



## PRECISION ALLOYS // POWDER METALLURGY



The precision alloys of Isabellenhütte are among the highest quality on the market and unfurl their extraordinary forces in many areas of electronics and electrical engineering. The alloys produced according to customer requirements are produced in the classic melting metallurgical process and then formed into wire, strip or film semi-finished products. This classical production route allows a wide range of products, but also has its limits in the flexibility of the shaping.

Completely new possibilities for further product innovations result from the production and further processing of metal powders. The alloy is first processed into fine powder particles. The subsequent processing techniques such as metal injection molding, for example, allow the integration of further degrees of freedom into the design of the shape. Through a sintering process, the powder particles are brought into contact at high temperature on their contact surfaces by diffusion of the metal atoms, which results in solid, fine-grained semi-finished or finished parts.

Metallic powders of our Cu- or Ni-based alloys such as MANGANIN®, ISOTAN®, NOVENTIN® or ZERANIN® 30 form the base material, which is used for the production of new types of resistors.

### THICK FILM TECHNOLOGY

Thick film technology can be used to build resistors with layer thicknesses in the range of a few micrometers. Alumina ceramics are usually used as the supporting or substrate material. Metal pastes (resistance pastes) in the form of conductor structures and various contact and insulation layers are applied to the carrier material using a screen printing process.

The printed substrate is then fired in air or an inert atmosphere, whereby the metal powder particles of the resistance paste sinter into functional layers. These resistors can be further processed by various post-treatment steps, e.g. laser trimming can be used to adjust the resistance value.

The thick-film technology in combination with alloys we produce has already been demonstrated on the first prototypes, such as a braking resistor. Compared to conventional film technology, ceramic-based thick film resistors have the following advantages:

- Flexible design and resistance value
- Improved temperature resistance
- High dielectric strength and low internal thermal resistance
- High pulse load

In addition to the development of thick-film power resistors, the next step is to work increasingly on the further development of pastes for precision resistors.

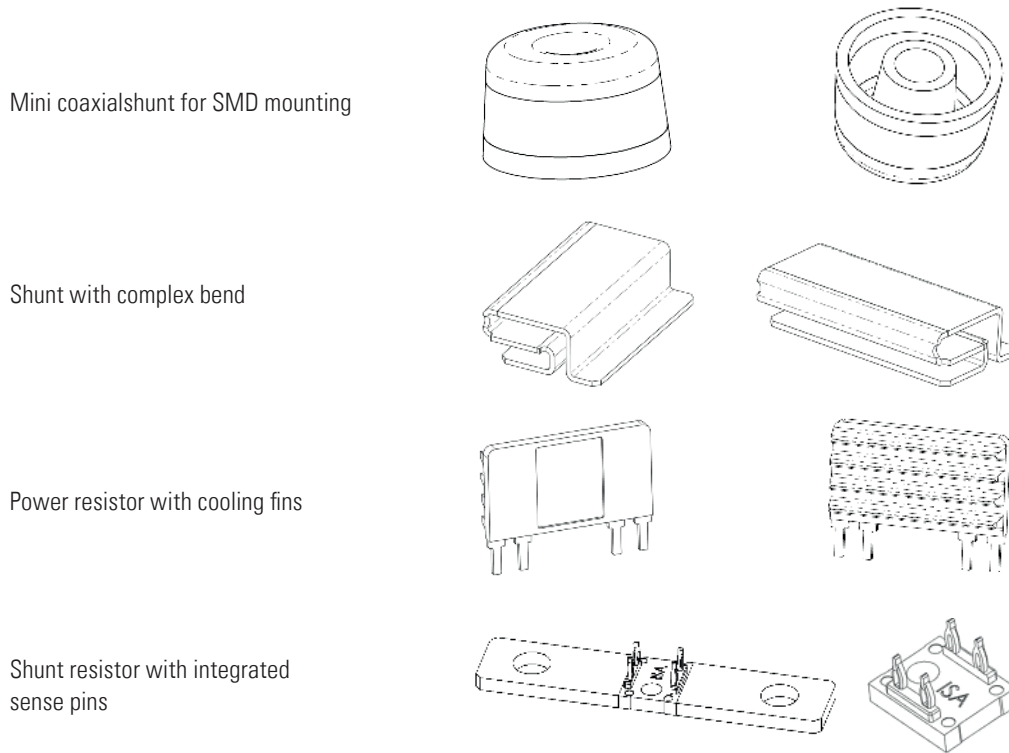
Fig. 1: Thick film braking resistor on ceramic substrate



Metal powder injection molding, or MIM, is a process for producing metallic components with complex geometries. It has its origin in plastic injection molding technology. The production of complex metal products using conventional processes such as casting and multi-stage machining requires a high input of materials and energy and is therefore very costly.

The MIM process makes it possible to realize geometric degrees of freedom, which are sometimes very complex or in some cases cannot be realized by conventional manufacturing methods. For this purpose, metal powder is mixed with an organic binder to form a so-called feedstock and is shaped on an injection molding machine and then sintered. In this way, new types of products can be made in a single step, which can only be produced in several stages in conventional processes.

**Fig. 2: Example applications for MIM Technology**



To demonstrate the technology, a shunt resistor with integrated pressfit pins was developed. The special feature of this component lies in the fact that both the resistance element and the voltage taps are made of the same resistance material.

This enables direct voltage tapping in the area of the resistance material of the component, which improves the measurement result and long-term stability. The measurement thus takes place without disturbing thermoelectric voltages and the absence of copper in the current path leads to very small temperature coefficients.

**Abb. 3: MIM-prototype: shunt resistor with integrated sense pins**

