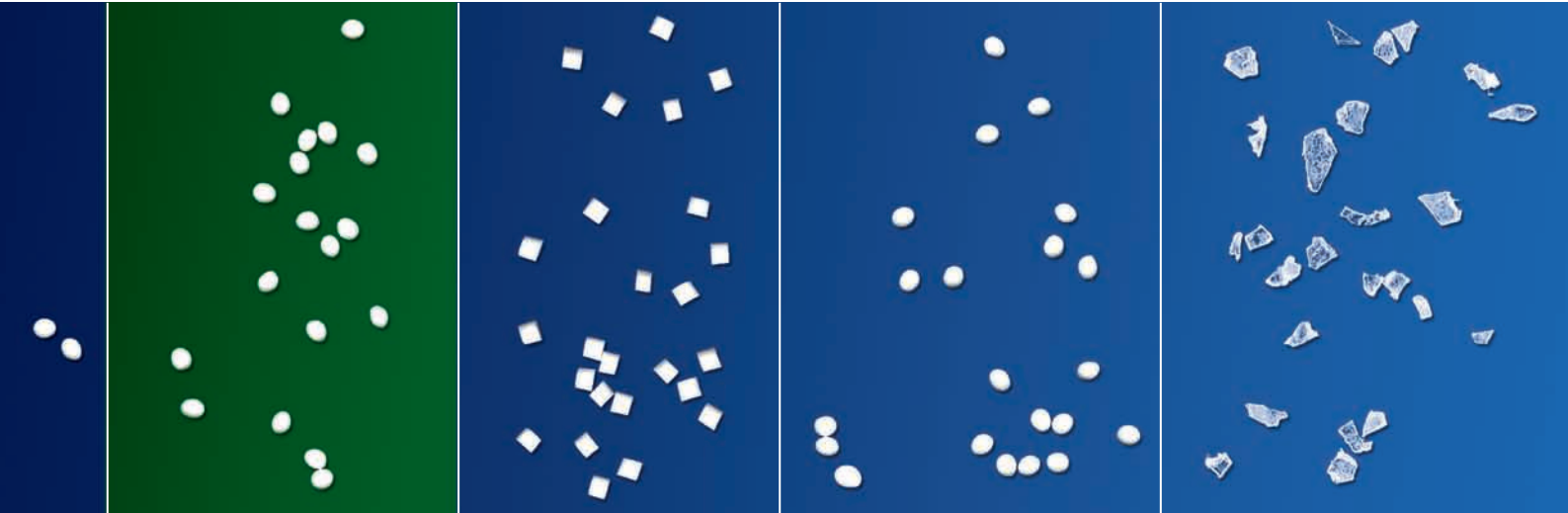


# Company Profile

## Think. Invest. Earn.



**Uhde Inventa-Fischer**



**ThyssenKrupp**

## About us

Uhde Inventa-Fischer is a forward-thinking, innovative engineering company. Our core competence is the design and construction of state-of-the-art polymerisation plants for producing polyesters and polyamides. We offer sustainable technologies, combining engineering expertise, specialist know-how of polymers and applied experience in a wide range of industrial applications worldwide.

Since 1924 we integrated knowledge from equipment manufacture, plant engineering as well as polymer production, so we are well-equipped to meet the challenges and demands of the polymer industry today. Since 2004, we are a subsidiary of Uhde, one of the largest engineering companies in the world, and a part of ThyssenKrupp Technologies. This unique business concept offers various advantages and benefits to our customers regarding competence, innovation and service. Within the Uhde family we can offer comprehensive local support, such as plant management and on-site engineering capacity.

Our highly-skilled employees analyse each customer's specific requirements and systematically research potential solutions. Meeting the exact needs of our customers is our main priority. This is supported by the fact that about 20% of our employees are working in Research & Development. In addition, Uhde Inventa-Fischer has pilot plants for our core technologies, so we can provide the best support at an early stage of a project and enable customers to make well-informed decisions. We feel it is our responsibility to provide our customers with the latest technologies which result in more energy-efficient processes with reduced raw-material consumption.

The resounding success of our Melt-to-Resin (MTR®) polyester process, the recent development of our own polylactic acid production process (PLAneo®) and more than 400 successful start-ups underline the effectiveness of our business concept. And we aim to continue in this vein – offering expert advice, delivering reliable solutions and ensuring the success of our customers.



# Facing the future. ... using our innovative technology



You live and work according to a certain philosophy – and so do we. Uhde Inventa-Fischer has developed a perfect combination of giving the world innovating and sustainable technologies as well as making sure that investors profit through our knowledge. We are a leading company undertaking plant engineering for polyesters and polyamides, and also for polylactide (PLA).

# Our Technologies



## Polymer and Chemical Plants

- Polyester (PET, PBT, PEN, PTT) and copolyester for textile, bottle and film grade, and for engineering plastics
- Polyamide (PA) 6, 6.6, 11 and 12 for textile applications, film and engineering plastics
- Polylactic acid (PLA) for packaging, textile and compounds
- Formaldehyde plants
- Elastic fibre plants

## Reactors and Special Process Equipment

- Reactors
- Melt-conditioning and melt-modifying units
- Viscosimeters, chip valves, dust removal, etc.
- Recovery of polymer waste, caprolactam, ethylene glycol and methanol
- Synthetic resins and glues based on formaldehyde
- Formic acid and alkali formiates

# Our Commitment



## Competitive Edge

To keep and improve our leading position in the core technologies of Uhde Inventa-Fischer, we consistently invest in upgrading our pilot plants and in strengthening our intellectual property rights.

We cooperate with institutes and universities and are involved in European R&D networks. These activities, in conjunction with our own innovations, ensure that we are among the first to open up promising new fields of activity to our customers.

By using this type of dual strategy, Uhde Inventa-Fischer is able to offer our customers economical, safe and environmentally sound plants and thus provide them with a competitive edge in the market.



# Our Company



## Our Company

Uhde Inventa-Fischer is located at two sites: Berlin in Germany and Domat/Ems in Switzerland. Our team of about 200 employees consists of engineers, chemists, scientists, planners, CAD experts and specialists in commerce and finance.

The structure of our organisation coupled with a competent management team ensures that we react quickly and flexibly when attending to and satisfying our clients' requirements.

Since 2004, we are a subsidiary of Uhde GmbH in Dortmund, Germany.

## Uhde

Uhde is one of the leading engineering companies for chemical and industrial plants for a variety of technologies and is part of the Technologies segment of ThyssenKrupp.

Uhde's know-how and global network create valuable synergies in combination with our own know-how. These enable us to cooperate globally and efficiently with other companies within the Uhde group and allow us to offer special and tailor-made services to our customers such as permit engineering, construction services and local sourcing of equipment.

# Our R&D Facilities

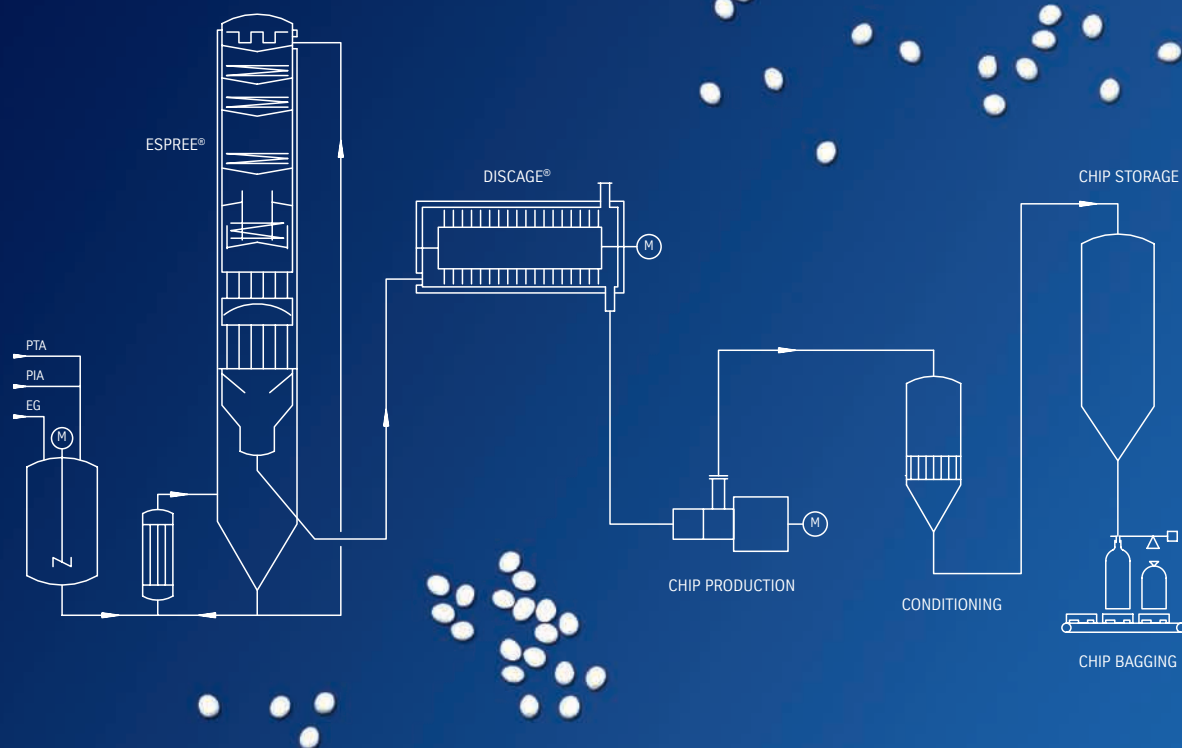


## Pilot plants

The polymerisation plants supplied by Uhde Inventa-Fischer are based on proprietary process technology and proprietary key equipment. Both technology and equipment, e.g. reactors, are developed and optimised in-house.

We operate pilot plants for polyamide 6, PET, PBT, copolyesters, copolyamides, and PLA. Their purpose is to optimise processes and products and to test additives as well as catalysts. The data from the pilot plants and computer-based process models are the basis for continuous improvements of all elements.

# Polyester



## Melt-To-Resin MTR®

The Melt-To-Resin MTR® Technology completely replaces the conventional solid-state postcondensation (SSP). It is based upon the established 2-Reactor technology. Innovative and patented design highlights like the advanced ESPREE® and DISCAGE® reactors as well as improved polymer line design, short term filtration, die-face hot cut, AA conditioning and gentle process conditions allow the MTR® process to offer many excellent features. The list includes highest melt viscosities up to 1,500 Pas, excellent colour, reduced crystallinity, reduced AA content, higher raw material yield and many more.



# A Proven Technology



## 2-Reactor Technology

The Uhde Inventa-Fischer 2R technology can be used for the production of PET and other polyesters like PBT, PTT or PEN. The versatility of the 2R technology is further demonstrated by a new process called Flakes-To-Resin FTR®. It adds post-consumer recycle to the virgin melt – combining excellent product-quality levels and increased profitability.

The 2R technology covers the full range of viscosities and can be used for textile, packaging and engineering plastics applications.

## Flexibility

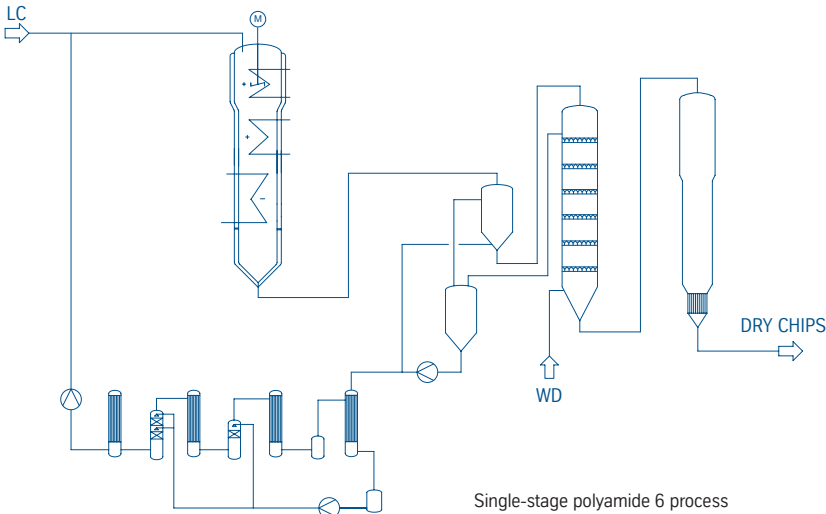
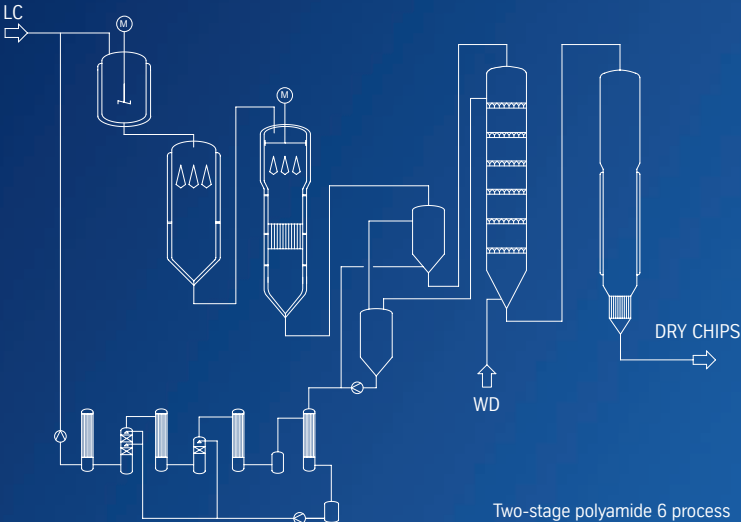
Direct production of high-viscosity polyester melt allows generation of bottle grade resin, sheet for containers, technical yarns and tyre cord in a one-step melt-phase polycondensation process, thus reducing conversion costs by more than 30% and adding to chips quality.

# Polyamide

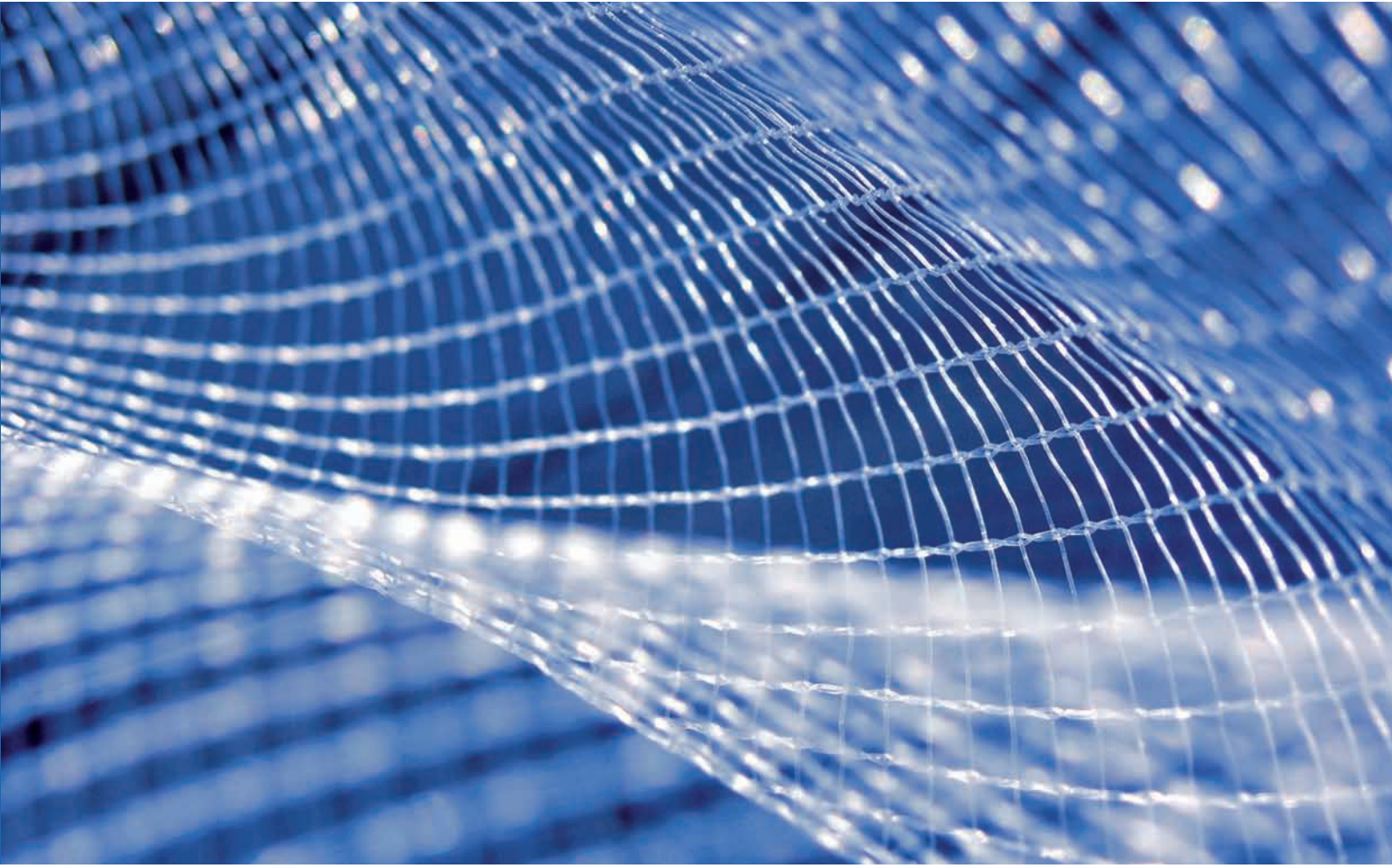
## Polyamide 6

Uhde Inventa-Fischer's know-how in the polyamide 6 field covers a wide range of processes for all applications. Process optimizations, new process developments and innovative polymer modifications ensure state-of-the-art technology.

For the polymerization process, Uhde Inventa-Fischer offers single-stage as well as two-stage processes. The choice of the optimal process depends on the desired application and the capacity of the production plant.



# Flexibility



## Polyamide 6.6

For the production of polyamide 6.6, Uhde Inventa-Fischer offers the high-performance autoclave for the batch process, with batch sizes up to 2,500 kg.

## Applications

Polyamide 6 is one of the most important polymers in today's synthetic fiber industry for the production of textile yarn and technical yarn – especially tire cord and carpet yarn (BCF). Other important fields of polyamide 6 applications are engineering plastics and film grade quality.

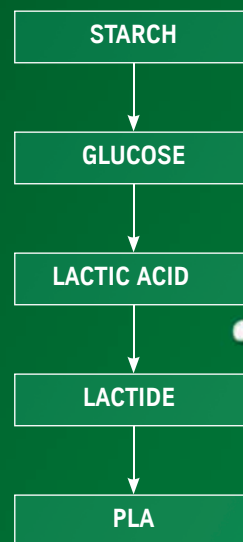


# Polylactic Acid

## PLA – a Sustainable Polymer

Polylactic acid or Polylactide (PLA) is a biodegradable polymer based on renewable resources. The feedstock of Uhde Inventa-Fischer's PLA process is lactic acid which is produced from any raw material containing starch or sugar, such as corn, cereals, cassava, sugar cane or beet, and may be sourced locally. It is expected that PLA will be sourced from non-food, cellulosic materials within the next few years.

## Basic process



## PLAneo® Process

The development of Uhde Inventa-Fischer's continuous PLA process and the optimization of various PLA grades are supported by a continuous miniplant. The Uhde Inventa-Fischer PLA process is further supported by more than 50 years of experience in developing and designing worldwide leading polymerization technologies and polymerization plants.

The continuous polymerization of PLA is similar to other melt-phase processes such as PET and to ring-opening reactions like PA 6, where Uhde Inventa-Fischer has long-term experience and offers proven process technologies.

Uhde Inventa-Fischer is in the position to license its technology for PLA production plants with annual capacities of industrial size.



PLA pilot plant in Guben, Germany



# A Renewable Polymer



## Applications

Due to its large operating flexibility, the PLA process of Uhde Inventa-Fischer is extremely capable of producing PLA with a wide range of viscosities and crystallinities for various downstream applications. PLA can be used as packaging materials such as extruded sheets for thermoforming, biaxially-orientated films and plastic bottles. Other applications are textile materials such as filaments, staple fibers and nonwovens and compounds. Packaging made from PLA has excellent tensile strength, is glossy and clear and very stiff. It has a very good aroma barrier and is excellent for packaging fruits and vegetables. PLA fiber is soft to the touch and offers excellent wearability.

# From Concept to Plant



## Global Engineering Power

In addition to our own scope of supply and services, our parent company Uhde offers turn-key plants, EPC projects and related services. As Uhde has offices around the world, they are able to provide supplementary local services such as engineering in accordance with local standards, permit engineering, etc. With an excellent track record of cooperation within the Uhde Group and reliable interface management, Uhde Inventa-Fischer supplies its customers with highly-comprehensive and efficient engineering on a worldwide scale.





## Integration of Processes

Raw materials account for the largest proportion of overall production costs. Uhde Inventa-Fischer is aware of potential savings offered by combining raw-material plants and polymerisation plants. Together with our parent company, Uhde, we offer an integrated approach: for instance, the lactic acid and polylactic acid plants are engineered by us, with Uhde providing the lactic acid process know-how. As a result, customers can cut capital investment, reduce manpower and save energy, as well as avoid additional risk thanks to well-defined interfaces.

# Our Products



## Products

Uhde Inventa-Fischer provides customers with the technology to generate products of superior quality and high sustainability. Continuous optimisation of raw material consumption, energy utilisation and waste minimisation in addition to recycling and the utilisation of renewable resources leads to improved overall performance.

Products from our technologies cover a wide range of applications, from packaging to textiles and nonwovens to engineering plastics. Especially in the area of polyesters and polyamides, Uhde Inventa-Fischer offers various grades with customised viscosity levels (high, medium, low). For PET, our DISCAGE® is used to achieve the desired viscosities generating chips in textile, bottle or film grades.



# Our Competence

Our scope of supply will be tailored according to the specific requirements of a customer's project, with options ranging from designing customer specific processes to the construction and commissioning of plants. We also provide options to meet the financing needs of our customers.



## Technical know-how

- Project planning
- Process licensing
- Basic and detail engineering
- Procurement and documentation
- Construction management
- Training and instruction of customers' personnel
- Supervision of commissioning and start-up
- Execution of revamp projects
- R&D services
- Downstream polymer processing
- Process simulation
- Energy and utility management
- After-sales services

## Associated services

- Assistance in financing
- Product marketing and procurement of raw materials
- Information on the latest market trends, new products and technologies

# Our Milestones



## History

- 1921 Friedrich Uhde founded an engineering firm in Dortmund
- 1924 Karl Fischer was established as an engineering office in Berlin
- 1947 Ems-Inventa was founded to market Ems-Chemie's patents
- 1979 Ems-Inventa became the largest shareholder of Karl Fischer
- 1998 Ems-Inventa created the division Inventa-Fischer within the Ems group
- 2004 Uhde GmbH acquired Inventa-Fischer and formed the present Uhde Inventa-Fischer

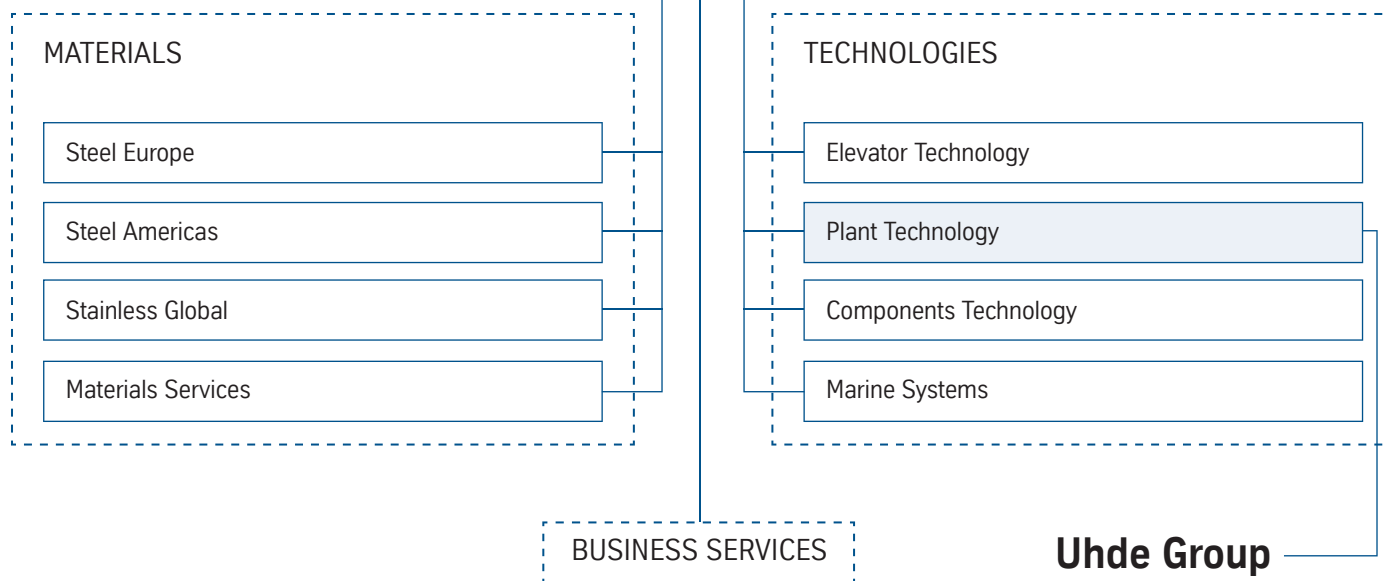
## Milestones

- 2011 The contract for the 10th 2R-MTR® plant was signed
- 2011 Successful start-up of Uhde Inventa-Fischer's PLA pilot plant in Guben, Germany
- 2009 First 150 mt/d PA line with Melt Conditioning and Direct Refeeding (DRP®)
- 2008 First contract for a 2R plant for a biodegradable copolyester
- 2006 Four additional orders based on the new 2R-MTR® technology
- 2005 World's first PET Direct-Film-Casting (MTF®) plant in operation
- 2005 World's first PA plant with a capacity larger than 150 mt/d
- 2005 World's first PET Melt-To-Resin (MTR®) plant under engineering
- 2005 Completion of a PLA miniplant in Berlin
- 2003 World's first PBT 2R plant (no SSP) in operation
- 2001 World's first 600 mt/d PET single line for PET bottle grade and textile grade in operation
- 1999 First high-viscosity PA plant with a capacity larger than 100 mt/d
- 1963 Ems-Chemie was the first company in the world to produce PET from PTA on an industrial scale



# Organisation

## ThyssenKrupp Group



## Uhde Group

Business Segments/ Product Divisions	Subsidiaries and Associates	Sales and Project Execution Offices
Ammonia & Urea Hydrogen & Nitrates Electrolysis Gas Technologies Coke Plant Technologies Organic Chemicals/Polymers Eddeleanu Refining Technologies Global Contracting/Biofuels Controlling and Corporate Finance	Uhde India, Mumbai Uhde, Johannesburg Uhde Engineering Egypt, Cairo Uhde Arabia, Al Khobar Uhde Fertilizer Technology, Roermond Uhdenora, Milan Uhde Corp. of America, Pittsburgh OOO Uhde, Dzerzhinsk Uhde Engineering Consulting, Shanghai Uhde Engineering de México, Mexico City Uhde do Brasil, Rio de Janeiro Uhde Services, Haltern <b>Uhde Inventa-Fischer, Berlin &amp; Domat/Ems</b> Uhde Eddeleanu, Brno Uhde Shedden, Melbourne Uhde Thailand, Bangkok Uhde High Pressure Technologies, Hagen	Russia, Moscow PR China, Beijing UAE, Abu Dhabi Vietnam, Hanoi Canada, Calgary



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