flexibility that can stand firm in snow and ice, strong wind, wood lodging and other natural disasters. Weighting one-sixth of the traditional pole, the installation is easier; only two workers are needed to complete the entire process from transport to installation. Moreover, its service life can reach 50 years. "The composite utility pole can significantly shorten the time of power supply repair and reduce the cost of the installation," said Dong. "Therefore, it brings a profound change to the power industry."

"The composite utility pole can significantly shorten the time of power supply repair and reduce the cost of the installation. Therefore, it brings a profound change to the power industry."

Dong Qiaonan
General Manager,
Anhui Huike Hengyuan Composite Material Company Limited

Weighting one-sixth of traditional poles, installation of composite utility poles can greatly save manpower.

2 workers replace traditional cement poles (at the front) with composite poles.

“BASF not only provides support on materials but works with customers to create higher value-added solutions.”

Ellen Yang
Manager, Sales,
Construction Performance Materials,
BASF Greater China

For Dong, who was familiar with the power industry but not proficient in production, BASF offered more than raw material supply. “BASF helps us in all aspects, including introducing equipment suppliers and providing manufacturing guidance,” he said. When the production line was first set up, BASF stationed technical staff to guide the manufacturing. “BASF has been in the industry for many years and has accumulated a lot of practical experiences,” said Ellen Yang, Manager, Sales, Construction Performance Materials, BASF Greater China, “We not only provide support on materials but work with customers to create higher value-added solutions.”

Tailor-made solutions for various scenarios within power industry

In addition to Huangshan, China’s southern coastal cities and some Southeast Asian countries, which often hit by typhoon, also benefited from the new composite utility poles. In July 2014, when the level-14 Typhoon Rammasun blasted Guangdong province, it was the composite utility poles that withstood the wind. Thanks to their good performance during typhoon conditions, the poles were recognized by China Southern Power Grid Company Limited.

It takes a lot to achieve the current results. As we know, the power industry has a very high standard in product quality. The access threshold is high and the products are required to undergo rigorous product experimentation and effect demonstration. With the good performance of composite utility poles in the south, Dong and Huike Hengyuan are now in active contact with the State Grid Corporation of China (SGCC) to develop application scenarios under more geographical surroundings and meteorological environment. Pilot projects for the composite utility poles have been carried out in Guangdong, Yunnan, Hainan, Xinjiang, Tibet, Hunan, Hubei, Anhui and Fujian, among others.

The extension in application scenarios has brought new requirements. The “one pole for all scenarios” seems too ideal, and the business model of “selling the standard products” has no way out. “Materials will have the maximum value only in the practical application,” said Ellen Yang. “Therefore, we need to start with the actual demand in the power industry and move from answering ‘what do we provide’ to ‘what do we solve’”.

Composite utility poles significantly shorten the time of power supply repair in Huangshan, Anhui province. In the photo, several workers are transporting the new composite pole.

In Xinjiang province in China’s north-west, utility poles are required to withstand strong sandstorms. “A colleague once saw the cement poles heavily damaged by Level 12 sand storm in Turpan, Xinjiang, which were full of small holes,” said Ellen Yang. In view of this scenario, Huike Hengyuan and BASF had an in-depth discussion. The two sides found that by adding a protective layer to the poles they would be able to resist this severe environment. However, they could not find a protective layer supplier at the time. Therefore, BASF sought a manufacturer and invited them to join in the development of a product perfect for sandstorm scenarios. Next, BASF will work with parties along the supply chain to provide relevant solutions for the extreme weather (minus 60 degrees Celsius) in Xinjiang.

More possibilities in cross-industrial application

At present, the application of composite poles focuses mainly on low-voltage distribution networks, while high-voltage transmission networks remain open to innovation. As high-voltage transmission towers are steel structures that can weigh tens of tons, their transport costs can be very high. In Europe, research on lightweight towers has been carried out. In Norway, university research institutes and BASF are collaborating on the development of new composite materials for the towers. As a leading chemical company, BASF provides not only raw materials but Computer Aided Engineering technology at an early stage of development. This technology can simulate the structural mechanics performance of complex engineering and products, thus largely reducing the time required for R&D.

The new materials can not only be used in the power industry, but also embrace great business opportunities in the telecom field. The 5G network is the future development trend of the industry, on which autopilot and telemedicine rely. “The signal poles design may refer to street lighting and communication network to ensure the speed of 5G signal transmission,” Ellen Yang explained. “The use of traditional cement or metal materials could result in great loss of 5G signals, while it won’t be a problem with composite poles.” At present, domestic telecommunications equipment suppliers are looking for new materials for signal poles to which BASF has responded positively. “We hope to provide an excellent solution with our in-depth understanding of the industry and mastery of the scenarios,” Yang said.

Collaborative innovation for personalized nutrition

“The core of a personalized nutrition R&D strategy is collaborative innovation.”

Dr. Felix Zhang
Director, Nutrition & Health Research Center for By-Health

Be it customized tours, sneakers or bottle design, there is a “customization” trend emerging in the consumption field. According to a January 2017 report by global market research company Mintel, a “one-size-fits-all” approach is becoming less relevant as customization is fast becoming a consumer expectation.

So is it for the health and wellness market. Physical condition and lifestyle vary from person to person, resulting in different demands for nutrition. Therefore, personalized solutions based on specific health needs or through diagnostic tools and devices are also transitioning to the mainstream.

To better promote the concept of personalized nutrition in China, By-Health, the country’s leading nutritional supplement company, is working with upstream and downstream industries, as well as scientific academies, to build a personalized nutrition industry alliance, with the end market as the orientation. As a global leading supplier of nutrient raw materials, BASF is actively involved.

Personalized nutrition in China

Personalized nutrition is the practice of carrying out safe and efficient individual nutrition intervention so as to maintain health and effectively prevent and control disease.

In a recently published paper by Celis-Morales et al.[1], a six-month intervention showed that advice on personalized nutrition delivered to a sample of 1,269 adults resulted in larger and more appropriate changes in dietary behaviour versus a conventional approach. Tailor-made interventions are not just improving quality of life, they are also gaining traction as an innovative approach to prevent disease.

At the consumer end, personalized nutrition is an emerging trend. “We see data validation from the research in a mature market such as the United States. Consumers are willing to pay for personalized nutrition, and the market demands have been sufficient to support the development of personalized nutrition industry,” said Dr. Felix Zhang, Director, Nutrition & Health Research Center for By-Health. “Personalized nutrition focusing on individual demand is bound to become an important aspect of nutritional science and disease prevention.”

In 2015, therefore, By-Health upgraded its positioning from a single dietary supplement supplier to a comprehensive nutrition solution provider.

However, personalized nutrition is still in its infancy in China, while related research and industrialized results are still insufficient. “Personalized nutrition is a topic that has just come to the public’s attention in the past two years,” said Zhang. “The fundamental research and perception from consumers here lags far behind those of developed markets such as Europe or the U.S. for over 10 years.”

The lag in recognition in the domestic market is only one thing; the implementation also faces enormous technical challenges.

On one hand, the human body is complex and people have diversified choices and demands for food and nutrients. Even for an individual, with factors such as time and environment changing, the demand for nutrition change increases the difficulty in developing personalized nutrition plans.

On the other hand, there is a lack of unified perception within industry on the individual health database and standards. In the actual operation, personalized nutrition requires technologies such as data tracking and collection, precision medicine and detection technology, and even phase I and II human experiment modelling to obtain individual health data. Only based on these technologies can we obtain individual data, and only by comprehensive data accumulation can an individual health database and health standards be established. In the current market situation, the monitoring of different data points belongs to different areas of scientific research involving scientific research, product R&D and application units.

“The core of a personalized nutrition R&D strategy is collaborative innovation,” said Zhang. Therefore, By-Health decided to partner with materials suppliers, scientific research institutions, medical institutions and other stakeholders to build a personalized nutrition industry alliance, integrating R&D, production and education. The alliance will integrate resources effectively and carry out R&D activities and solution development focusing on the application in the end market.

BASF actively participating in personalized nutrition

Nutritional products with clear functions and mechanisms are an important part of personalized nutrition. Therefore, the design of related products is among the top priorities of By-Health’s R&D strategy. Due to the complexity of personalized nutrition, By-Health has placed higher requirements on raw materials. A supplier with leading technology and comprehensive competence is in urgent need.

With its demands in raw materials and technical difficulties, By-Health turned to BASF. After listening to customers’ demands, Leon Chen, Senior Manager, Human Nutrition, Nutrition and Health, BASF, became excited. “By-Health and BASF share a common vision in providing the right nutrients to the right people at the right time. We are willing to share our experience in this field, work closely together and help By-health achieve its market place and business goals.”

According to Chen, BASF has anticipated the trend of personalized nutrition for some time. In recent years, the company has developed solutions for improving daily dietary nutrition and life quality of the elderly through a global R&D platform and professional knowledge network, and is a global market leader in personalized nutrition. It is able to provide customized raw materials for By-Health on personalized nutrition solutions.

In May 2017 in Beijing, the two companies signed a 10 year R&D strategic cooperation agreement. The deal calls to fully leverage their respective advantages in products and raw materials, and to carry out technical cooperation and industrialized projects for personalized nutrition solutions.

BASF is now actively working with By-Health on two projects: customized vitamins and nutritional products for old people with sarcopenia. Since individual demands for vitamins are different, BASF will help By-Health develop vitamin products that meet consumers’ personalized needs. BASF will consider the product from perspectives of raw materials, end products and compliance scope. As for the R&D of personalized nutrition products targeting sarcopenia, BASF will participate in cooperative efficacy experiments to explore the effect of conjugated linoleic acid on sarcopenia. In addition, the companies will conduct regular exchanges in market insights and trends for a sound go-to-market strategy, thus actively promoting personalized nutrition.

The participation of BASF will bring advantages to the alliance. Human Nutrition, Nutrition and Health, BASF has invested in a global R&D team to support relevant product development. “We have R&D professionals in Germany, Denmark, Singapore and other places,” said Betty Lu, Technical Manager, Nutrition and Health, BASF. “All regions work under the shared R&D platform and resources, hence the competence improves.”

The advantage of BASF is more. “The promotion of personalized nutrition needs cross-discipline cooperation. Similarly, the development of raw materials also needs the joint effort from multiple units,” said Lu. “Besides Human Nutrition, a number of departments including Pharma Solutions are also actively involved.” As a long-established integrated raw materials supplier, BASF is also capable of providing drug excipients. “Nutritional tablets need drug excipients. Pharma Solutions possesses sophisticated medical equipment and is able to produce products that meet the requirements,” she said. “With nutrient raw materials from Human Nutrition, we form a whole package of solutions, thus bringing convenience to customers.”

BASF can also offer guidance for mass production. “Being a market player for years, BASF has accumulated a wealth of experience at all ends of the value chain,” said Lu. “For example, in terms of production process, we have given By-Health a production equipment supplier list with related brands, capacities and advantages/disadvantages for selection.” For the cooperation in personalized nutrition, BASF can offer such support and on-site guidance.

In the view of Zhang, the cooperation with BASF has brought about a positive impact. Such cooperation can reduce R&D and registration time, so as to speed up the entrance time for high-quality raw materials into the China market. In addition, the cooperation will cultivate a coordinative relationship and effectively bring together R&D resources from two sides to develop products that meet the China market needs. “Under the premise of a market-orientated R&D strategy it is a way for the fastest speed and most efficiency,” he said.

Personalized nutrition is the practice of carrying out safe and efficient individual nutrition intervention so as to maintain health and effectively prevent and control disease.

“We are willing to share our experience in this field, work closely together and help By-health achieve its market place and business goals.”

Leon Chen
Senior Manager, Human Nutrition, Nutrition and Health, BASF

According to Dr. Felix Zhang, there are three dimensions of personalized nutrition:

Intervention in diet and lifestyle, i.e. using wearable devices or other Internet of Things technologies to track people’s diet, exercise, daily activities and other lifestyle data, thus customizing health solutions.

Phenotypic analysis and intervention, i.e. proposing intervention plans based on physical examination results, and data results from hospitals and laboratories, among others.

Genotypic analysis and intervention, i.e. proposing nutritional intervention guidance based on gene sequencing, single nucleotide polymorphism (SNP) analysis related to health, metabolism and disease, population cohort studies, intestinal population macro gene detection, among others. The evaluation should also be conducted with reference to phenotypic data.

[1] Celis-Morales et al., 2016. Effect of personalized nutrition on health-related behaviour change: evidence from the Food4me European randomized controlled trial. International Journal of Epidemiology. DOI: https://doi.org/10.1093/ije/dyw186

Protect innovations in China

“IP protection is important, independent of where the invention was done.”

Dr. Harald Lauke
President, Advanced Materials & Systems Research, Regional Research Representative for Asia Pacific, BASF

“We encourage researchers to involve us in their research projects as early as possible, so as to evaluate whether a patent should be filed in a timely manner, to prepare along the way for patent applications and to strengthen the awareness of IP protection for our researchers.”

Liu Xia
Director, Intellectual Property, BASF China

“How should researchers work with the IP team? Why do we need legal support for patent preparation in China? Would it not make more sense if we rely on the existing resources in Europe?” On a recent meeting, researchers from BASF Innovation Campus Asia Pacific (Shanghai) asked these questions during a discussion on intellectual property and research innovations.

To Dr. Harald Lauke, President, Advanced Materials & Systems Research, Regional Research Representative for Asia Pacific, BASF, the relationship between intellectual property protection and R&D innovations is obvious: “IP protection is important, independent of where the invention was done.” Along with the increasing research and development activities in Asia Pacific, the local competence of IP regarding patent preparation needs to be further developed and matured. Researchers in Asia Pacific should acquire basic skills and knowhow related to how to prepare patent, with professional support from IP team.

Strengthening regional IP protection competencies

Liu Xia, head of Intellectual Property in China, officially joined the R&D Leadership Team Shanghai. With more than 10 years of experience as IP counsel at BASF, Liu has been leading a team of IP attorneys since April, 2016. They work in Shanghai and Beijing, supporting various research and business units on all IP related matters, including drafting, prosecuting patent applications globally for the inventions made in China and maintaining the existing patents.

As introduced by Liu, each patent attorney in China covers several business units and broad technical fields, which is different from the setup in Europe where each attorney takes care of a specific technical field. To ensure quality service, IP in the region is largely supported by the global intellectual property team in Europe via various means.

The number of patents is one of the key indicators for the innovativeness of a research organization. From 2012, when the Innovation Campus Asia Pacific (Shanghai) was inaugurated, Patent Cooperation Treaty[1] applications on local innovations have risen each year.

China's strategy is changing from "Made in China" to "Created in China”. It represents an enormous number of opportunities for BASF to provide solutions for less energy consumption, cleaner air and water, and higher standard of living. “We should capture these opportunities and turn our inventions in our labs into innovations on the market,” said Lauke.

The PCT application on formaldehyde abatement dispersion for interior decorative paints developed by Dispersion and Colloidal Material Research Team at the Innovation Campus Asia Pacific (Shanghai) was successfully filed in 2014. This dispersion is used as one of the main components for interior decorative paints. It can permanently remove up to 90% of the free formaldehyde within a day. It also has excellent anti-yellowing properties.

Looking back the patent application preparation, Dr. Zeng Zhong, the technical person-in-charge, said, “The IP team provided support throughout the entire preparation process.” Since the patent landscape analysis at early research process, the IP team and the research team has been working closely with each other. Zeng shared his most impressive moment, “During the PCT application preparation, to have the patent granted with the broadest protection scope, we communicated for a number of times, from supplementary data to even use of a single terminology. The professional and responsible work from the IP team has provided the strongest support in the patent protection of this invention.” “We encourage researchers to involve us in their research projects as early as possible, so as to evaluate whether a patent should be filed in a timely manner, to prepare along the way for patent applications and to strengthen the awareness of IP protection for our researchers.” said Liu.

Zeng regards IP related knowledge as a must-have quality for each researcher. “Whenever it is in patent preparation or daily research work, researchers should keep close communication with the IP team, so as to identify potential patent application opportunities or avoid latent IP infringement risks.”

Except for professional services provided by the IP team, two training courses related to IP are provided via BASF human resources platform. One is the basic IP training which covers a broad field of basic knowledge including patent, trademark, copyright, and trade secret, etc. The other one is the advanced training on patent, which offers a deep dive on the patent related knowledge.

New order of IP protection in China is being built up

According to the statistics released by the State Intellectual Property Office of China in April 2017, 1.339 million patent applications for invention were submitted in the country in 2016, an increase of 21.5% over the year previous. Over 40,000 PCT patent applications were received, and the number of Chinese valid patents for invention was more than 1 million.

“People would think that IP protection is very challenging in China, where Shanzhai (mass produced imitation goods) still flourishes on the market,” said Liu, “In recent years, there is an increase in IP awareness and the IP protection develops rapidly in China. IP owners are more confident and willing to seek protection through legal processes. For example, according to the *White Paper on Intellectual Property Protection by Chinese Courts (2016)*, Chinese courts accepted 152,072 various IP cases of first instance in 2016. The number represented a 16.8% year-on-year increase, of which civil IP cases of first instance saw a significant increase, up 24.82% year-on-year.”

The Chinese government is now strengthening the protection of IP, optimizing IP services and promoting the overall development of the IP. In 2014, specialized IP courts were set up in Beijing, Shanghai and Guangzhou. In 2015, General Office of the State Council forwarded the *Action Plan for Further Implementation of the National IP Strategy (2014-2020)* that clearly defined the guiding thoughts, main goals and action steps of the implementation of the National Intellectual Property Strategy during the following period. The Action Plan indicates, by 2020, China will significantly increase the level of IPR creation. The State Intellectual Property Office (formerly known as Chinese Patent Office) is one of the five biggest patent offices in the world, and enjoys good reputation regarding the quality of patent examination.

How effectively BASF and other international companies can protect their IP against competitors in China, is a most interesting question among researchers.

“We have been helping protect our local business with established expertise in IP protection. For instance, in the Crop Protection market in China, BASF has been actively enforcing IP rights.” said Liu. Since 2009, BASF has been initiating IP protection actions at international pesticides exhibitions by demanding exhibitors who infringed on IP rights of BASF to remove relevant materials. In 2014 and 2015, BASF legally pressed charges against three exhibitors for patent infringements. The court has justly ruled in favor of BASF in all cases.

Nevertheless, challenges still exist especially in IP enforcement. For instance, evidence collection is difficult and costly, the damage compensation is discouragingly low, and execution of the ruling is troublesome. “We are in the hope that China will eventually harmonize its IP laws with international IP laws, and facilitate enforcement to foster a business environment that provides the necessary assurance to enable world-class innovation in China,” said Lauke.

[1] PCT is abbreviation of Patent Cooperation Treaty. It is an international treaty on patent. PCT allows applicants to submit patent applications through PCT to multiple countries.

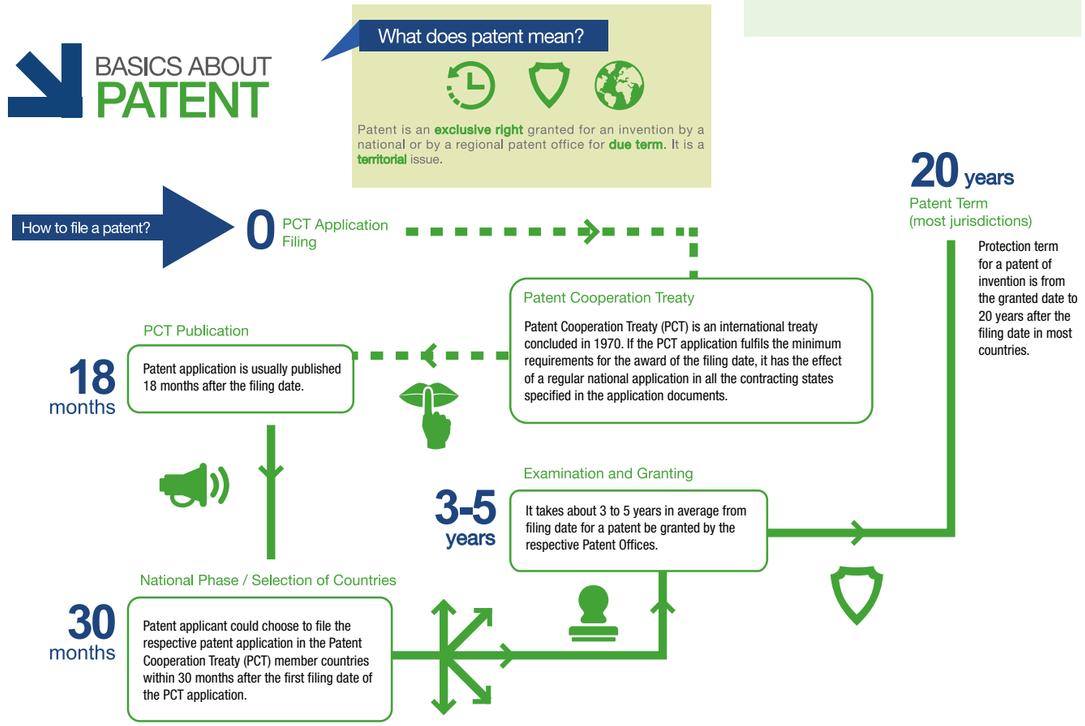
BASF patent in China

1985
- Since April 1, 1985, PATENT LAW OF THE PEOPLE’S REPUBLIC OF CHINA has been implemented. The first patent: PROCESS FOR PREPARATION OF N-PHENYL-(PYRIDYL-)-SULFONIC ACID DIAMINE gets protected by Chinese patent law.

1994
- China becomes the PCT member since Jan.1, 1994, which means patent applicant could enter into China via PCT application.

2008
- The first patent application of BASF generated in China: POLYURETHANE SOLE OBTAINED BY USING RENEWABLE RAW MATERIALS.

2014
- The first PCT application filed generated jointly by Innovation Campus Asia Pacific (Shanghai) research and development department: COATING COMPOSTIONS FOR REMOVING FREE FORMALDEHYDE FROM THE ENVIRONMENT.



Employees come first: unfolding energy towards a colorful future

“The right chemistry among our people is crucial to our sustainable development.”

Dr. Sébastien Garnier
Director of Business Management Automotive Refinish Coatings, BASF Greater China

BASF recognized by Jiangmen Municipal Government

On February 2017, BASF Coatings (Guangdong) Company Limited was awarded the "Workplace Occupational Health Management Role Model Enterprise" following a strict on-site audit by the expert team of Jiangmen government, Guangdong province. With its workplace occupational health management policy, the company has actively implemented the occupational disease prevention, defined control responsibilities and met the standard on workplace occupational health management. Therefore, it has become an enterprise representative recommended by the Jiangmen Safety Supervision Bureau.

BASF Coatings (Guangdong) Company Limited has adhered to the company’s stringent standards on EHS since its establishment last year. According to BASF’s global standard, the company has gradually standardized its occupational health management with increased investment and focus in workplace management, protective facilities, equipment management, and occupational health monitoring. It operates its production facilities strictly complying to the standard requirements.

Hu Wenyi had mixed feelings when she saw that her employer’s name was changing from Yinfan Chemistry Company Limited (“Yinfan”) to BASF Coatings (Guangdong) Company Limited.

Since 2004, Hu had been responsible for quality control at Yinfan, the private-owned Chinese enterprise, and had gotten used to working and living in Jiangmen. Then, on September 26, 2016, she became an employee for BASF, one of the world’s Top 500 global enterprises. She anticipated this change with both excitement and anxiety.

Since April 2016, the BASF Human Resources Greater China team had been engaging in in-depth communications with the management teams of both organizations. They provided professional support to foster mutual understanding between the two companies’ corporate cultures and management styles. This helped to identify the best approach to the transitional period with minimum interruption.

It all begun with the establishment of BASF Coatings (Guangdong) Company Limited, the global chemical giant’s first automotive refinish manufacturing operation in Asia Pacific, more specifically: in Jiangmen, southern China.

In September 2016, BASF completed the acquisition of Yinfan’s assets and established a new legal entity. For the 126 Yinfan employees joining BASF, this marked a big change in their career development.

To support the new employees’ transition into BASF, the company offered a series of development plans and trainings, especially in areas such as compliance and safety management. It was then that things started to take a new turn.

Caring for employees

“Proper rearrangement of employees serves as a decisive factor to a successful acquisition,” said William Pu, Vice Director of Human Resources Greater China, Operations & Engineering, Joint Venture Support, BASF, who crafted the HR integration plan. “At BASF, we care for employees. Whether it comes to work-life balance, health or safety, we do our best to create a safe and reliable working environment and to form the best team.”

He explained that since the start of the integration work, BASF has carried out an evaluation and upgrade plan for the facilities. Now, the site not only meets BASF standards but also provides a highly efficient and enhanced working environment for employees.

“I am responsible for quality control,” said Hu. “BASF invests twice as much as we had in the past on maintenance and upgrade for inspection equipment and R&D facilities.” An upgrade in production lines has been planned and scheduled as well.

For Fan Yongqiang, a former Yinfan employee and current production manager of BASF Coatings (Guangdong) Company Limited, the usage of a personal protective equipment kit made him quickly realize that his new employer makes people and safety its top priorities.

At BASF, employees must wear proper personal protection equipment before entering plants, which is a practice different from the previous Yinfan culture, but in strict accordance with Environment, Health and Safety (EHS) requirements. Some experienced operators thought it was unnecessary. “It seemed like a waste of time for I am doing a simple job,” said one of the operators. However, after several rounds of safety training and communication, employees started to think differently. They now have a much stronger safety mindset. “We were proud of our work experiences in the past but now we have begun to understand the great potential of combining our experiences with theory. We strive to enrich our knowledge about plant equipment. We are more familiar with the chemicals we are dealing with at work, both with its potential risk and foremost the necessary protection. I am grateful that the company cares for us,” said Fan.

A technical personnel is doing daily maintenance of equipment.

Photo of employees of BASF Coatings (Guangdong) Co., Ltd.

Apart from work safety, BASF also provides a competitive total offering, insurance and welfare system for the employees to recognize their contributions to the company. Hu, a mother of two, now has more days off to be with her family and her children are happy with this change for family hours gained.

Better platform for further development

The acquisition by BASF means not only new job opportunities, but also an uplift in competencies, a key to career development.

Training, therefore, is a key element of the integration plan. The Human Resources Greater China team has prepared a package of comprehensive trainings for the new employees, covering the company’s strategies, businesses, compliance, human resources, safety and professional skills. In addition to general training, there are specialized trainings for different job fields and one-on-one guidance and tutoring.

“Training is just one of the ways for learning,” said Fan. “We also want to learn from daily challenges in our day-to-day work.”

Since the acquisition, there have been close exchanges between BASF Coatings (Guangdong) Company Limited and other BASF sites. New employees received the chance to visit other sites in China and experts were invited to give recommendations in process management, safety control and personnel management. The aspect of BASF learning from a mid-size local entity has not been neglected. There were follow-ups so that suggestions and findings could be well implemented. For management personnel such as Fan it was a new learning opportunity. “Under the premise of fulfilling my own job I would like to grasp every opportunity to gain new knowledge and skills related to the industry,” he said.

For any business acquisition, conflicts between old and new practices are inevitable. Hu said in the beginning there was doubt about the new rules. “However, the company fully listened to our voices and encouraged us to get involved instead of simply conforming us to follow. When we experience more and benefit, we not only understand the company's intentions, but also cultivate ourselves in a sense of responsibility at work,” she said. “This is probably what they called entrepreneurship. BASF has provided me with a better platform for further development.”

Grow with BASF

BASF Coatings (Guangdong) Company Limited aims to serve as a technology and production hub to support the company’s refinish business operations in different market segments across the Asia Pacific region. “The right chemistry among our people is crucial to our sustainable development. Their competencies, motivation to win and enthusiasm will act as the cornerstone for the sustainable development of our business”, said Dr. Sébastien Garnier, Director of Business Management Automotive Refinish Coatings, BASF Greater China.

“At BASF, we care for employees and do our best to create a safe and reliable working environment.”

William Pu
Vice Director of Human Resources Greater China, Operations & Engineering, Joint Venture Support, BASF

Employees remain the focus throughout the entire process of the acquisition. Before the official acquisition, BASF conducted comprehensive investigations on Yinfan, especially on employees’ needs. During the transitional period, BASF closely connected with employees, informed them about the opportunities and BASF’s culture and helped them to understand BASF better. After the closing, BASF carried out an integration plan with safety education, on-the-job training and facility upgrades to show employees opportunities in career development.

In this new company, established less than one year ago, the positive energy has spread into the team. Fan sees an improvement in operators’ skills, which ultimately leads to higher customer satisfaction and more orders, indicating better overall performance in product offerings. Many job opportunities have arisen for the BASF site in the south, ranging from e-commerce to new EHS or production roles, some of which did not exist in the past.

While the business is developing quickly, Hu is also improving her own abilities. Now, as an employee of an international company, she is learning English with her children. In one of her child’s homeworks she was surprised to find the following written: “My mother is learning English with me at home. I am so proud of her.” This certainly delighted her. “I look forward to growing with BASF, to connecting and to creating a brighter future.”

Inspire innovation and grow with the Innovation Campus

“R&D professionals are the foundation of innovation. We have created many opportunities for them at the Innovation Campus Asia Pacific and we encourage them to conduct scientific research projects with application value.”

Dr.Helmut Winterling
Senior Vice President of Dispersion & Colloidal Materials Research, BASF

Sydney Peng, a scientist who joined BASF’s Care Chemicals Research Laboratory at the Innovation Campus in Shanghai in 2016, recently got to know more of her colleagues during a special occasion – Afternoon Mind Refresh, an idea competition where she won the first prize for this round.

Afternoon Mind Refresh is an event for regular idea sharing and discussion that encourages R&D professionals to find problems in their lives and work and put forward innovative solutions. In doing so, it can turn ideas into projects with close follow-up measures to drive technological innovation and business growth. Three rounds of the competition, which is open to all R&D professionals at the Innovation Campus in Shanghai, have been held since 2016.

“Here we have created an open atmosphere for people to exchange ideas through vivid presentations,” said Dr.Helmut Winterling, the Senior Vice President of Dispersion & Colloidal Materials Research, BASF and sponsor of Afternoon Mind Refresh. “Throughout the process we have met many aspiring colleagues who are not only intelligent but also strongly motivated to drive innovation in their daily work.”

Taking the lead

At the idea competition in March 2017, Sydney pitched to “increase the drying speed after shampooing without adding other steps”. Her proposal came from life experience: “Many of my friends, especially girls with long hair, have such a problem: every time they need to spend half an hour to dry their hair. I have been thinking whether I can find a solution to help them.”

As a newcomer to the company, Sydney works on well-developed projects with preliminary results. After learning of the activity, she immediately signed up for it. The proposal was entirely initiated and led by her, which made her excited. “It seems that it was my own baby.”

Like Sydney, Zhang Mengyu, a former chemist in Construction & Coating Material Research at the Innovation Campus in Shanghai, led her own project for the first time thanks to Afternoon Mind Refresh. Since joining BASF in 2014, she has been assisting her lab leader to do experiments in daily work.

She focuses on construction materials R&D and got an idea to develop a “smart” flooring material that can work in any environment.

To materialize the project, one needs to first learn how to present his or her ideas and gain support. Afternoon Mind Refresh allows only five minutes for each presentation. Before the formal presentation, Mengyu did many exercises but was always entangled in the technical details.

“You should introduce your idea from a listener’s perspective, and this person is very likely to have no knowledge of the field,” Her colleagues gave her a suggestion. Mengyu sorted out her thought: Why do I do such a thing and how do I achieve it? It helped her get the jury’s acceptance and she was lucky to win the activity.

Enhancing cross-unit collaboration

To be a project leader, the winner should think more than the perspective of R&D. Since participating in the competition, Mengyu’s cross-unit collaboration capabilities have been improving. “I need to jump out of the box of ‘chemist’.” In the past, as a chemist, she only needed to consider whether the technology could be realized, and how to test, among other considerations. Now she needs to listen more, perceive market demands, consider commercial prospects and avoid policy risks. For this young lady, these are new experiences.

During the proposal preparation, in order to understand the usage scenario of flooring materials, Mengyu inquired among colleagues from business units about the pain points of floor materials in actual use. She found out that temperature was an important factor affecting floor construction and eventually confirmed the proposal of “smart” flooring material.

As the project proceeded, Mengyu met more colleagues whose work was related to her project but from different units. “I happened to know that a product from another team had something in common with my ‘smart’ flooring materials technical-wise, so I established contact with the help of the idea council and received a lot of guidance.”

For Sydney, the connections she built through the competition will benefit her future work. Through the initiative she met more colleagues from business units who gave her suggestions and ideas from the market perspective, inspiring her from different viewpoints. “In the R&D process, the ideas of colleagues of different units help me think my R&D ideas better.”

Engineering field also innovating

Different from Sydney Peng and Zhang Mengyu, Jerry Cao’s work in engineering R&D is closely related to production. His innovation focuses on chemical and process engineering. He is good at using computers to simulate materials, energy and process units so as to solve production problems in the industrialization process and improve production efficiency. He has now successfully transferred from a process engineering scientist to a process manager at the BASF Shanghai Caojing site. In future, he will continue his work in process and plant operation.

When he joined the company, Jerry was sent to BASF headquarters in Ludwigshafen, Germany, for nine months of training. Besides learning work-related skills systematically, he also participated in several practical projects. “In terms of process and engineering, Germany has a wealth of experience,” said Jerry. “Real project experiences help me to understand the importance of cooperation between different units and to accumulate a lot of expert contacts.”

And the shift comes from actual work. “I had project experience in the university before but this is the first time that the experience is so closely combined with actual production,” said Jerry. “In the projects at university, my goal was to ‘get the experimental results and understand the phenomenon’, but in actual production I need to think from the perspective of the plant and business: ‘Why do I do this?’ ‘What does this problem indicate?’ In this way, I provide not only a report but a set of solutions.”

In June 2016, Jerry undertook a project: a BASF plant needed to change part of its process from manual control to automatic control. It seemed that “manual” was replaced with “automatic”, but after communicating with plant and business units, reading previous project reports and consulting the headquarters about the experience of other countries, he found that besides automation, the plant could further reduce its cost by optimizing the operation parameters according to market prices of raw material and products.

After that, Jerry developed a simulation tool that could automatically calculate several key operating parameters by entering a few factors affecting the production, thus guiding the plant to achieve optimal operational efficiency. After the tool validation was complete, he worked with the engineering department to adjust the model according to feedback from actual production data.

“Good simulation tools require continuous debugging of accurate data. The accumulation of BASF’s first-hand production data provides a solid foundation for innovation,” he said.

In addition, BASF’s global laboratory resources can be deployed on demand. “BASF has first-class experimental facilities and, if necessary, colleagues can measure the required experimental data in laboratories," said Jerry. “In a multinational company, our projects are often done with the help of multinational colleagues. We look for the most viable solutions throughout the world, which makes me think further when considering problems.”

Sydney’s quick-drying experiment also requires multiple laboratory resources. The German headquarters can provide product testing, while China has a strong analytical center that can support relevant follow-up analysis.

“R&D professionals are the foundation of innovation,” said Winterling. “We have created many opportunities for them at the Innovation Campus Asia Pacific and we encourage them to conduct scientific research projects with application value. We look forward to seeing more innovative ideas to become product innovations in the future.”

Impressions of Afternoon Mind Refresh idea pitch

Professional firefighting capability based on emergency response system

At the main production sites of BASF Greater China, there is such a scene: uniformly dressed firefighters full of energy carrying out training regardless of the weather; behind them eye-catching red gates and neatly arranged high-professional fire engines and emergency equipment. In case of a fire alarm, the brigade will rush to the scene with their equipment.

As the world's leading chemical company, BASF applies global uniform emergency response standards. As an important part of the emergency response management system, the BASF Fire Department performs tasks that include the design of a fire protection plan for the plants, development of firefighting and prevention plans. They also undertake emergency response plans, fire drills, training of staff on emergency knowledge and skills and emergency accident management, among others.

The breathtaking frontline experience

For Li Zuobin, Emergency Response Supervisor at BASF Chemical Co., Ltd., the large fire that broke out at the Shanghai Chemical Industrial Park in September 2011 is still impressive.

"Personal safety is the top priority for both firefighters and people to be rescued."

Li Zuobin
Emergency Response Supervisor at BASF Chemical Co., Ltd.

The quiet night was broken by a sound of an explosion and hurried alarm. One production facility of a company in the park exploded and was engulfed by a large fire. On receiving his superior's order, Li, then a firefighting shift foreman on active military duty, assembled the firefighters and led them to the scene with two fire engines from the BASF fire brigade. "At that time, the situation was very critical. The flames lit up the night sky. Even when we tried to approach the central point from the upwind direction we still felt the scorching heat. The accompanying squeaks of the leaking materials indicated that there was likely to be a second explosion, which may cause harm to the personnel on the spot," he recalled.

On receiving his orders from the accident command center, Li led the team to set up mobile cannons in favorable directions to cool and protect the major parts of the facility and the storage tanks. With years of experience he deemed that the situation was very dangerous and risky. He immediately reported to the command center. To avoid any accident and to control the fire, they needed to reduce the number of frontline firefighters and use more fixed and vehicle-mounted firefighting equipment. His suggestion was quickly adopted by the center. Through the adjustment in water cannons and gun positions and tactics, the entire fire rescue was able to continue under a safe situation. Li and his colleges fought the blaze until 4 a.m. when the fire was extinguished.

In joining the armed police fire brigade in 1997 Li has accumulated nearly 20 years of firefighting experience, developing a strong psychological quality. Even in critical moments he remains calm and makes clear and professional judgments on the scene. He was rewarded for his excellent performance, while the rescue this time was just one of his successful cases.

Li attributes the effective control of this chemical fire to four aspects. First, the improvement of firefighting infrastructure on site. There were dozens of firefighting vehicles on site that required a large use of water. Thanks to the reasonable design and sufficient allocation of firefighting equipment, the water supply was never interrupted during the rescue. Secondly, the facilities were designed with measures to ensure process safety. For example, in case of material leakage, the upstream valve could be closed and the pipes could be cut off to effectively prevent the spread of the accident. Thirdly, advanced firefighting equipment, such as automatic-swinging cannons, mobile cannons, atomizers, special vehicles and special-vehicle equipment, significantly improved the efficiency of firefighting. The last point that cannot be ignored is the daily training of firefighters. Without solid basic theories, physical fitness and regular training, any fault at the scene might lead to failure of the rescue.

Improvement of professional firefighting competence

As a frontline firefighter, Li once advocated heroism. "Through the training provided by firefighting experts from BASF's German headquarters and my daily practice I have gradually changed my mind," he said. "Personal safety is the top priority for both firefighters and people to be rescued."

For Li, this was his biggest gain from the training. For example, since it was not clear if the rainwater in the plant contained hazardous materials, experts required firefighters to wear personal protective equipment before dealing with it, which will significantly avoid possible harm and ensure their personal safety. Inspired by this, Li abandoned his previous practice in fire rescue. Now he assesses the fire situation and carefully weighs the consequences of each disaster relief action before taking action.

In addition to the rise of relevant awareness, Li has strived to improve his professional competence. He has studied firefighting tools in depth, not only knowing their functions but also working principles. For example, with water guns he knows how they are constructed and spray, thus he is able to use them precisely. Moreover, he has also gotten to know more about material in his duty areas, including the major materials, toxic materials, flammable and explosive materials. He is also able to deal with them. "If one works without thinking he will never make any progress."

In 2013, Li retired from the military and joined BASF Chemical Co., Ltd. for which he had worked, becoming a formal BASF emergency response specialist responsible for fire prevention and emergency response coordination. On March 28, 2017, BASF Chemical Co., Ltd. completed the transformation and handover of its fire brigade, becoming Shanghai's first corporate-established fire brigade of an international company. The new full-time fire brigade is composed of BASF employees and contractors, and Li has become a fire brigade on-site commander once again.

Li maintains his practice of continuous learning. His latest task is to participate in the construction of BASF's standard emergency response force. This fire brigade will be trained according to BASF's global uniform standard, and explore the professional development of corporate fire brigades. This initiative will also greatly enhance the stability of the team and help to accumulate and improve its technical and tactical capacities.

The corporate fire brigade has also shown personnel diversity: it includes not only those who were once engaged in professional firefighting work like Li, but also operation and technical personnel of production plants who are familiar with the chemical facilities and have good chemical knowledge, operational skills and emergency operation capacity. "Our fire brigade needs to have the expertise to deal with chemical hazards so the training after the transformation will be more professional and comprehensive," said Yue Haibing, Emergency Response Manager, Responsible Care and Service, BASF Greater China. "It will focus on safe handling of hazardous chemicals in emergency situations."

In addition to the existing equipment, the transformed fire brigade will have more advanced professional firefighting equipment, including the forthcoming turbo-jet fire engine, the first ever at the Shanghai Chemical Industrial Park. The turbo engine is used to spray whirled water and handles hazardous gas and vapor clouds by eddying water from long distances, thereby increasing efficiency and minimizing personnel risk in emergency response. "In future, this fire brigade will take on more work," said Yue. "The firefighters will likely provide professional emergency and firefighting training and support for other BASF plants in China."

Comprehensive emergency response system

In the emergency response, the fire department is most obvious – but a comprehensive emergency response system is more than the establishment of a fire brigade and professional training.

"BASF never compromises on safety. This principle is anchored in our strategy," said Charlie Zhang, Director, Responsible Care, BASF Greater China. "Emergency response means being prepared for possible incidents in our company at any time and at any place. This applies to production at our sites as well as our transport chains."

Under the Responsible Care Management System (RCMS)[1], BASF applies a global uniform safety standard and adopts a structured procedure to assess all its sites worldwide. BASF Greater China strictly enforces relevant standards. The global binding directives and requirements regarding process safety, for example, regulate the safe design, construction and operation of the plants and define the use of specific methods and procedures for the individual elements of process safety. The experts identify and assess possible risks during the design process of new plants in periodic reviews during the operation of existing plants and when plant or recipes changes are performed.

Based on the concept of mutual aid, BASF has established an off-site emergency network in China: sites provide consultancy, rescue and support to other sites in case of an accident during transportation within the region. All accidents are first reported via BASF's Emergency Call Center, which provides 24-hour service to our sites, customers and the public.

In addition, BASF has been working with China's State Administration of Work Safety (SAWS) and China Petroleum and Chemical Industry Federation (CPCIF) to share best practices on emergency response, and support local authorities in the development of emergency and rescue skills on hazardous chemicals.

"The combination of a comprehensive prevention system with professional firefighting competence is the best way of ensuring safe production," said Zhang. "With a wealth of industry knowledge and experience, BASF will continue to implement its corporate social responsibility, actively practice the concept of environment, health and safety (EHS) and further promote the implementation of Responsible Care in the China chemical industry, thus promoting the common progress of the industry."

"BASF will continue to implement its corporate social responsibility, actively practice the concept of EHS and further promote the implementation of Responsible Care in the China chemical industry, thus promoting the common progress of the industry."

Charlie Zhang
Director, Responsible Care, BASF Greater China

[1] Responsible Care is a voluntary initiative of the chemical industry to continuously improve its performance in the areas of environmental protection, health and safety. BASF has committed to the principles of Responsible Care since 1992. Environmental protection, health and safety, as well as security, communication, and energy efficiency, are embedded in its global Responsible Care® policy, which is applied to operations via the Responsible Care Management System (RCMS).

Post-quake psychosocial recovery and basic education quality improvement

The long-term success of a corporate is related to the impact-orientated social activities. Together with partners, BASF has been actively assuming its social responsibilities through donation, not-for-profit activities, as well as supporting starting ventures. The societal projects cover from education and empowerment, housing, health and nutrition, disaster relief and disaster risk reduction to water and sanitation. In doing so, BASF is not only helping those people in need, but also contributing to solving current and future social challenges.

A student is introducing a blackboard newspaper about disaster risk reduction.

In 2016, a three-year education support program for Sichuan province was successfully concluded. This is the continuation of the 2013 Sichuan Ya'an earthquake reconstruction project carried out by BASF and BASF Stiftung (a charitable foundation based in Germany). Prior to this, the two sides have funded UN-Habitat to complete a repair and maintenance projects for the schools in disaster-hit areas.

"China is an area with a high incidence of natural disasters. It is important to raise children's safety awareness and self-protection abilities," said Ulrike Wilson, Specialist, International Development Projects of BASF Stiftung. The support program includes a one-year post-quake campus psychosocial support project and a two-year basic education quality improvement project, which is implemented by the global child development organization – Save the Children. After three years, it has brought positive impacts on the long-term improvement of the local children's educational environment.

Psychological recovery and reconstruction after disaster

Zhang Muyao, Senior Project Officer of Save the Children, was in charge of the implementation and coordination of the program. As introduced by her, in the event of a disaster, it is essential to conduct psychological first aid for the affected people, which is often highly concerned. However, post-disaster psychological support is a long-term and systematic work. During the 1 to 2 years after a disaster takes place, the rescue forces are evacuated successively, but there is still a demand in psychological support in the area. According to the feedback from the Ya'an Municipal Education Bureau, as well as the teachers and students there, local schools still needed much continuous help in disaster risk reduction as well as psychosocial support. In November 2013, Save the Children decided to carry out the Phase I Project of Psychosocial Support and Disaster Risk Reduction for Elementary Schools, mainly to help the teachers of the 23 project schools in Ya'an to improve the ability in post-quake psychosocial support for over 20,000 children, thereby enhancing their disasters coping abilities. Meanwhile, the project also provided systematic training for teachers in disaster risk reduction, so that they can carry out activities in schools to help students better understand, develop and implement disaster reduction plans.

The training is mainly carried out through participatory training, lecture, discussion and presentation, aiming to equip the trainees with independent and practical abilities to set up psychological classes and organize disaster prevention drills, while ensuring that they master the relevant theories.

The project helps the schools to greatly improve their psychological support ability. On one hand, the psychological intervention has helped children to restore their basic life. On the other hand, a long-term psychological support mechanism has begun to form.

"After the training, the psychology teachers carried out regular psychological activities in the schools, and gradually applies the psychological support equipment such as psychological counseling rooms. Meanwhile, they could also deliver trainings on psychological health education to other teachers in the schools. In this way, the influence of the project is expanded, and the psychological education of Ya'an is able to continue in a longer period of time," said Liu Linhui, Psychological Education Researcher of Ya'an Educational Science Institute, who is responsible for carrying out related psychological trainings in the region, "A lot of teachers have become interested in psychology, and even considered psychological support as a long-term development direction. A teacher from Baoxing County, because of the increased interest, has obtained the National Secondary Psychological Counselor Certificate."

"The greatest achievement of the project is to develop psychosocial support into a regular course and integrate it into daily teaching activities," said Zhang, "When the students are having psychological stress in their daily life, the teachers can also offer support."

Basic education quality improvement after earthquake

In addition to helping children improve their ability to cope with disasters, BASF and BASF Stiftung care especially about their future. The southwest of Sichuan, where Ya'an is located, has been facing the issue of uneven educational resources, relatively backward education level and lack of qualified teachers. In order to further enhance the competitiveness of the children in the disaster area, in November 2014, the second phase of project Improving the Quality of Basic Education was officially launched.

Save the Children selected four town-level nine-year compulsory education schools in the three prefecture-level cities – Xichang, Ya'an and Meishan of Sichuan Province. The project aims to help teachers to form a student-centered teaching philosophy and to learn related methods by teaching facilities and equipment upgrade, teacher trainings and supervision, exchanges between schools, among others, thus improving the quality of education and providing more development opportunities for students.

Yang Liang is a teacher of the project school Xichang Lojishan School. After graduating from college in 2012, she came to school to teach Chinese for junior high students. Since she is also the class tutor, some small disputes between her and the students occur from time to time. "I would like to learn how to get along with students, enhance mutual understanding, while improving my teaching capability," said Yang.

A major focus of the training is the participatory teaching methodologies. It is to center on students, encourage students to actively participate in the learning process and to take initiative to raise questions and acquire knowledge.

The traditional lecturing way is often dominated by teachers and the atmosphere is relatively depressing. By introducing participatory methods such as group discussion, sitcom, games and so on to the classroom, the atmosphere becomes more relaxing and the students are more self-motivated. Yang found out that grouping the students of different personalities and learning performances into a team to complete learning tasks together, is also helpful to improve students' learning ability and social skills. "The introverted students, in the relaxing atmosphere and through discussion with their peers, become more cheerful and bold to speak aloud," said Yang, "Once there was a student who hated writing compositions. After regular class discussions, his view of writing was changed. He no longer considers it as a homework, but as a way to share interesting stories with his classmates. Hence, his writing ability improved. From being unable to write anything at first, he can now write compositions of 300 words or even more."

The idea of participatory teaching brings not only new teaching skills, but also new education philosophy. During the training, the project team invited lecturers who had been teachers before, and their abundant teaching experience has inspired a lot. In the past, once the students "made troubles", Yang would criticize them or even asked their parents to come to the school. On the contrary, the project advocates considering from the perspective of students and thinking about the reasons behind students' behaviors, which makes Yang begin to rethink the relationship between her and students. Therefore, she abandoned the former practices, beginning to listen to the students, protect their self-esteem, and change criticizing to encouraging. She gradually discovers that the distance between her and students is closer, and the teacher-student relationship changes from tension to intimacy.

The project hopes that the advanced teaching methods could be practiced there for a long term even after the training. In the later period, the focus of the training of trainers, which means they are to pass on the teaching ideas and methods to other teachers. Now, Yang is actively promoting advanced teaching methods and helping teachers to enhance teaching abilities in her school through open classes, teaching and research activities and other forms.

"Education is closely connected to the future of children and plays an important role in social development," Ulrike Wilson said, "Teachers' education philosophy will have long-term impacts on their teaching behaviors. We will continue to support the promotion of advanced teaching ideas, improve children's educational environment, and create a better tomorrow for them."

The promotion of advanced teaching ideas will improve children's educational environment and create a better tomorrow for them. (Photos: Save the Children)

Save the Children

Save the Children is the world's leading independent organization for children. Founded in 1919 in England, it's currently working in more than 120 countries.

Save the Children has been donating for flood of the Yellow River since the 1920s, and started working in China since the 1980s. As one of the largest INGOs working in China, Save the Children currently run projects in over 10 provinces in mainland China, managed by 100 professional staff in our program offices in Beijing (head office in China), Shanghai, Sichuan, Yunnan, Guangzhou and Xinjiang.

Save the Children has played a crucial role in helping to protect poor and vulnerable children in both rural and urban areas and to offer them a brighter future. Our work covers the fields of health, education, child protection, and humanitarian aid. The scope of our operations ranges from directly assisting the most vulnerable communities in partnership with government agencies and civil society, to advising national policy makers. In 2016, Save the Children in China helped 500,000 people, with a total expenditure of 11.16 million US dollar.

BASF Stiftung

BASF Stiftung is a charitable foundation incorporated in civil law based in Ludwigshafen, Germany. It is recognized as a non-profit organization by the respective tax authority. It was founded as the BASF Jubiläums-Stiftung in 1948, and it gradually evolved in several stages into the BASF Stiftung in 2012.

BASF Stiftung supports employees of BASF SE and its subsidiary companies, their family members and other individuals and families who are experiencing hardship through no fault of their own. It is committed to disaster relief and the promotion of international development cooperation that contribute to long-term improvement in the living conditions of disadvantaged people, especially children and youth. The BASF Stiftung is already involved in round about 60 initiatives globally. The projects and benefits provided by BASF Stiftung are funded by the income of the foundation and by donations from BASF SE, the BASF Group companies in Germany and their employees.

Mobile air conditioner to wear

Functional cooling textiles of core sports and occupational safety brands use a special superabsorber fleece from BASF

Humans are born runners. Evolution once gave us the ability to overcome the distance of many kilometers through the hot savannas of Africa. In addition to the upright posture of the body and head and the optimized mechanics of legs and feet, cooling by millions of sweat glands plays a key role. Under extreme stress, they can release about one liter of sweat per hour and cool down the body by evaporation.

But as often seen in nature, this specialization comes at a price. To keep its core temperature stable, the body has to expend much energy to protect itself from overheating. About 75 percent of the energetic processes in physical exertion are used for thermoregulation and therefore only 25 percent of the energy can be used for muscular processes such as sports or work performance.

This limits our performance even at moderate outdoor temperatures. Athletes as well as workers and many other people worldwide who are exposed to high temperatures are therefore now using active functional cooling clothing. Thanks to innovative materials, this provides evaporative cooling which is individually dosable and lasts for hours. The functional cooling textiles of the E.COOLINE and IDENIXX brands, incorporating the specially developed superabsorbent nonwoven fabric from BASF, offer a mobile air conditioning system to wear which effectively supports the cooling system of the human body.

Cooling vests, for example, are easy to use and can be worn like any other item of clothing once being activated by “charging” with water. The water enters the active layer – the Luquafleece® from BASF – after being rapidly absorbed and distributed through a bacteriostatic textile fabric. “The fibers of this nonwoven fabric are coated with superabsorbent polymers (SAP) through a special technology. They absorb the water in a few seconds and retain it,” explains the expert Norbert Heidinger of BASF New Business GmbH, who markets the material.

Like a fishing net, the polymer network of the superabsorber traps increasing numbers of water particles until its elastic restoring forces compensate the osmotic forces of the prevailing concentration gradient. In this way Luquafleece® can absorb ten times its weight in water and retain it so firmly, that the functional textiles are dry on the surface.

With higher outdoor temperatures or increasing skin temperature during sports or work activity, the water molecules firmly bound inside the functional cooling clothing absorb the thermal energy, evaporate from the large surface of the three-dimensional nonwoven structure and thereby cool down the wearer. The body sweats less and thereby saves energy that would usually be needed for thermoregulation. External cooling can therefore provide an increase in performance of up to ten per cent in hot conditions. Moreover, important body parameters – such as heart rate – are improved which protects people’s health.

Athletes who work out want to have fun, while promoting their health and also testing their own limits. These limits are only reached through the interplay of mind and body, explains a prominent triathlon champion, who calls it a relationship of trust. If the head wants to increase performance, it has to learn how to interpret the body's signals correctly. You must not stop your efforts too early, neither exceed your own capabilities.

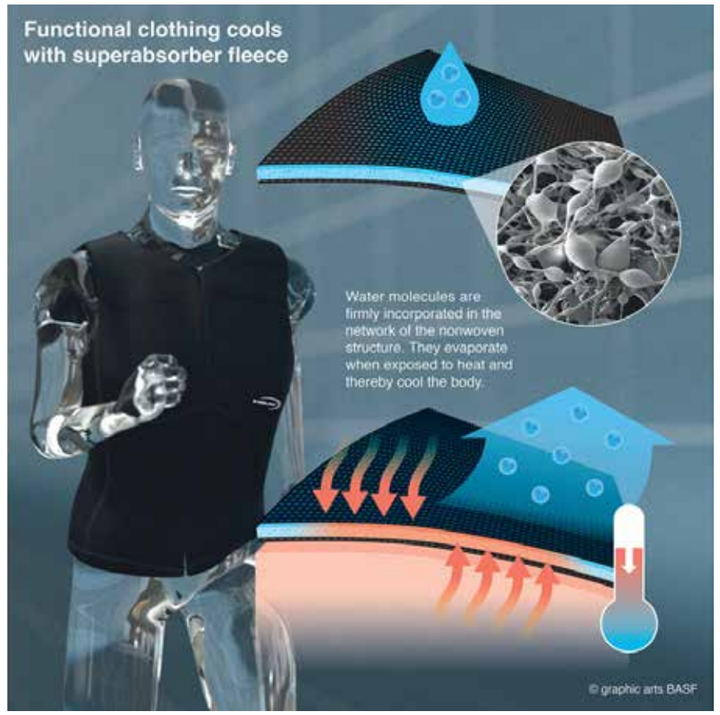
Relief of circulatory and metabolic stress to protect health for hours

The functional clothing only cools the body to the extent required by the prevailing situation. The intensity of evaporative cooling adapts to the surrounding temperature and exertion. Thus no negative cooling effects can occur. “After a while, you even don't notice the cooling anymore because the body is air-conditioned,” is how Gabriele Renner CEO of the manufacturing company “pervormance international GmbH”, from Ulm (Germany), describes the benefits. “You sweat less and thereby relieve the load on the cardiovascular system, metabolism and energy balance.” Depending on the outdoor and body temperature, the cooling effect persists for up to 20 hours – and any other clothing stays dry.

Since the World Football Championship in 2014 in Brazil, functional cooling textiles have been used at many international sporting events worldwide. For example, the national football teams from Switzerland, Ireland and the USA nowadays use these cooling vests and headgear to improve their recovery during the half-time interval or before energy-intensive extra time.

But not only top athletes are improving their health and performance with active functional cooling clothing. Many companies also use it to protect their employees from the hazards connected with overheating and overexertion.

With the E.COOLINE and IDENIXX brands, the idea of mobile, simple and effective cooling has therefore been successfully implemented and marketed. Apart from innovative materials, they are environmentally friendly because bionic system only requires water and the heat the user wants to get rid of anyway. “We compensate the CO_2 volume generated over the entire production chain by financing climate projects on the same scale,” says Gabriele Renner, indicating that she has not only the individual body climate in mind, but also the world climate while operating a future-oriented, climate-neutral company.



Luquafleece® as problem solver for wound healing and moisture management

Innovation for wound healing: BASF together with OSNovative Systems, Inc. have developed an innovative universal wound dressing which is suitable for all types of wounds and creates ideal conditions for wound healing. The wound dressings are marketed under the name Enluxtra® in the USA. This disruptive technology based on the superabsorber nonwoven material Luquafleece® provided by BASF accelerates the wound healing process of most wounds and thereby reduces medical treatment costs.

Passive seat temperature control: In the lightweight comfort seat of the concept vehicle “smart forvision” from the Recaro company, as well as in office chairs of the Vitra company, the BASF nonwoven fabric Luquafleece® reduces moisture in the seat and on its surface. In this way, prolonged sitting remains pleasant even on stressful workdays and during long car journeys. This moisture management also plays an important role in electronics, which represents another future application for this innovative material. Moreover, intelligent ventilation elements for shoes, offered by the Hamburg company IQTEX, are already based on the moisture-absorbent fleece. Depending on the weather conditions, these elements are either breathable or watertight.

“Cooling vests improve the health and safety of employees”

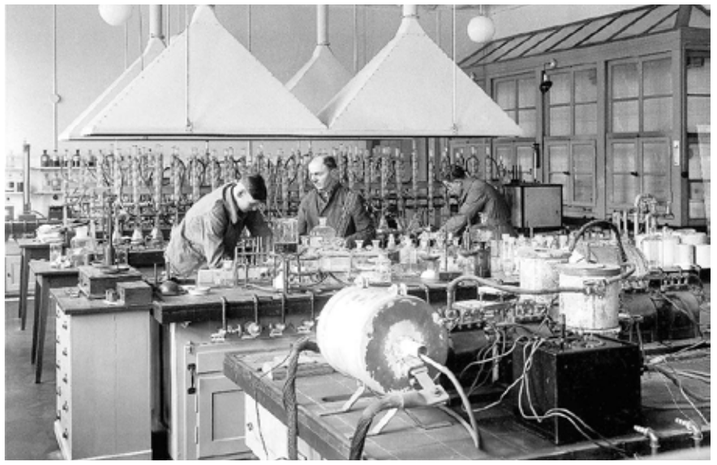
Interview with Gabriele Renner, CEO of the company “pervormance international GmbH” from Ulm (Germany)

What advantages does the BASF product Luquafleece® offer to you?
In this joint project, it was particularly important for us to obtain a washable cooling product which is also hard-wearing and hygienic. The three-dimensional nonwoven fabric with its special fiber structure also offers an enormously large surface area capable of delivering 600 watts per liter of cooling energy through the evaporating water. Through our “cool to go” principle, the material generates a rapid and perceptible cooling effect even in extreme environmental conditions.

What areas of application of the cooling system are particularly important?
At present the main application is in the field of occupational health and safety, because many people worldwide have to work at high environmental temperatures, partly also because of climate change. The resulting cardiovascular strain, concentration problems and states of exhaustion impair health and safety at work. Studies have also shown that the productivity of companies is thereby reduced. Both can be improved by using our functional cooling textiles.

Where do you see further potential for air conditioning functional clothing in future?
Medicine is definitely another field of application in the future. Here we have already shown that we can significantly improve quality of life of people affected by multiple sclerosis with our cooling vests. There are also other valuable uses such as treating menopausal complaints like hot flushes or reducing fever with our calf coolers, to mention only two. We also have projects under development in the fields of orthopedics and even beauty medicine.

Acetylene: cornerstone of a firm foundation



Interior of the materials testing lab, 1937

As a basic chemical component, acetylene presents as a colourless and inflammable gas at normal temperature. It is widely applied as an important starting material for many everyday products, including pharmaceuticals, plastics, solvents, electronic chemicals and highly elastic textile fibers. We process acetylene into many subsequent products at BASF. Our customers then use these products in the automotive, pharma, construction, consumer goods and textiles industries.

BASF chemist founder of acetylene chemistry

The production and processing of acetylene is closely connected with the name Walter Reppe (1892—1969), a BASF chemist considered the founder of modern acetylene chemistry.

In the early 1920s, acetylene attracted extensive attention as a highly active chemical material. Its processing, however, was extremely dangerous with the high volatility. For the sake of security, chemists could only work with acetylene under the pressure of no higher than 1.5 bars.

Reppe's goal was the large-scale use of acetylene for plastic production, but an obstacle was the acetylene process. Therefore, he set about looking for new processing methods in hope to increase the working pressure under the prerequisite of ensuring safety.

After extensive research, he discovered that acetylene could be processed safely under the pressure as high as 25 bars. This discovery cleared the way for the chemist's aim. With the help of Reppe's processing technique, BASF researchers laid the foundation for the safe processing of acetylene.

It was a significant success, but Reppe was still not satisfied. Between 1934 and 1938, he conducted research on four fundamental chemical reactions including vinylation, ethinylation, cyclization, and carbonylation, which created a variety of chemical compounds. This chemistry pioneer thus paved the way for the production of countless products that contribute to today's quality of life.

Inheriting the century craft in modern times

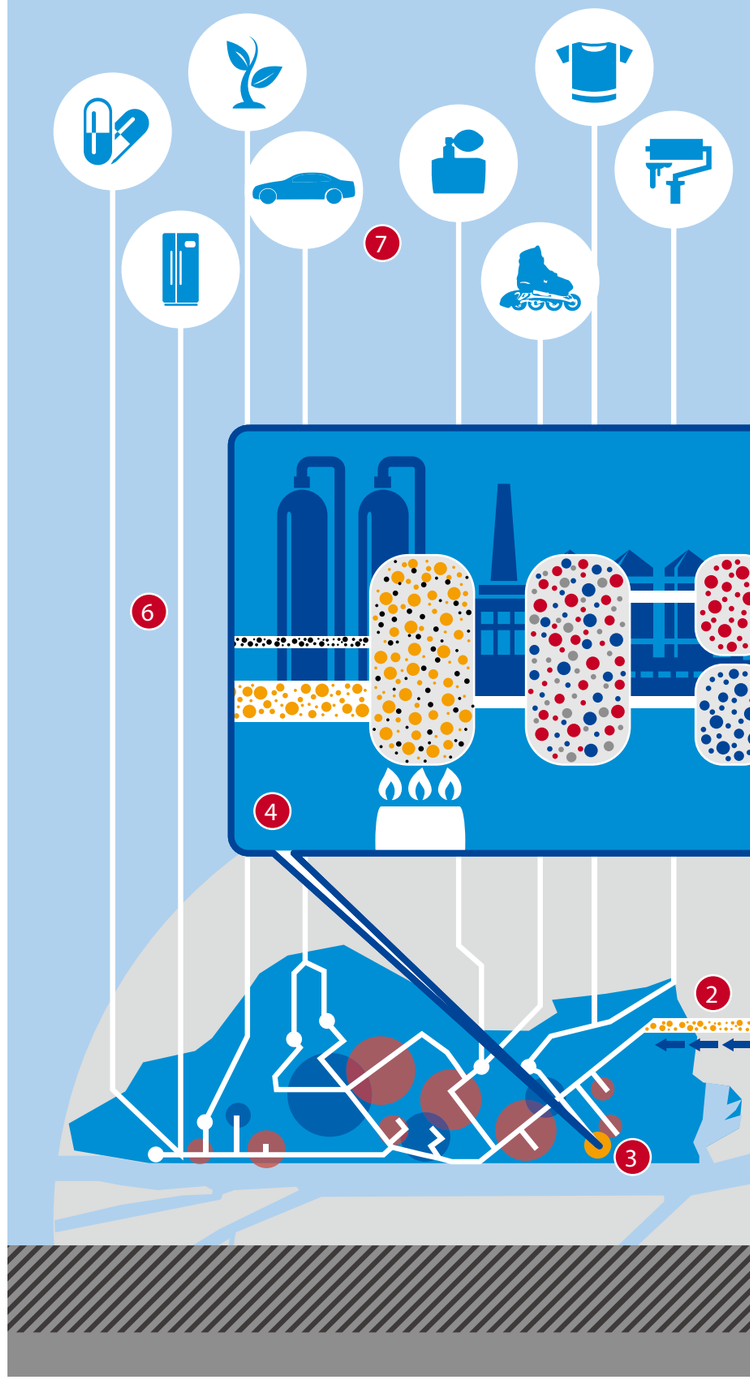
BASF has been manufacturing acetylene for more than 50 years. Industrial acetylene has been under production in the Ludwigshafen site since 1963. Until now, about 20 production facilities at the Ludwigshafen site use acetylene as a starting material for many other products and value chains. The acetylene plant in the Geismar site was put into production in 2000.

In 2016, the 90th anniversary of Reppe's invention of the acetylene processing technique, BASF announced it would build a world-scale production plant for acetylene at its Ludwigshafen site. The plant will start up at the end of 2019 and replace the existing plant. The facility will have the capacity to produce 90,000 metric tons of acetylene per year and use the world's most efficient production process.

"With the new plant, we are strengthening the BASF Verbund by ensuring an efficient supply of the key intermediate acetylene at our Ludwigshafen site. This brings a series of advantages including efficient use of resources, excellent production synergies and short supply routes. This approach will enhance our competitiveness and support growth in the various value chains involving acetylene," said Dr. Stefan Blank, President of BASF Intermediates division.

Model of new acetylene plant Ludwigshafen

From natural gas to acetylene



1. The journey of acetylene starts with natural gas, deep under the ground.
2. Still on site, the natural gas is purified and prepared for the transport to Germany.
3. Production plants at the site in Ludwigshafen receive the raw material for further processing.
4. In the acetylene plant, a highly complex chemical process is used to heat, crack, separate and purify natural gas with oxygen.
5. The reaction products are acetylene and a syngas. They are used in different plants.
6. In further production steps, BASF then manufactures several subsequent products.
7. Customers of BASF use them as the starting materials to make products for daily life.

Scan the code and watch the complete video.

Kids' Lab marks 20 years of discovery

In June 1997, BASF launched Kids' Lab, the first hands-on chemistry workshop in Europe at its headquarters in Ludwigshafen. It is an interactive, fun and free chemistry education program designed for kids ages 6 to 12 to discover the world of chemistry through simple and safe experiments.
In 2002, to commemorate the 30th anniversary of the establishment of diplomatic relations between China and Germany, BASF Kids' Lab made its debut in Beijing. Ever since, the program has been brought to cities including Shanghai, Nanjing, Chongqing, Guangzhou, Shenyang, Wuhan, Hong Kong, Taipei, Kaohsiung and Taoyuan. It has now reached more than 170,000 children in China. All along, "BASF Kids' Lab" is welcomed by children and parents and has become a must-go event each summer.

1997

Kids' Lab launched in Germany

2002

Kids' Lab launched in Beijing, China

20th ANNIVERSARY OF BASF KIDS' LAB

Team with Sesame Street for "Magic Map" interactive drama during World Expo Shanghai

100,000th Kids' Lab chemist in Beijing, China

"Germany and China" five city roadshow driven by government in Guangzhou, Wuhan, Shenyang, Chongqing

2007–2009

2009

2010

2010

Kids' Lab launched in the United States

2015

Virtual Kids' Lab goes live globally

2017

In 2017, BASF celebrates the 20th anniversary of Kids' Lab, and it marks 15 years of Kids' Lab in China. On this occasion, a series of home experiments are hosted to create a high-quality parenting and interaction atmosphere and stimulate the curiosity and exploration of kids.

Home Experiment

Experiments for clever foodies - Water or oil?

Do you like purple grapes, red tomatoes or green lettuce? Researchers are discovering that many plant pigments from fruits and vegetables are very good for your health. Do you know how to isolate individual pigments from them?

To complete the experiment, you need:

- 1 carrot
- a handful of blueberries, fresh or frozen
- about 200 ml of colorless vegetable oil
- 2 screw-top jars (jam jars or similar)
- 2 drinking glasses about the same size as the screw-top jars
- 1 grater
- 1 fork
- 1 fine sieve (tea sieve)

IMPORTANT:
Ask an adult to help you use the grater. Make sure you wash the carrot and blueberries thoroughly and that the kitchen utensils are clean.

Scan the QR code for more experiments.

Here's how it's done:

1. Peel the carrot and grate it into one of the screw-top jars.
2. Put the blueberries in the other screw-top jar and mash them with the fork.
3. Add enough water to the two jars to cover the pieces of carrot and the blueberries.
4. Add about the same amount of oil.
5. Close the jars tightly and shake them for a while.
6. Pour the contents of each jar through the sieve into a fresh glass.

What do you notice?

Find out more

If you would like to know more about the topics covered in this issue of BASF information, please use the following links.

To find out more about BASF's new corporate campaign film, visit: www.wecreatechemistry.com

To find more about BASF Automotive solutions, visit: www.automotive.basf.com

To find more about BASF Performance Materials, visit: www.performance-materials.basf.com

To find more about BASF Human Nutrition solutions, visit: www.newtrition.basf.com

BASF information

Published by: Corporate Affairs Greater China, BASF
Editor in chief: Frances Luk
Editors: Ling Cao, Elaine Yang
Publishing date: November, 2017

Contact us

Corporate Affairs Greater China, BASF
e-mail: elaine.yang@basf.com

Follow us

You can find this publication at www.basf.com and scan the codes (below) to visit our website and follow us on social media for an easy access.

How did you like BASF information?

Thank you for taking the time to read this publication. We welcome your opinions and feedback, and would appreciate your response to our short reader questionnaire.

Simply fill out the questionnaire and be entered in a draw to win the By-health Bilberry Lutein & Beta Carotene Soft Capsule whose lutein ester and beta carotene are supplied by BASF.

Access to online questionnaire: https://on.basf.com/2wRfNKh

Prize draw terms and conditions:
On submitting a completed entry, you will automatically be entered into a draw for this prize. The winner will be notified by email within 28 days of the closing date. The closing date for entries is January 31, 2018. The competition is not open to employees of BASF or participating companies. No cash alternative will be offered. No responsibility can be accepted for entries lost, delayed or mislaid. Entry in the prize draw is restricted to entrants of 18 years of age or over. BASF's decision is final and it is a condition of entry to any competition that the entrant agrees to be bound by these rules.

When electricity supplies are unaffected by a natural disaster, lives can return to normal more quickly.

When natural disasters occur, loss of electricity often compounds the problem because today we rely so heavily on it. To solve this problem, we've helped develop extremely robust, ultra-light utility poles. When installed, they're several times stronger than the other poles and can withstand the most severe conditions.

That's why, when electricity supplies are maintained in disaster areas, it's because at BASF, we create chemistry.

To share our vision, visit wecreatechemistry.com

BASF

We create chemistry