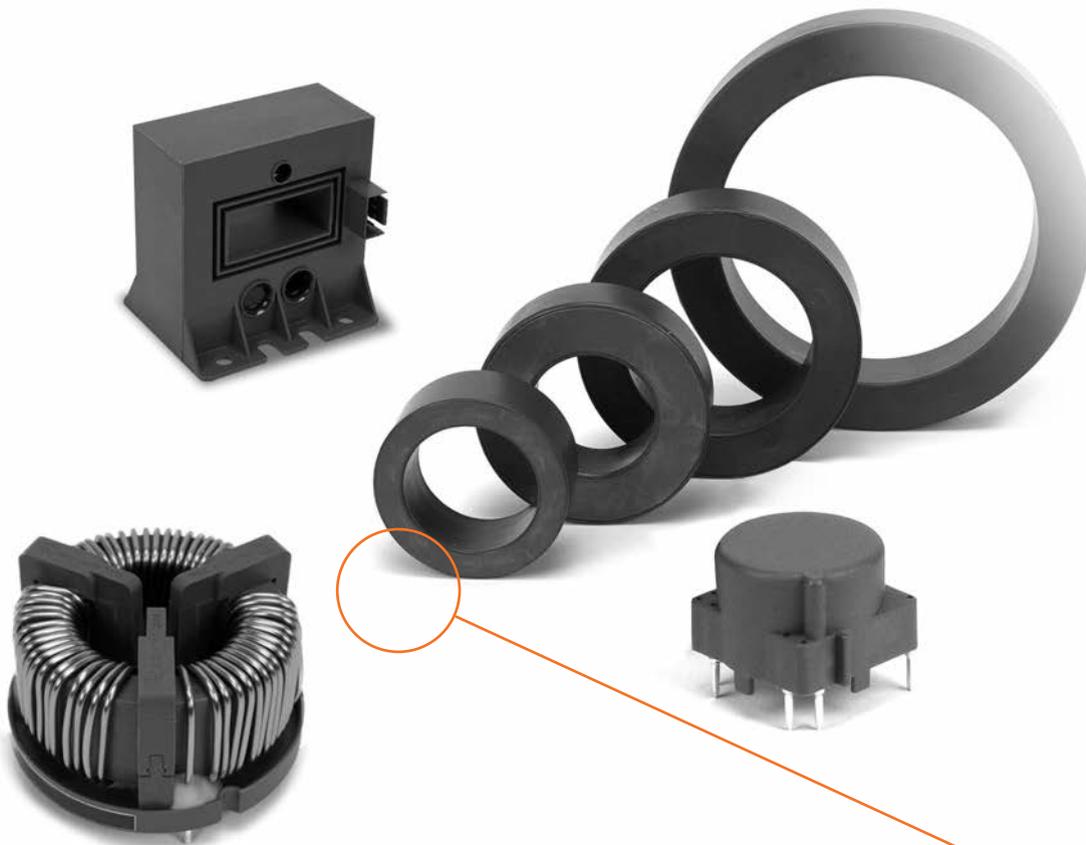


CORES AND COMPONENTS

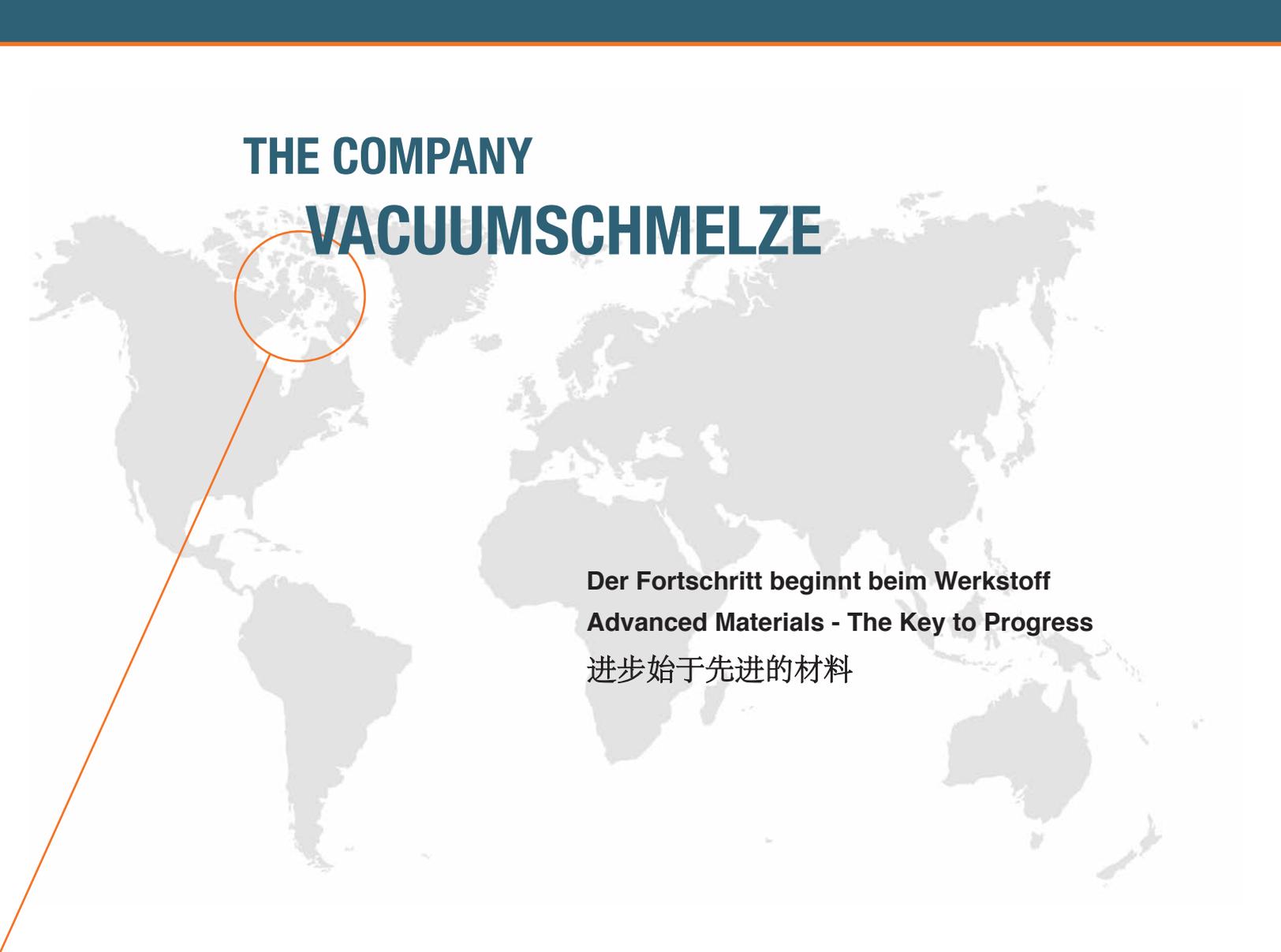


ADVANCED MATERIALS – THE KEY TO PROGRESS

VAC
VACUUMSCHMELZE

THE COMPANY

VACUUMSCHMELZE



Der Fortschritt beginnt beim Werkstoff
Advanced Materials - The Key to Progress
进步始于先进的材料

VACUUMSCHMELZE GmbH & CO. KG is one of world's leading producers of special metallic materials and related products with exceptional magnetic and physical properties. Our wide range of high quality semi-finished products, parts, components and systems are used in virtually every field of electrical and electronic engineering. This makes us one of the few global companies to offer our customers the complete range of magnetic technology products from a single source – from magnetically soft products to the most powerful permanent magnets in the world.

In all our activities, we benefit from our highly developed material expertise and our decades of experience in magnetic technology. As early as 1923, we became the first company to introduce alloy smelting in a vacuum on an industrial scale and it was from this process that the name VACUUMSCHMELZE was derived.

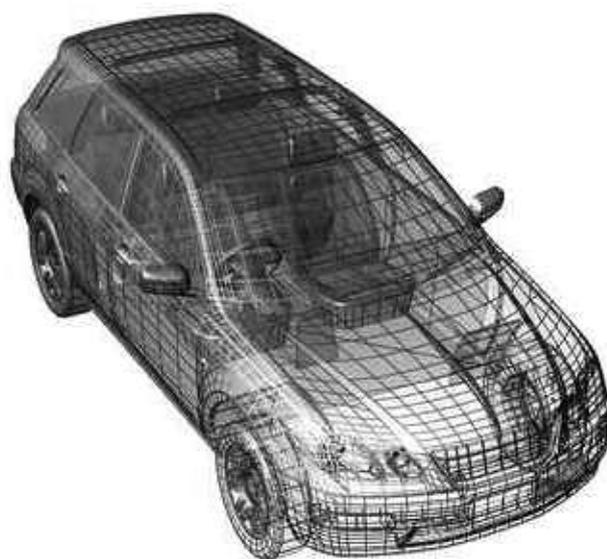
We are a global company with our headquarters in Hanau, Germany. We currently have over 4500 employees who are spread over production and sales locations in more than 40 countries on every continent, generating annual sales of approximately EUR 350 million.

One of our great strengths is our versatility. All of the world's key industries rely on products and expertise from VACUUMSCHMELZE, with our principal customers active in drive and installation technology, medical technology, renewable energy, automation systems, process and control engineering, measurement technology, as well as the very important automotive and aerospace industries. VAC's custom solutions are developed in close cooperation with customers and reflect a high level of material and application expertise combined with the latest production technology.

AUTOMOTIVE APPLICATIONS

The trend towards increasingly efficient electronic control devices in vehicles continues unabated. Regulations such as those established by the ACEA (European Automobile Manufacturer Association) with regard to reducing CO₂ emissions have led to the development of environmentally-friendly vehicles with new drive technologies and complex electronic systems. This leads to an even greater demand for power inductors and EMC components that satisfy the requirements of the automotive industry.

Over the years, VACUUMSCHMELZE has established itself as a competent and reliable tier 2 supplier, selling millions of inductive components to the automotive industry. VAC products can be found in the majority of vehicles currently produced. We achieve this by developing bespoke solutions for a wide range of applications using a comprehensive set of tried and tested components and techniques — all according to the individual requirements of our customers. By using standard materials as well as our own innovative alloys, VAC has gained a strong reputation as an important development partner for advanced magnetic materials and associated components. Our expertise is widely recognised and highly valued by many well-known automotive OEMs. In our laboratory, we rigorously test products and designs to ensure they are suitable for use in vehicles and undertake full validation studies on behalf of our customers. Our Quality Management system is certified in accordance with TS 16949 and follows the product life cycle from development right through to application.



Products and current developments

- **Chokes for voltage stabilisation, e.g. for gasoline and diesel direct injection systems**
- **Compact and loss-optimised transformers and storage chokes for inverters and rectifiers in hybrid and electric vehicles**
- **Mechanically robust and compact EMC chokes with superb attenuation characteristics, e.g. for electric power assisted steering**
- **Highly permeable temperature resistant VITROPERM® cores for EMC applications, even within the engine bay**
- **Precise and temperature-stable current sensors based on our magnetic probe principle, e.g. for battery energy management**
- **Flexible, low weight, high performance antennae for keyless LF entry systems**

® = registered trademark of VACUUMSCHMELZE GmbH & Co.KG.

INDUSTRIAL APPLICATIONS

The field of industrial applications is characterised by the use of state-of-the-art power electronics with great emphasis on energy, volume and cost efficiency, together with high quality to provide long life and maintenance-free operation. The fields of application are just as diverse as our technical solutions.

Our products can be found in electric drives of every power class and in a wide range of power supply units from high accuracy, ultra stable systems to high volume computer PSU's. Renewable energy is an extremely important growth area. We are continually developing and supplying innovative products for use in wind generators and, in particular, solar inverters with emphasis on our key benefits of increased energy efficiency and reduced volume. Our inductive components are also widely used in other industries such as railway technology, automation technology or household equipment (e.g. induction hobs).

In every case, our aim is offer a low-cost, highly functional product in a volume optimised package with maximum reliability. This is made possible through interdisciplinary collaboration between experienced engineers and by use of our own innovative materials. This unique combination of application and materials knowledge enables VAC to develop optimal solutions for some of the toughest design challenges.

In choosing VAC, our customers gain the benefits of our state-of-the-art materials, worldwide production locations, experience in global markets and our work with international standardisation bodies. We work closely with our customers to integrate our standard components or develop optimised innovative products that meet specific customer needs. Our certified production locations in Germany, China, Malaysia and Slovakia, as well as our global purchasing, ensure cost effectiveness and a high quality standard.



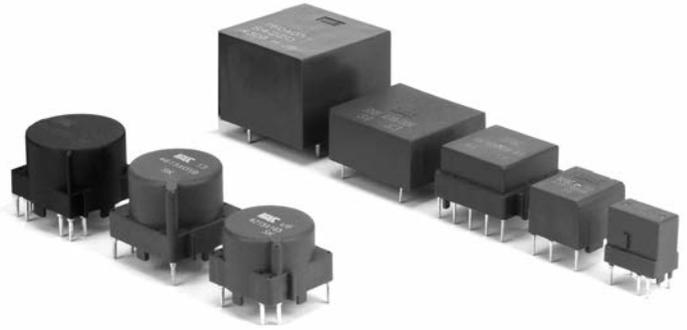
Our strength lies in our comprehensive range of standard series products, customised for diverse application profiles and individual solutions. A wide range of skills and capabilities are available from VAC, including:

- **Understanding of our customers' applications and requirements**
- **Individual dimensioning and construction**
- **Application of international standards and regulations**
- **Selection and application of optimal core materials**
- **In-house core production facility**
- **Our own crystalline, amorphous and nanocrystalline materials**
- **Continuous product maintenance and further development**
- **Logistics systems for just-in-time and ship-to-line deliveries**
- **Quality standard in accordance with DIN ISO 9001/ISO/TS 16949**

PRODUCTS

Transformers

- Compact gate drive transformers for semiconductor switches with low leakage inductance for optimal pulse transmission
- Low-loss power transformers for switched-mode power supplies and frequency converters



Cores and chokes

- Highly permeable nanocrystalline toroidal tape wound cores
- Prefabricated core modules for EMC applications
- Compact, low-loss, current-compensated radio interference suppression chokes
- Cost-effective saturable chokes (magnetic amplifiers) for precise voltage regulation

Current sensors and transformers

- High-precision current sensors for detecting AC and DC currents
- AC/DC-sensitive differential current sensors
- Current transformers for monitoring energy distribution networks

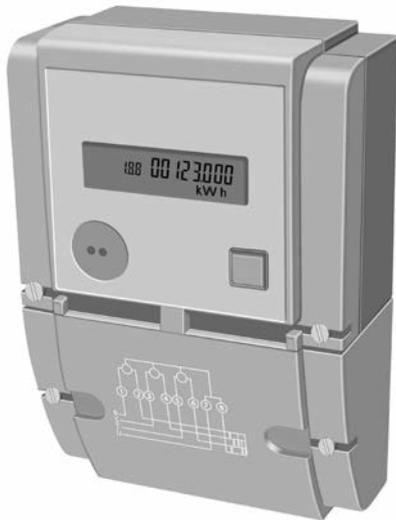


Toroidal tape wound and cut cores

- Low-loss nanocrystalline toroidal tape wound cores and cut cores for transformers and chokes

INSTALLATION TECHNOLOGY

Current transformers for electronic electricity meters



Electronic electricity meters are being increasingly employed worldwide. In some countries, the changeover is prescribed by law, while in others it is voluntary. We serve well-known customers in both the IEC and ANSI markets who manufacture electricity meters with VAC current transformers with great success.

Innovative and cost-effective solutions based on nanocrystalline materials from the VITROPERM alloy family have been proven to provide a robust and accurate solution in a wide range of meter designs.

Our current transformers boast many technical advantages, such as a high level of linearity, low temperature dependence and a compact design. Our current transformer product range sets new standards worldwide for precision current measurement.

In addition to our standard single current transformers for operation up to 400 A, we also offer enhanced solutions, such as triple modules for simplified assembly in polyphase meters, versions with built-in shielding for protection against external magnetic fields and designs with integrated primary current connectors and customer-specific connectors.

We offer product ranges for each of the following current transformers:

- **With or without DC tolerance according to IEC standards (based on VITROPERM)**
- **With shielding against external magnetic fields**
- **For direct or indirect connection**
- **For ANSI markets**

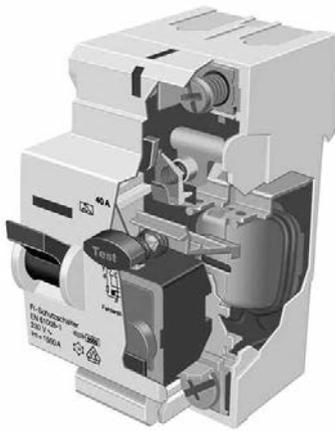


Cores and transformers for earth leakage circuit breakers

For several decades, we have been providing products using our high-quality materials to provide reliable function in voltage-independent residual current devices. This began with the development of high-quality NiFe materials such as VACOPERM® and PERMAX®. More recently it was possible to considerably reduce the size of the cores by using newly developed materials. At this time, ULTRAPERM® was the dominant force in the market.

Currently, the introduction of nanocrystalline materials such as VITROPERM has led to the development of innovative solutions that move far beyond the limits and possibilities of crystalline materials. VITROPERM offers optimal solutions for almost every common switch type (AC/A/B/B+).

Our unique combination of advanced materials and application expertise help to ensure that VAC remains a key innovation and development partner to our customers. The use of comprehensive simulation and dimensioning programmes allows us to optimise the accuracy of new designs, thus reducing the need for an empirical approach to development.



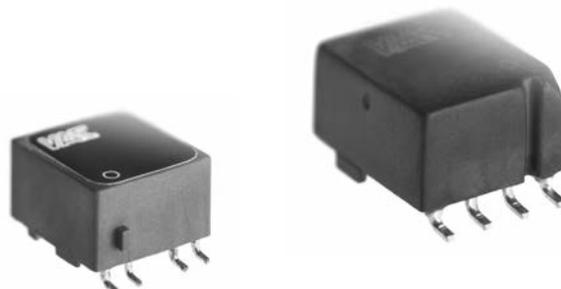
PLC transformers for smart metering

Several systems can be used for the data communication within the new smart meter products. Aside from wireless connections such as GSM, PLC (powerline communications) systems are becoming increasingly popular. In many systems, the combined data from several meters is sent via PLC to a concentrator for onward transmission to the data management centre using GSM technology.

Our market leading PLC transformers feature a low distortion factor, a high excitation level and low design volume.

For the most common modulation methods DCSK, FSK and OFDM, VAC offers optimised solutions in its product range for all major PLC chipsets from well-known manufacturers.

VAC Powerline transformers are commonly used in the meters, concentrators and in the controller units to which electricity, gas and water meters can be connected. Our PLC products help to ensure the communications technology is galvanically isolated from the power network whilst faithfully transmitting the required signal.





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