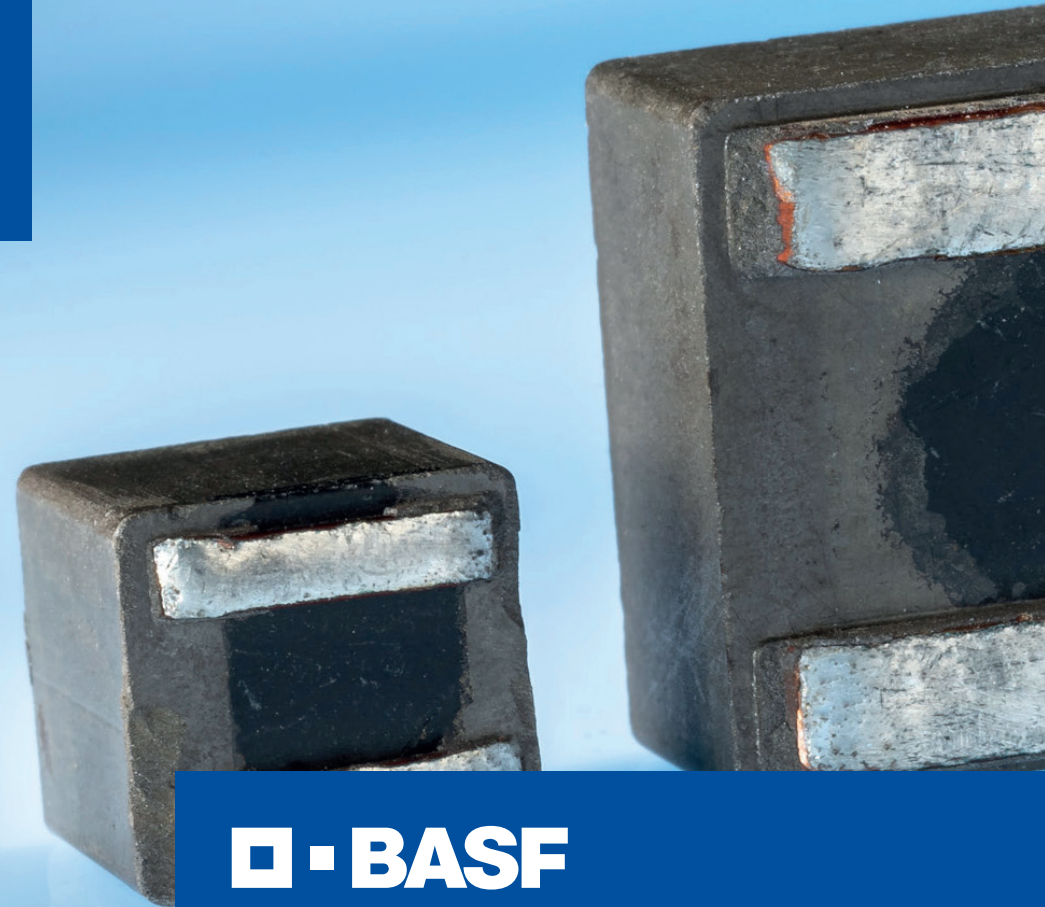


CARBONYL IRON POWDER

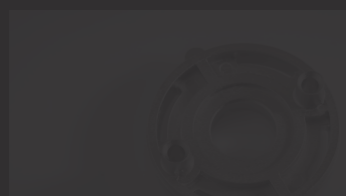
for Inductive Electronic
Components



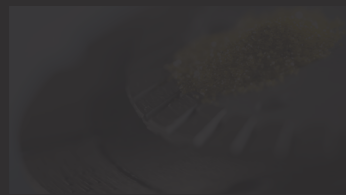
BASF
We create chemistry



Inductive Electronic Components



Metal Injection Molding and Powder Metallurgy

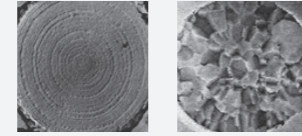


Diamond Tools



Microwave and Radar Absorption

INDUCTIVE ELECTRONIC COMPONENTS

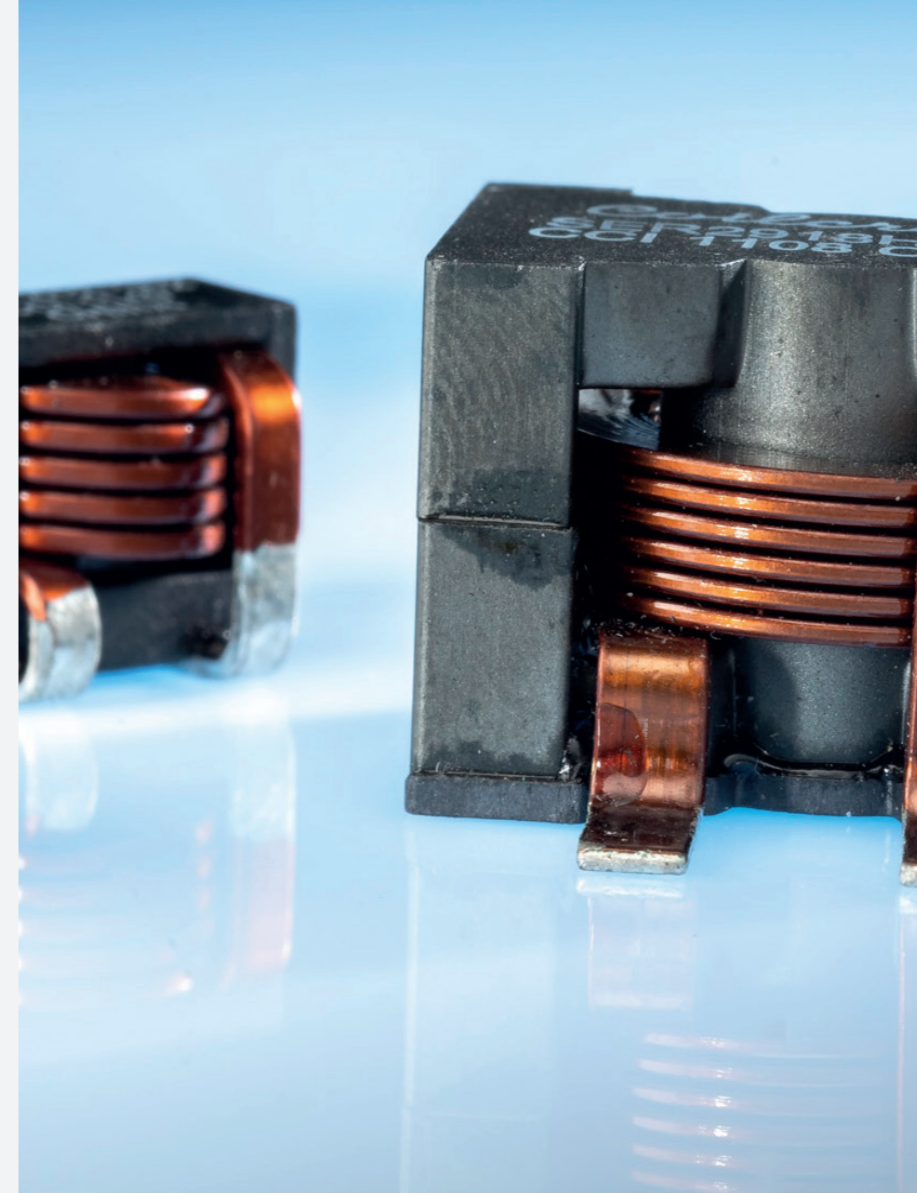


CARBONYL IRON POWDER FOR INDUCTIVE ELECTRONIC COMPONENTS

BASF produces carbonyl iron powders (CIP) since almost one century. The unique microstructures and unparalleled purity give our powders its outstanding magnetization behavior for electronic applications. BASF's CIP grades are frequently used as inductor core material in DC / DC converters for power supply and in filter chokes for noise suppression. We continuously work on innovative solutions in order to give the best possible support to our customers.

ADVANTAGES OF CIP BY BASF

- Suited for high current operations due to high saturation magnetization well above 1 Tesla
- Soft saturation allows excellent performance control at high currents
- Applicable at high frequency operations due to stable permeability and low core losses
- Good processability during SMD core production due to spherical shape
- Broad range of different particle sizes



Our CIP grades for high-quality Inductive Electronic Components

Thanks to their outstanding fineness and homogeneity, our well-known high-quality CIP grades contribute to superior inductor performance. Our continuously expanded product portfolio in insulated grades meet state-of-art market demands and set new trends due to their specifically designed properties.



BASF'S SOFT GRADES

BASF's mechanically soft grades can be pressed to high densities using low amounts of binder. Thus, high permeability levels are reached at considerable Q-factors for frequency ranges up to 5 MHz.

Our standard and well-established product, **CIP SQ**, offers an excellent combination of high and stable permeability over a broad range of frequencies and currents combined with low core losses.

Our deep understanding of coating chemistry enabled us to enrich the exceptional quality of **CIP SQ** with further properties to meet most recent market trends.

Our soft CIP grades

Typical Properties[†]

Grade	Fe (%)	D10 (mic.)	D50 (mic.)	D90 (mic.)	Permeability (2.8 wt% Epoxy)	Resistivity (Ohm)	Special properties
CIP SQ	min. 99.5		3.9 – 5.0		25 – 27		
CIP SQ-I	min. 98.5	1.9 – 2.9	3.8 – 5.4	6.0 – 11.0	22 – 24	min. 1·10 ⁷	Insulated
CIP SQ-R	min. 98.5	1.9 – 2.9	3.8 – 5.4	6.0 – 11.0	20 – 21	min. 1·10 ⁷	Insulated, corrosion resistant
CIP SQ-W	min. 98.0		4.0 – 5.5		18 – 23	min. 1·10 ⁷	Insulated, mid-temperature stable
CIP SQ-HT	min. 98.0	1.9 – 3.2	4.3 – 5.5	7.7 – 9.4	15 – 18	min. 1·10 ¹⁰	Insulated, high-temperature stable
CIP SW-S	min. 98.0		3.0 – 4.5		17 – 20	min. 1·10 ⁹	Insulated, low-core loss
CIP SF	min. 99.5		max. 2.5		min. 20		Fine CIP; Good electromagnetic performance

[†]magnetic properties depend on type of core, values not subject to specification

- **CIP SQ-I**, our standard insulated grade with even lower core losses vs. **CIP SQ**, is our “working horse” for customers that prefer to use pre-insulated powders.
- **CIP SQ-R** is the ideal choice if exceptional corrosion resistant properties are needed, enabling our customers to skip their own anti-corrosion coating step.
- **CIP SQ-W** and **CIP SQ-HT** are our newest accomplishments and offer an optimized temperature stability to fulfill the most recent market demand, especially in the automotive electronics industry

The combination of precise particle size control and coating technology enabled us to offer **CIP SW-S** to the market, one of our soft grades with lowest core loss properties, exceptional high resistance values and mid-temperature stability.

BASF'S HARD GRADES

Mechanically hard grades reach lower density levels. Their onion-shell structure strongly increases the resistance against eddy current losses. Thus, the combination of low permeability and the extremely low core loss make hard grades suitable for high frequency applications well above 10 MHz.

CIP EW is one of our standard grades with resistance values above 10¹⁰ Ohm.

Our **CIP HQ** grade is the material with the smallest particle size distribution in the market, resulting in lowest core losses at very high frequencies.

The small particle size distribution enables our customers to reach high packing densities.

Our outstanding coating capabilities have also been applied to our **CIP EW** and **CIP HQ** grades giving access to their insulated counterparts, **CIP EW-I** and **CIP HQ-I**. These grades combine an even lower core loss with high resistance values.

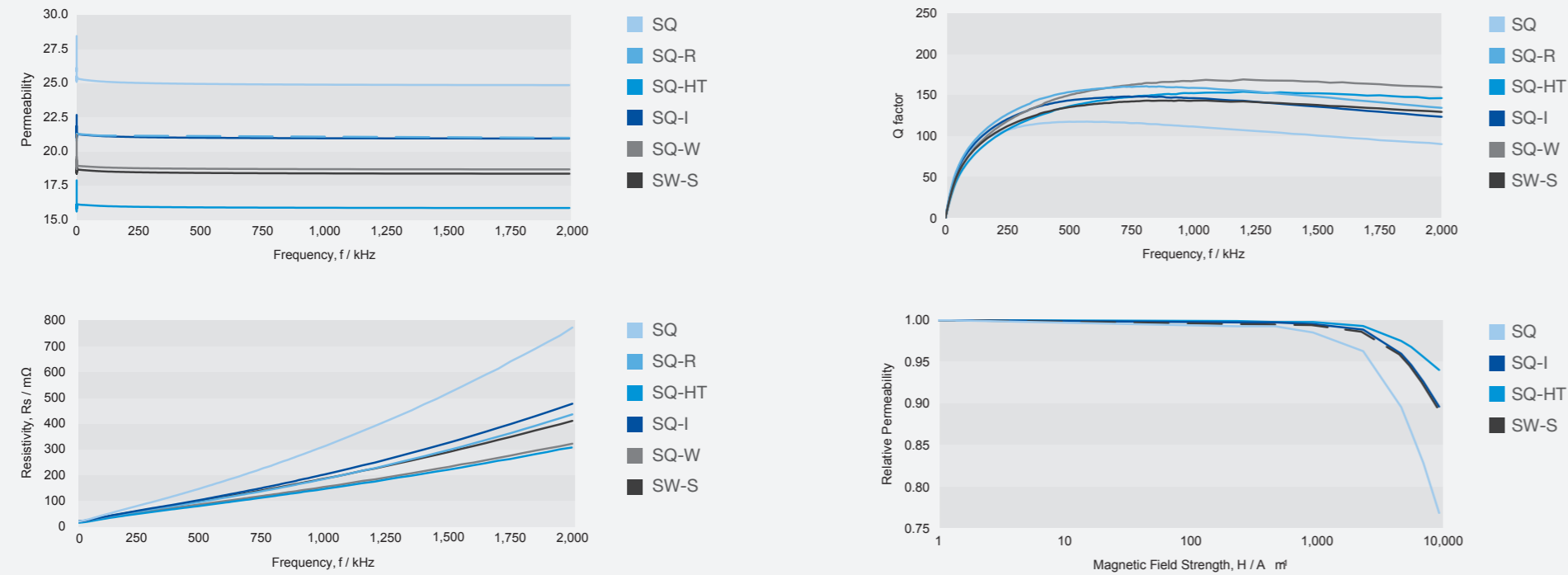
Our hard CIP grades

Typical Properties[†]

Grade	Fe (%)	D10 (mic.)	D50 (mic.)	D90 (mic.)	Permeability (2.8 wt% Epoxy)	Resistivity (Ohm)	Special properties
CIP EW	min. 97.0		3.0 – 4.0		10 – 12		Optimized Q factor at low frequencies
CIP EW-I	min. 97.0	1.5 – 2.1	3.0 – 4.0	5.0 – 7.0	9 – 11	min. 1·10 ¹⁰	Insulated
CIP HQ	min. 97.8	max. 1.0	max. 2.0	max. 3.0	9 – 11		Optimized Q factor at low & high frequencies
CIP HQ-I	min. 96.0	max. 1.2	1.2 – 2.3	2.5 – 5.3	8 – 10	min. 1·10 ⁷	Insulated
CIP HF	min. 97.7	max. 1.2	max. 2.5	max. 3.5	10 – 12		Optimized Q factor at low & high frequencies
CIP HS	min. 97.5		1.8 – 2.3		10 – 12		Optimized Q factor at low & high frequencies
CIP HQ UF	min. 97.8	max. 1.0	max. 1.6	max. 3.0	9-11		Optimized Q factor at low frequencies
CIP HQ-I premium	min.96.0	max. 1.2	1.40-1.70	2.50-5.30	9-15	min. 1·10 ⁷	Insulated

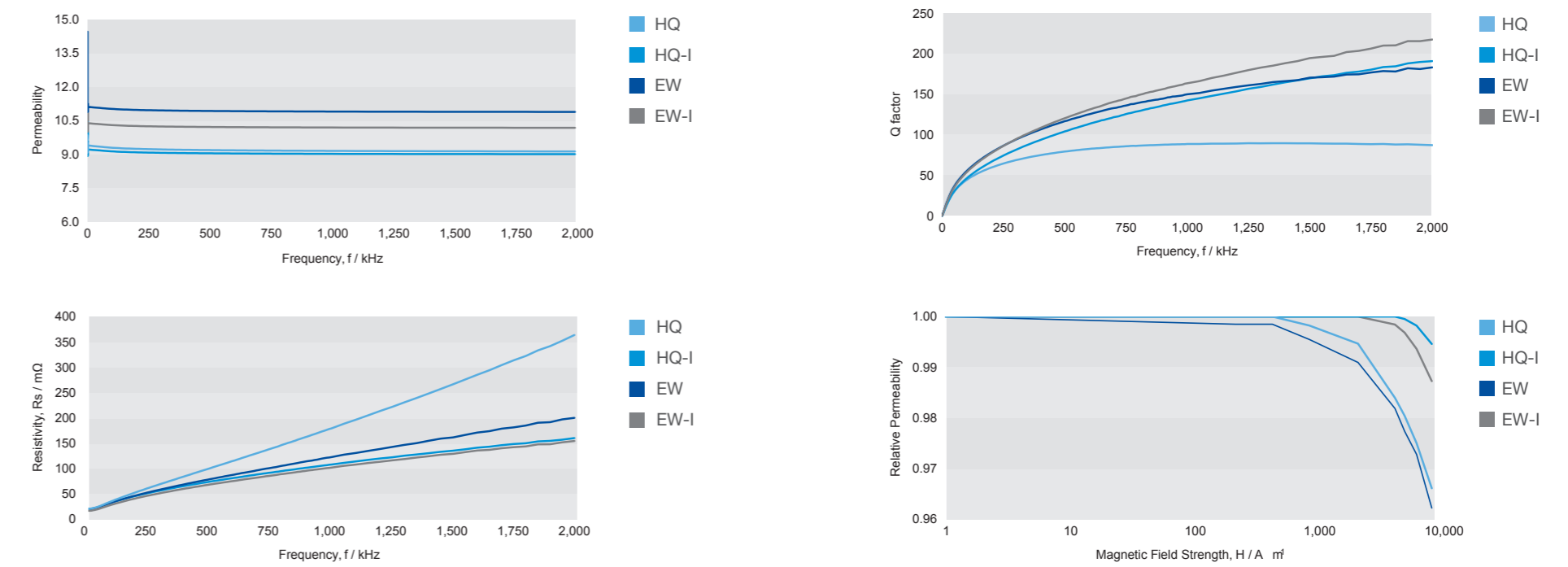
[†]magnetic properties depend on type of core, values not subject to specification

Electromagnetic Performance of BASF's Soft Grades[‡]

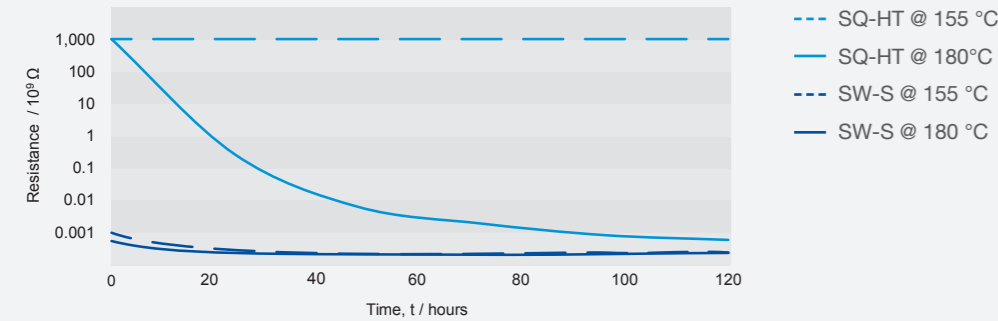


[‡] Ring core dimensions: outer diameter 20.5 mm, inner diameter 12.4 mm. For a better comparability the CIP grades have been prepared using identical conditions. These conditions do not necessarily reflect the preparation technique used for quality control and specification. The ring cores have been prepared with 2.8 wt% Epikote and pressed with 440 MPa. The hardening process have been conducted at 70 °C and 160 °C for 2 hours, respectively. For all measurements the ring cores were covered with 20 copper wire windings (d = 0.85 mm).

Electromagnetic Performance of BASF's Hard Grades^{**}



Temperature stability of selected BASF's coated CIP grades



Corrosion resistance of selected BASF's coated CIP grades*

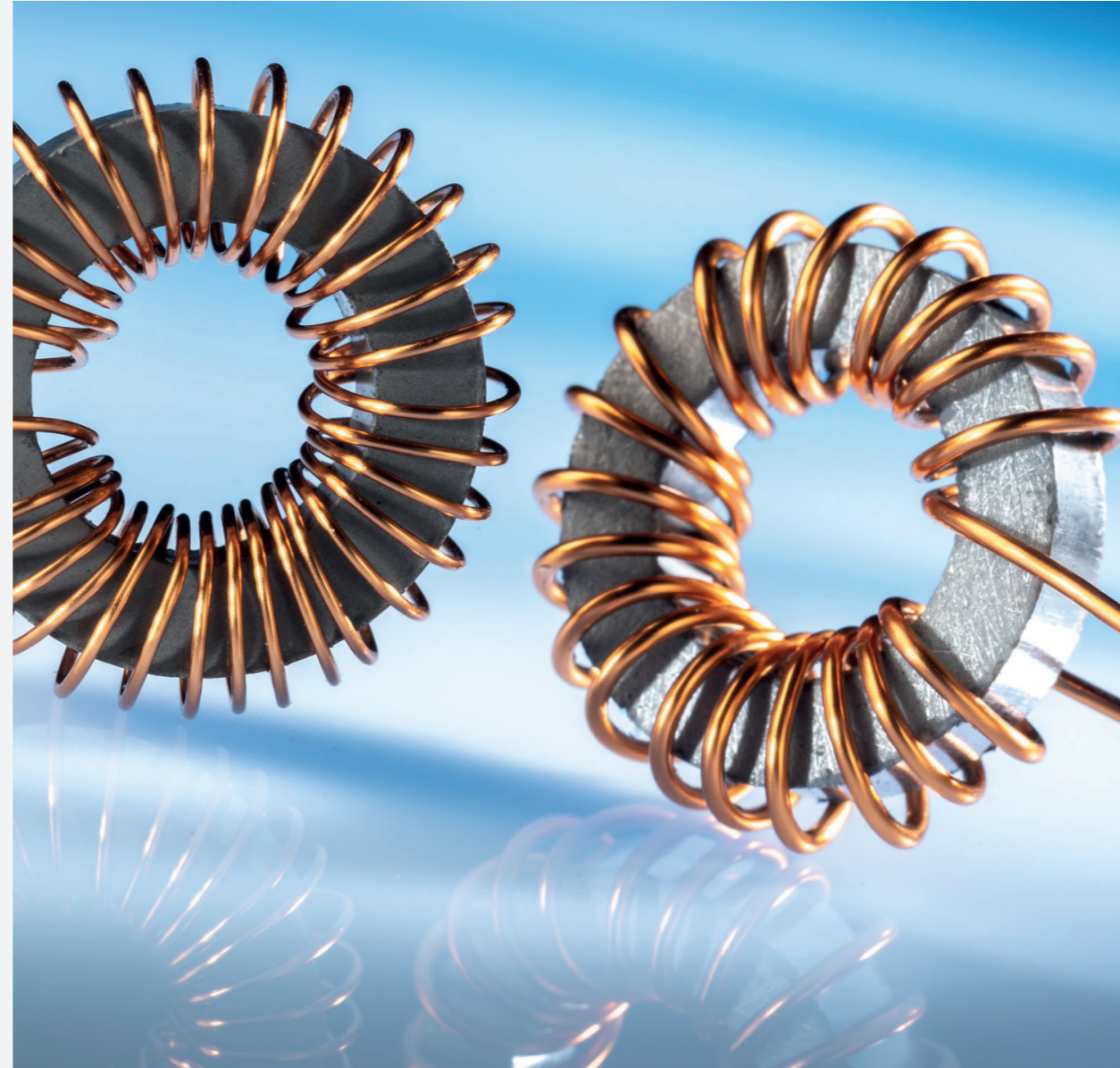


Our **CIP SQ-R** shows excellent corrosion stability even under harsh corrosive conditions*. No signs of corrosion.

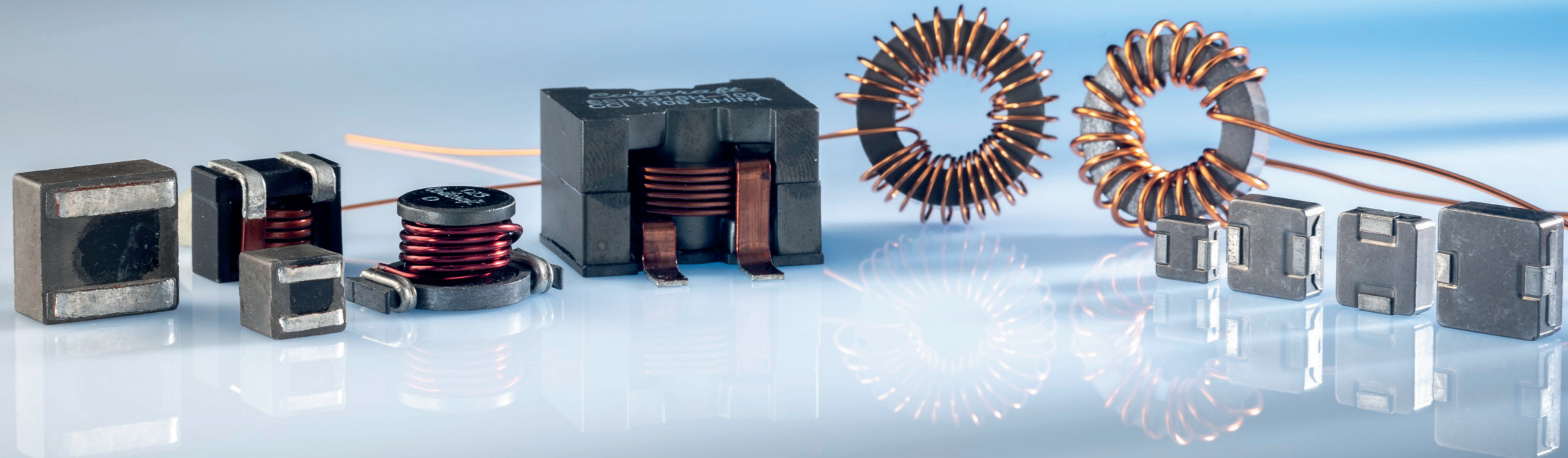


In comparison to our corrosion resistant **CIP SQ-R** a standard CIP is corroding significantly. The bottom part, exposed to identical, harsh corrosive conditions* as our **CIP SQ-R**, shows certain degree of corrosion.

* 50% of the ring core (2.8 wt% Epoxy) is exposed to a 5% NaCl solution at 40 °C for 5 hours.



At BASF, we create chemistry for a sustainable future. We combine economic success with environmental protection and social responsibility. More than 110,000 employees in the BASF Group work on contributing to the success of our customers in nearly all sectors and almost every country in the world.



Please contact us to discuss the requirements of your CIP application.

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