

News Release

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BASF Research Press Briefing 2025

How innovations drive BASF's success

- **R&D focus is on green transformation, sustainable agriculture and competitiveness**
- **About 80 percent of R&D activities in scope support BASF's sustainability targets**
- **Digital solutions and artificial intelligence advance productivity and accelerate innovation**

“Innovation has always been part of BASF’s DNA. Especially in these volatile times, it is crucial to leverage our innovative strength to develop competitive solutions that differentiate us as a company in our markets and give us a competitive edge,” said Dr. Stephan Kothrade, Member of the Board of Executive Directors of BASF and Chief Technology Officer, at the company’s Research Press Briefing held today. To achieve this, BASF implemented its “Winning Ways” strategy about a year ago with the clear goal of becoming the preferred chemical company to enable its customers’ green transformation. “Our ambition extends beyond making BASF green. We aim to inspire customers to choose BASF as their trusted partner for their future success,” Kothrade said.

Research and development (R&D) is a vital pillar in this strategy, as BASF’s products and process innovations enable customers to innovate and grow in their respective markets and significantly contribute to achieving profitable growth and value creation in a world moving towards greater sustainability. For BASF, the green transformation, sustainable agriculture and competitiveness are the most important topics where progress in R&D is essential. This also includes continuous improvement of

technologies, processes and operations, which has always been a priority for BASF. “Through continuous improvements in the energy and resource efficiency of our plants, we not only secure cost leadership in many value chains but also make our products more sustainable,” Kothrade said.

To further strengthen its R&D portfolio, BASF is continuously researching new solutions and enhancing existing products and processes by leveraging its innovative power. With annual investments in R&D of around €2 billion in 2024, BASF is the leading company in the chemical industry. Around 80 percent of R&D activities in scope are directly related to BASF’s sustainability targets. “That shows our strong commitment to the green transformation,” Kothrade said. Investment in R&D also pays off: Over 15 percent of BASF’s sales – around €11 billion in 2024 – were generated by innovative products launched in the past five years that stemmed from R&D activities. “The most important factors in our success are the know-how and the commitment of our approximately 10,000 R&D employees globally,” said Kothrade. In 2024, their work and expertise resulted in over 1,000 new patents worldwide, with about 45 percent focusing on sustainability and 23 percent on digitalization and artificial intelligence (AI).

Dr. Christoph Wegner, President Group Research, underlined the significance of digitalization in BASF’s R&D activities: “Digital solutions and artificial intelligence are indispensable in today’s R&D work.” BASF’s knowledge management platform QKnows enables the global R&D community to search scientific literature, patents and internal reports all in one place. AI capabilities make finding relevant information in the more than 400 million documents much quicker, thus helping researchers to explore complex scientific topics and gain valuable insights for their work. “You will hardly find such a powerful system elsewhere. This clearly gives us a competitive advantage,” Wegner pointed out.

Another example of digitalization in R&D at BASF is the company’s first AI reactor. Maximizing the yield of a reaction is one of the typical and sophisticated tasks of a chemist. The common practice has been to vary different reaction parameters one after the other, which can be a very time-consuming process until yields reach a satisfying level. The AI reactor now significantly accelerates this complex process. It plans, executes and analyzes chemical experiments. And more importantly, the reactor learns and autonomously triggers the next reaction cycle and maximizes the yield of the reaction. “Our first experiments already demonstrated that we are

20 times faster than when we do it manually,” Wegner said. BASF therefore plans to expand this system to cover all chemistry relevant to the company.

The third example for AI use in BASF’s R&D comes from the Agricultural Solutions division. Groundwater leaching assessment is a critical step for the registration of plant protection products. This process is complex, time-consuming and requires deep regulatory expertise. Given current regulatory models, it is impractical to conduct assessments for the high number of candidates involved in early research phases. Here, an AI-supported tool has been developed which predicts groundwater leaching risk for all compounds involved early in the research process. To develop the underlying model for that prediction, BASF ran about one million simulations on its supercomputer Quriosity. “Artificial intelligence helps us to focus our resources on the safest compounds with the highest chance of success,” said Wegner, summarizing the advantages.

At the Research Press Briefing, BASF experts presented concrete innovations to illustrate how the focus on green transformation, sustainable agriculture and competitiveness looks in practice.

Circularity you can wear

The fashion industry generates more than 120 million metric tons of textile waste annually worldwide, of which less than 1 percent is recycled. With loopamid®, BASF researchers have developed an innovative process that enables circular textile-to-textile recycling of polyamide 6, also known as nylon 6. Textile waste can be transformed into new polyamide fibers with the same high quality as conventional polyamide 6 and with up to 70 percent lower CO₂ emissions. The apparel industry uses polyamide 6 to produce sports and outdoor clothing and swimwear, for example.

The innovative recycling process, which can also be used for mixed materials such as fabric blends that include spandex and dyes, involves several steps. First, the textiles containing polyamide are collected, for example, from donations of used garments, returns to retailers or production scrap from textile manufacturing. They are then separated from other materials. Buttons, zippers and other decorative elements are removed before the textiles are shredded into smaller pieces. Using a chemical process, the material is depolymerized – meaning that the long molecular chains of the polyamide polymer are broken down into the individual molecular

building blocks, known as monomers. The monomers are purified in a multi-step process, which removes undesired substances, such as dyes and additives. Finally, the purified caprolactam monomers are again polymerized – or joined together – to make new polyamide.

In early 2025, BASF started up the first commercial loopamid production facility at its Caojing site in Shanghai, China. It has an annual capacity of 500 metric tons and is certified in accordance with the Global Recycled Standard (GRS). Consumers and textile producers can thus be sure that loopamid is produced from recycled material, and the production processes comply with GRS-specific environmental and social criteria.

Competitive hydrogen for the future

Hydrogen plays a key role in the chemical industry. It is an indispensable raw material for important base chemicals such as ammonia and methanol. BASF's current global demand for hydrogen is about 1 million metric tons of hydrogen annually. Of this, around 200,000 metric tons of hydrogen are produced or generated as a by-product of chemical production at the Ludwigshafen site alone each year. In addition to its use as a feedstock, hydrogen is seen as a key energy carrier of the future.

Until now, BASF has produced hydrogen primarily through steam reforming, which uses steam to split natural gas into hydrogen and carbon dioxide. BASF is working on a new technology called methane pyrolysis to produce hydrogen cost efficiently and with a significantly lower carbon footprint. In cooperation with partners, BASF has been developing methane pyrolysis technology as part of several projects funded by the German Federal Ministry of Research, Technology and Space (BMFTR). The principle of methane pyrolysis is the following: Methane (CH₄), the main component of natural gas or biogas, is directly split into its constituent elements carbon (C) and hydrogen (H₂) at high temperatures. Compared to electrolysis of water, methane pyrolysis requires only around one-fifth of the electrical energy. By using electricity from renewable sources, the chemical reaction is CO₂-emission free. As previously announced on [November 17, 2025](#), BASF and ExxonMobil have now signed a joint development agreement to further develop this

technology. The aim here is to mature methane pyrolysis into a commercial-ready process, which can be used to produce emission-free hydrogen at competitive conditions.

Besides hydrogen, methane pyrolysis produces high-purity solid carbon, a valuable raw material that does not occur in this form in nature. This carbon can be used, for example, in the production of aluminum, steel, electrodes and lithium-ion batteries. BASF and ExxonMobil are currently collaborating with their customers to optimize the carbon in such a way that it can be customized for use in the customer's individual production processes.

BASF has been operating a methane pyrolysis test facility at its site in Ludwigshafen, Germany, since 2021. A unique feature of this facility is its innovative reactor. It is the first to use a special technology that is especially efficient at splitting methane. Therefore, it has a high degree of effectiveness and a high level of process efficiency. This makes BASF's process superior to other methane pyrolysis technologies. To scale up this technology and offer it as a competitive alternative for hydrogen production, BASF and ExxonMobil plan to jointly build and operate a demonstration plant capable of producing up to 2,000 metric tons of low-emission hydrogen and 6,000 metric tons of solid carbon per year.

Rethinking catalysts

Catalysis is one of the key technologies in the chemical industry. More than 85 percent of all chemical products come into contact with catalysts at least once during their production. Catalysts increase process efficiency, reduce energy and raw material consumption, and minimize waste.

Traditionally, catalysts are manufactured via extrusion (the mass of raw material is pushed through a die to make catalyst bodies) or tableting (the mass of raw material is compressed in a press to make catalyst bodies). These have been proven catalyst production technologies for more than 70 years and have made a significant contribution to improving the efficiency of chemical processes. However, their limitations become apparent when developing next-generation catalysts with complex three-dimensional structures and optimized flow properties.

With the new X3D[®] catalyst shaping technology, BASF has achieved a technological breakthrough in catalyst manufacturing. The innovative technology is based on

3D printing and can produce catalysts with customized geometrical shapes offering optimized performance and efficiency. During development, BASF researchers successfully increased the throughput of the 3D printing process, making industrial-scale production of 3D-printed catalysts a reality. The resulting catalysts feature open structures and enlarged surface areas, significantly reducing pressure drop in reactors and improving overall catalyst performance. Their use in chemical production processes leads to lower energy demand, reduced CO₂ emissions and improved product quality.

The X3D process is highly flexible, enables the manufacture of various catalysts using precious and non-precious metals as well as different substrate materials. BASF can thus develop customized catalyst solutions tailored to individual customer needs. In response to high customer demand for BASF's 3D-printed catalysts, the company has invested to expand its production capacity. BASF is currently building a new production facility in Ludwigshafen, which will start operations in 2026.

Seeds full of science

Farmers worldwide are facing numerous challenges, including climate change and limited land available for cultivation. Weeds are another challenge, as they are becoming increasingly resistant to conventional crop protection products (herbicides) and this resistance can cause considerable harvest losses. When weeds compete for nutrients, water and light, crops cannot grow optimally. Controlling weeds is therefore crucial to secure the productivity and quality of the harvest.

This is also a challenge facing farmers growing cotton. For them, BASF researchers have developed two new herbicide-tolerant cotton traits: Axant Flex™ is the first and only quad-stack herbicide trait package available for farmers in the United States. Seletio TP™ is a first-of-its-kind herbicide-tolerant technology for grass control for farmers in Brazil. Both traits enable farmers to control resistant weeds more effectively. In addition, the cotton offers the usual protection against harmful insects.

The development process focused on special enzymes called 4-hydroxyphenylpyruvate dioxygenase (HPPD). Certain herbicides work by hampering HPPD and thus key metabolic processes in weeds, so that the weeds stop growing and die. BASF identified numerous HPPD enzymes in bacteria that are tolerant to these herbicides. After further optimizing the tolerance of these

enzymes, the genes responsible for the production of these enzymes were introduced into the genome of the cotton plants. To identify the modified cotton plants with the best properties, researchers tested thousands of plants under a wide variety of conditions in greenhouse and field environments. They looked not only at herbicide tolerance but also at other traits such as insecticide resistance, plant health, and fiber quality as well as yield.

Farmers see multifold benefits from the new traits of this cotton: Without having to compete with weeds in the field, the plants grow better, generate higher yields and require smaller amounts of crop protection products prior to and during cultivation. Cotton production becomes more sustainable and the risk for resistant weeds decreases, meaning herbicides remain effective for longer.

Further information about the presentations, the recording of the Research Press Briefing and the press kit can be found at: [Research Press Briefing 2025](#)

About BASF

At BASF, we create chemistry for a sustainable future. Our ambition: We want to be the preferred chemical company to enable our customers' green transformation. We combine economic success with environmental protection and social responsibility. Around 112,000 employees in the BASF Group contribute to the success of our customers in nearly all sectors and almost every country in the world. Our portfolio comprises, as core businesses, the segments Chemicals, Materials, Industrial Solutions, and Nutrition & Care; our standalone businesses are bundled in the segments Surface Technologies and Agricultural Solutions. BASF generated sales of €65.3 billion in 2024. BASF shares are traded on the stock exchange in Frankfurt (BAS) and as American Depositary Receipts (BASFY) in the United States. Further information at www.basf.com.