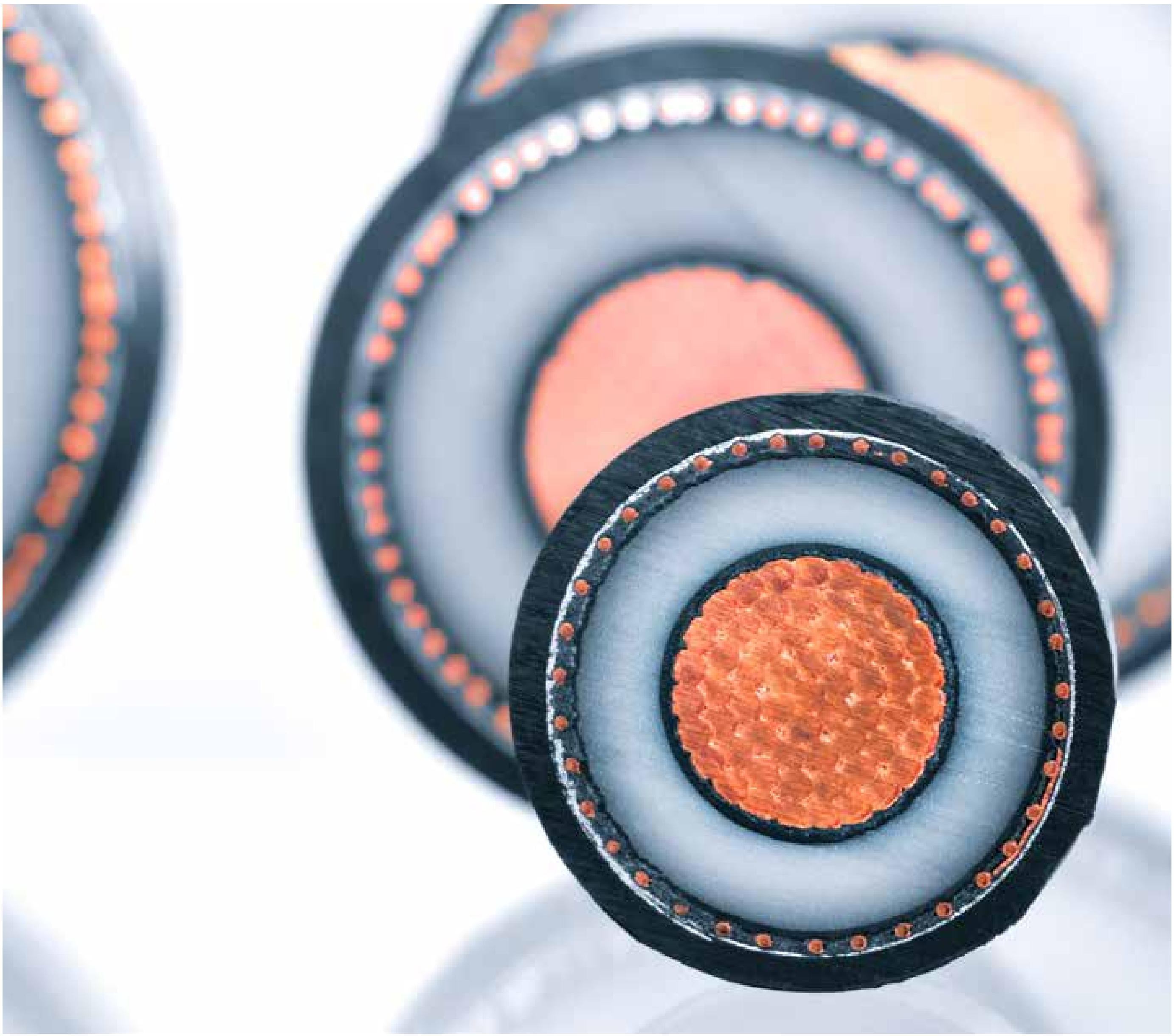
PRODUCT RANGE

WIRE & CABLE



... we make better polymers

LUCOBIT AG

the EBA Company

(Ethylene-Butyl-Acrylate)

ORIGINAL EBA (ETHYLENE BUTYL ACRYLATE)
PRODUCED ACC. TUBULAR REACTOR PROCESS BY BASF POLYMERIZATION TECHNOLOGY

For carbon neutrality energy-efficient cables are more and more important. They use the Tubular – EBA as the most suitable polymer for semiconductor in medium and high voltage cable industry. Replacing technologies that emit carbon with electric options are recognized as key methods for cutting emissions. This trend is encouraged by the expansion of renewable energy sources like solar and wind, which in turn boosts global electricity use.

For green energy technology there is a growing demand for high-voltage power cables, which are crucial for the transmission and distribution of energy. The production of semiconductive materials, by carbon black filler in ethylene butyl acrylate (EBA), plays a critical role in this context.

LUCOBIT synthezises polymers like EBA and increase their availability globally.

EXPLORING THE DYNAMICS OF POWER CABLES

Before explaining EBA and its functionality for cables energy, it is crucial to understand the basics of electricity delivery. Are you aware of the varying intensities of electricity? Voltage acts as the "force" propelling electricity's flow, with higher voltages facilitating a high flow. Electricity's intensity is tailored for various uses. For instance, high voltage (HV) is employed in the generation, transmission, and distribution of power, whereas low voltage (LV) is suited for powering smaller gadgets such as electronics and appliances. To ensure energy is transmitted safely and efficiently, different voltage levels need different types of cables.

THE KEY TO EFFICIENT POWER TRANSMISSION: HIGH-VOLTAGE LINES

The use of high-voltage transmission lines in power generation, transmission, and distribution is primarily driven by the need for efficiency. Transporting energy over long distances is associated with a high energy loss. High-voltage transmission systems are designed to reduce these losses significantly, ensuring that electricity is delivered most effectively from its source to the end user. This efficiency is particularly critical for renewable energy sources such as solar and wind power but also for nuclear power plants, often situated far from consumption centers. The shift towards renewable energy demands high-voltage cables and their essential components. But what role does EBA play in the design of these cables?

ABOUT EBA ACC. BASF TUBULAR PROCESS

Ethylene butyl acrylate (EBA) is used as polymer for the semiconductive material. EBA is synthezised by polymerizing ethylene and butyl acrylate molecules. This type of material compound filled up with conductive carbon black is called "semiconductor". It is characterized by the ability to conduct electricity better than insulators like glass but not as well as pure conductors such as copper. Semiconductors are widely recognized for their role in powering electronic devices, including computers, smartphones, and cars. However, their importance extends beyond electronics to the cables that supply power to these devices.

THE ADVANTAGES OF TUBULAR EBA VERSUS AUTOCLAVE EBA

The BASF tubular reactor systems for Ethylene Butyl Acrylate (EBA) production offer several key advantages, enhancing industrial efficiency and product quality. First, their continuous operation significantly boosts production capacity while minimizing downtime, making them ideal for large-scale manufacturing. This method ensures a consistent and uniform polymerization process, resulting in EBA of highest quality and consistency. Additionally, tubular reactors are more energy-efficient, as they allow precise temperature control, leading to lower energy consumption. Despite a potentially higher initial investment, the reduced operating costs and efficient raw material use contribute to long-term savings. Moreover, these systems offer flexibility to adjust production parameters for different EBA grades without extensive system modifications. Overall, tubular EBA production has outstanding advantages for efficiency, quality, and cost-effectiveness, making this process a preferred choice for large-scale polymer manufacturing.

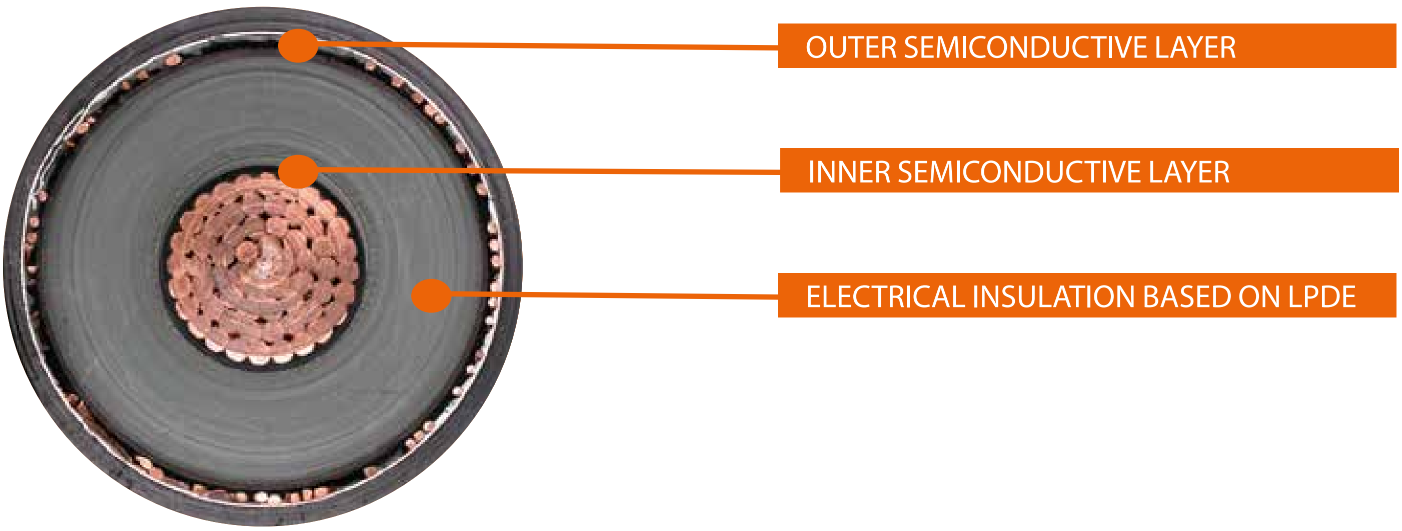
THE ROLE OF TUBULAR EBA FOR MEDIUM AND HIGH VOLTAGE

Power cables are composed by several layers:
- semiconductive layer and
- insulating layers
- outer jacket

The semiconductive layers manage the electric field around the conductor, preventing the cable from failing due to electrical stress. The semiconductive layer is crucial for ensuring a steady and even flow of power, reducing the likelihood of cable failures, and decreasing electrical losses.

Among possible semiconductive materials, EBA as most suitable polymer stands for
- its compatibility with different materials,
- its resilience to high temperatures,
- moisture, and physical damage.

EBA can be filled filled easily and homogeniously by carbon black, a electrical conductive black filler. With its reliable and adaptable qualities, EBA constitutes a significant portion of the semiconductor layer in medium andhigh-voltage power cables, making it a key player in the infrastructure supporting the green energy transition.



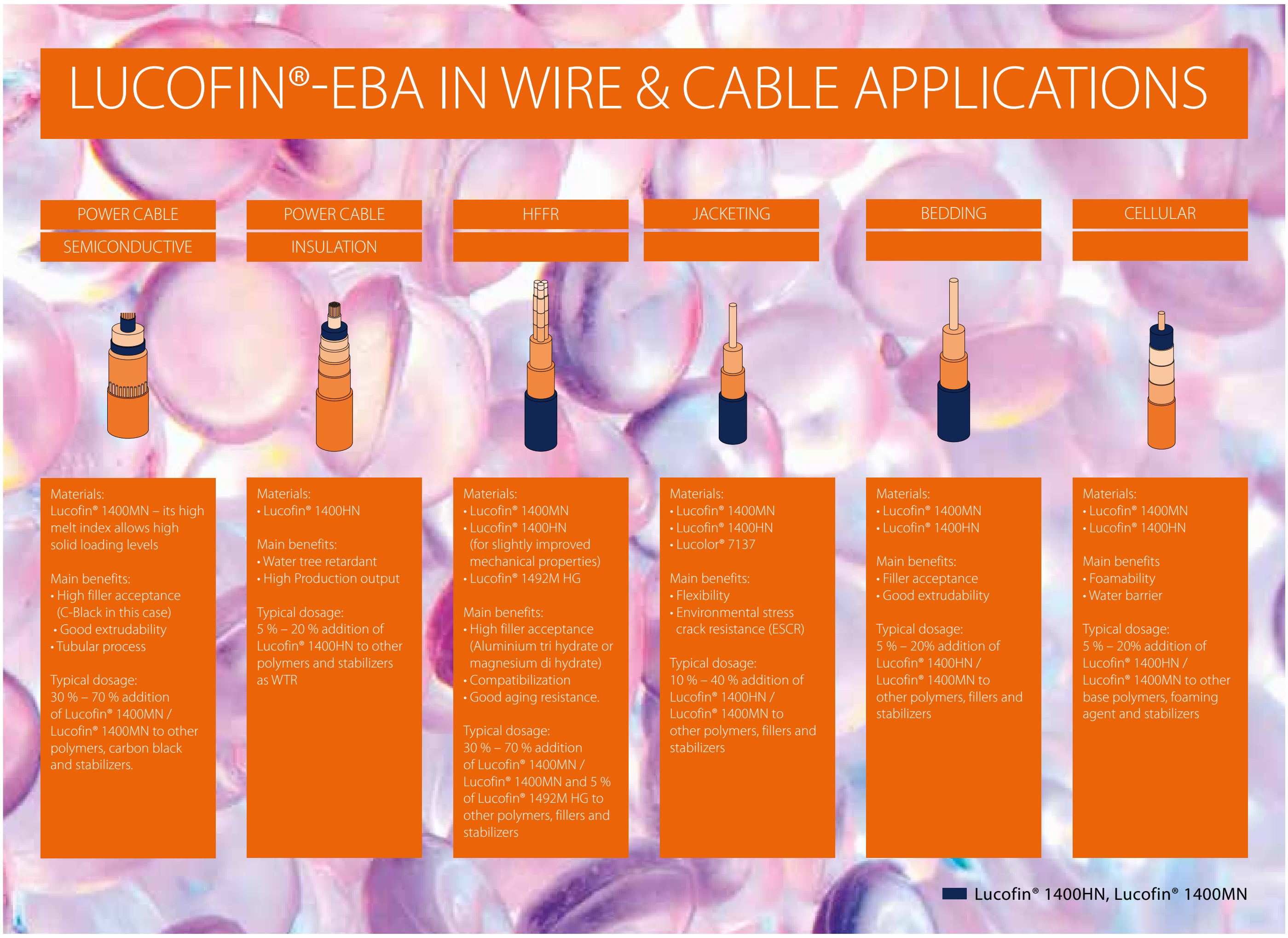
THE RISING DEMAND FOR SEMICONDUCTIVE MATERIALS IN GREEN ENERGY TRANSITIONS

The increasing need for effective high-voltage power cables has catapulted semiconductive materials, by Ethylene Butyl Acrylate (EBA) to the forefront of global demand. As the planet pivots towards more greener energy solutions, the role of high-voltage cables becomes increasingly critical. These cables are paramount in enhancing the efficiency, capacity, and reliability of energy transmission systems. The move towards renewable energy, more than ever, necessitates the availability of these crucial components to ensure that clean power reaches its intended destinations efficiently.

Strengthening the backbone of renewable energy infrastructure of a global net-zero emissions status by 2050 requires a significant ramp-up in clean energy investments—over $4 trillion by 2030. This monumental investment includes the development and expansion of essential infrastructures like high-voltage power cables.

HIGH-VOLTAGE CABLES USE EBA AS THE SEMICONDUCTING LAYER

Indeed, the global consumption of Ethylene Butyl Acrylate (EBA) exceeds 50,000 tons annually. This material is integral to a wide range of power cable applications, including the submarine cables that link offshore wind farms to onshore substations, as well as those used in the transmission and distribution networks of large-scale power plants.



PRODUCTION OF THE POLYMERS

LDPE (low-density polyethylene) for insulation
LDPE is polymerized by two processes (Fig. 1):
a) Tubular Reactor Process acc. BASF process
b) Autoclave Process (ICI)

The advantage of the Tubular vs. Autoclave process:

- Good optical properties
- good Drawability
- High cost-effectivnes
- Super clean material,
- No metal abrasion residue from polymer production

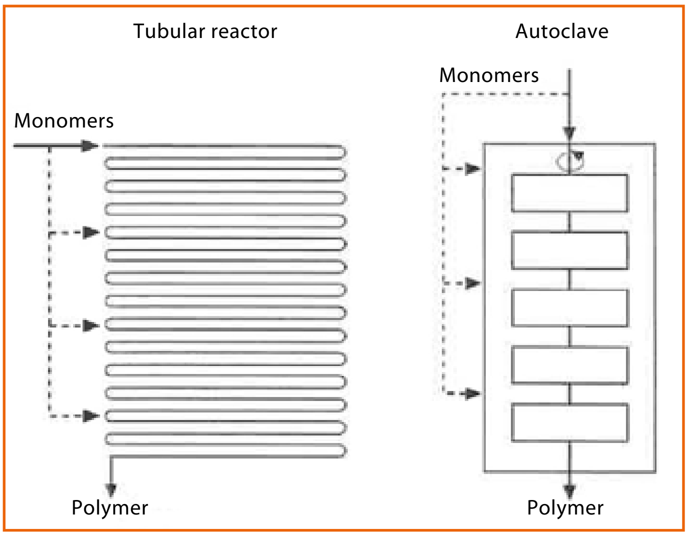


Fig1: Reactor types for free-radical polymerization of ethylene

In this free-radical polymerization, the ethylene molecules are linked together to give chains, which may have various degrees of branching. LDPE is produced by polymerizing ethylene at a high pressure of from 1000 to 3000 bar, and from 80 to 300 °C. The initiator used is oxygen or a peroxide (Fig. 2).

The conversion in the tubular reactor has a maximum of 35%.

- Internal diameter of tube 25-75 mm
- Outer diameter of tube with cooling jacket 600-700 mm
- Wall thickness 50-100 mm
- Tube length 10-15 m
- Total tube length 1000m
- Flow rate 20 m/s
- Good energy utilization

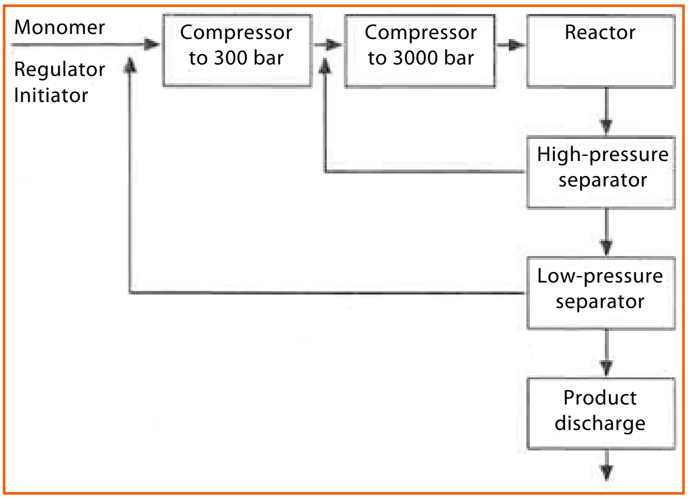


Fig2: Flow chart for high-pressure polymerization of ethylene

The conversion obtained in the autoclave reactor is about 20%. These are thick-walled vessels equipped with a stirrer for thorough mixing of the reaction mixture. Two types of autoclave are commonly found in industrial processes, and these differ in their length to diameter (L/D) ratios (Fig. 3).

The reaction temperature and product properties, such as density, melt flow rate and molar mass distribution, are adjusted by varying the pressure, the amount of initiator and the gas inlet temperature. Autoclaves are nowadays operated at pressures of from 1500 to 2500 bar.

The modern medium- high voltage cable construction is insulated by a very clean PE. The cable is composed of a central conductor, an inner semiconductor, an insulating material by PE, an outer semiconductor and an outer jacket. Semiconductive layers are used to eleminate electric field deformation and to provide a more uniform electric field with the insulting material PE.

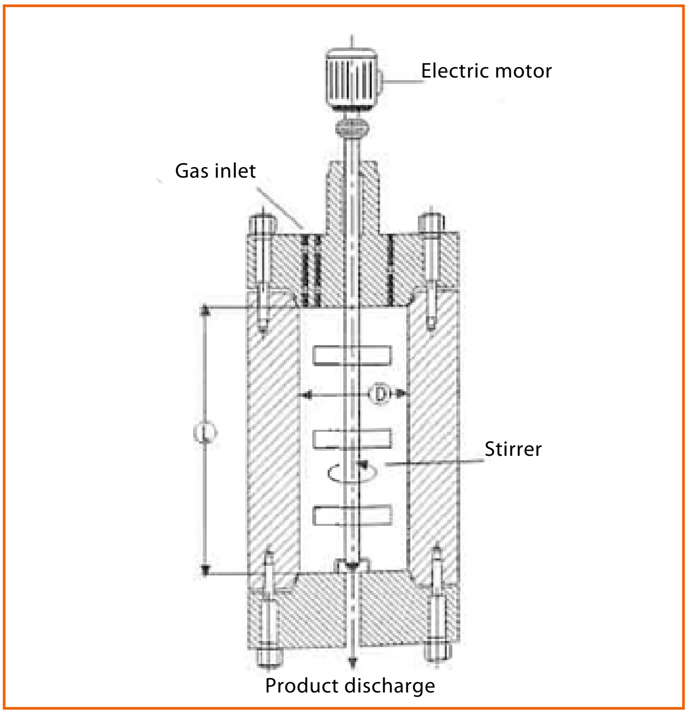


Fig3: Autoclave reator

ADVANTAGE OF USING LUCOFIN (EBA)-POLYMERS IN CABLE PRODUCTION

Ethylene-butyl-acrylate (EBA) and ethylene vinyl acetate (EVA) are both copolymers with distinct advantages depending on the application. Here are some advantages of ethylene butyl acrylate (EBA) over ethylene vinyl acetate (EVA):

1. **Improved Flexibility**
EBA typically offers higher flexibility compared to EVA, making it suitable for applications where flexibility and resilience are crucial, such as flexible packaging, coatings, and adhesives.

2. Enhanced Barrier Properties
EBA exhibits better barrier properties against moisture, gases, and chemicals compared to EVA. This makes it a preferred choice for packaging materials requiring high barrier performance, such as food packaging or medical packaging.

3. Temperature Resistance
EBA copolymers generally have better resistance to high and low temperatures compared to EVA. This property makes EBA suitable for applications where temperature extremes are encountered, such as automotive components, construction sealants, or outdoor sporting goods.

4. Adhesion
EBA offers excellent adhesion to a wide variety of substrates, including metals, plastics, and textiles. This adhesive property makes EBA desirable for applications such as coatings, laminates, and pressure-sensitive adhesives.

5. Chemical Resistance
EBA copolymers typically exhibit superior resistance to chemicals, oils, and solvents compared to EVA. This makes them suitable for applications requiring exposure to harsh chemicals, such as industrial coatings or chemical-resistant linings.

6. Processing Advantages
EBA can be easily processed using conventional thermoplastic processing techniques like extrusion, injection molding, and blow molding. Its processing versatility allows for efficient manufacturing of various products across different industries.
The melt pressue is reduced when Lucofin is introduced. Therefore the output is on a higher level because the tourque would not increase due to melt pressure

Overall, while both EBA and EVA have their advantages, EBA's superior flexibility, barrier properties, temperature resistance, adhesion, chemical resistance, and processing advantages make it a preferred choice for specific applications where these properties are critical.

LUCOBIT AG – THE EBA-COMPANY

As a renowned market leader in the field of EBA, we pride ourselves on developing innovative solutions that shape the world of tomorrow. Our many years of experience, our commitment to top quality and our passion for continuous development make us a reliable partner for customers worldwide.

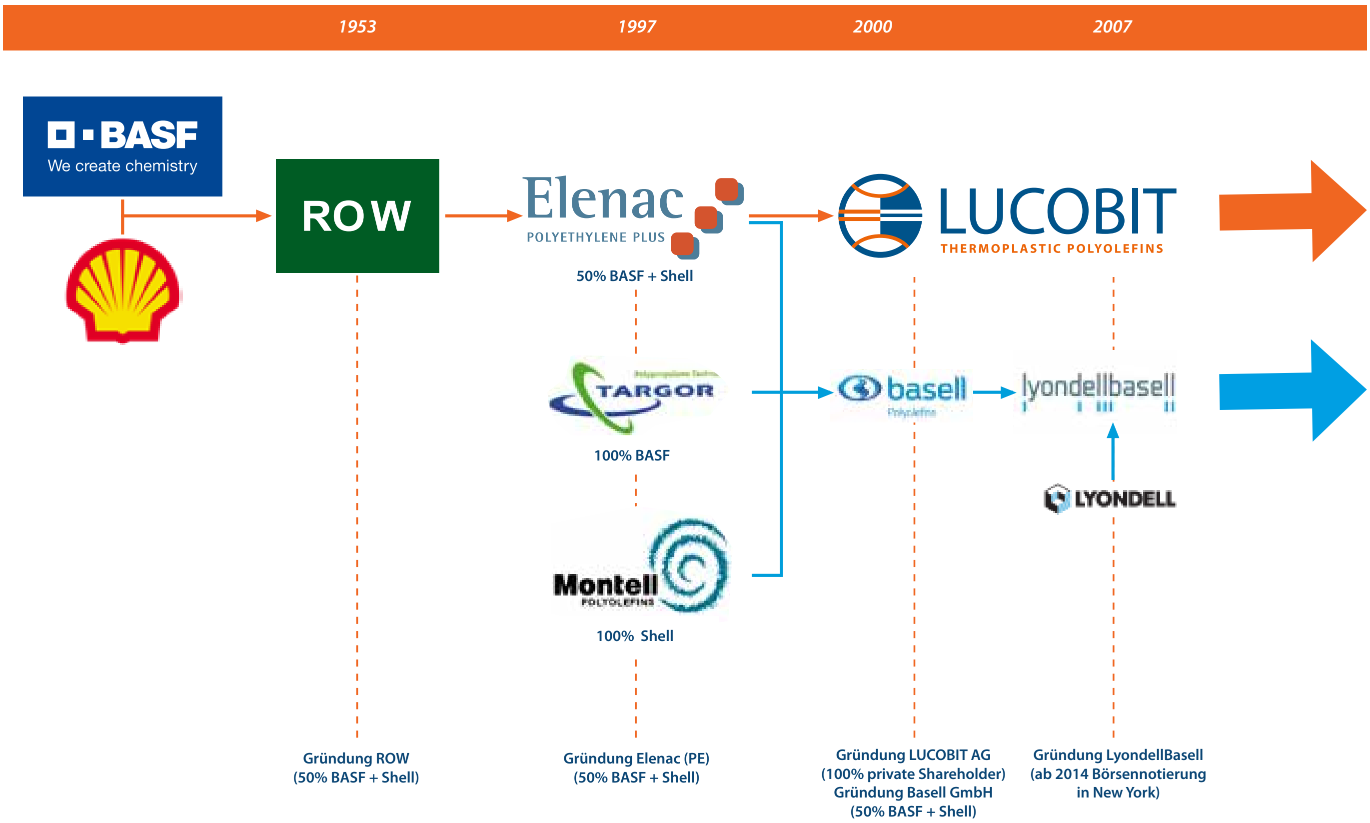
Our vision is to shape the future of materials. In doing so, we rely on three pillars that characterise our company:

Innovation: Our passion for continuous research and development drives us to constantly break new ground. We are pioneers in materials research and set trends in the industry.

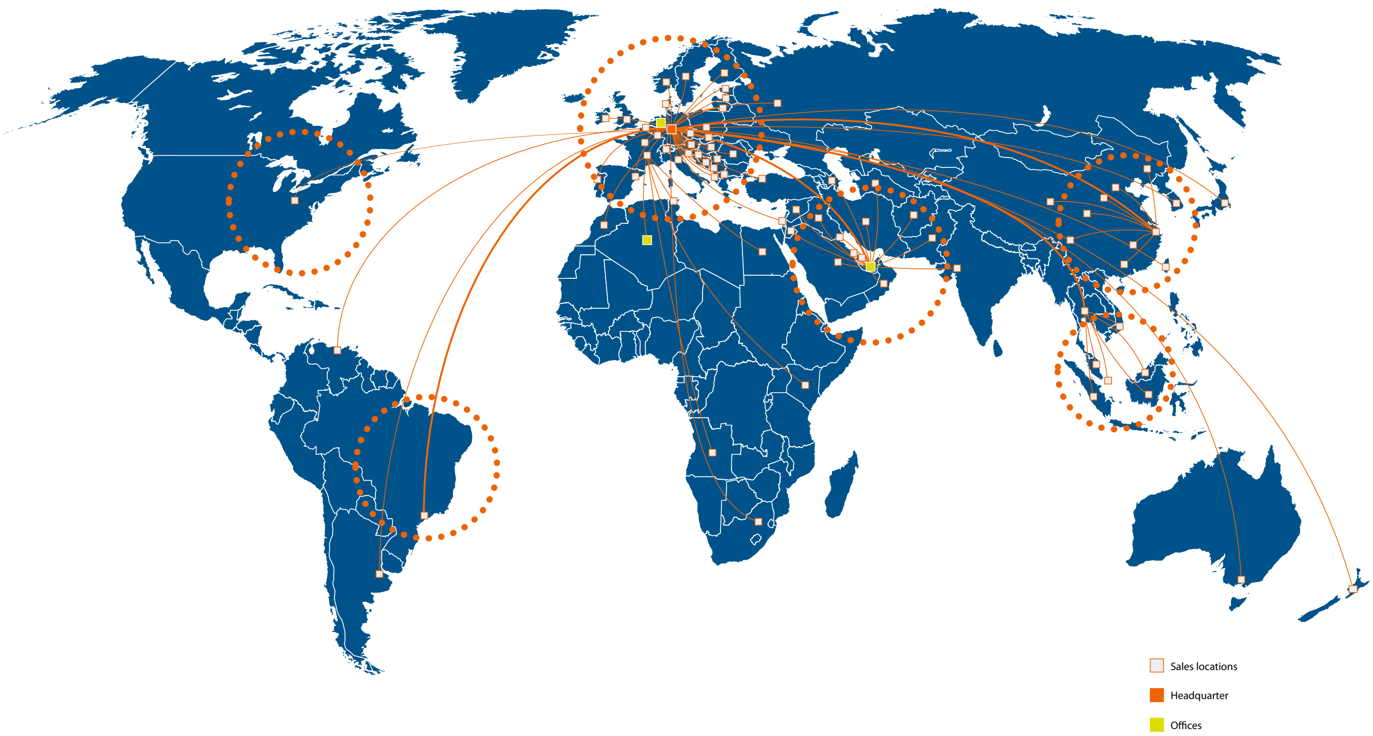
Quality: The quality of our products and services is our top priority. We adhere to the highest standards to ensure that our customers always receive the best solutions.

Sustainability: We firmly believe in our responsibility towards the environment and society. Our products are designed to be sustainable and environmentally friendly.

OUR HISTORY



LOCATIONS



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