

Platinum temperature sensors

Precise, fast, stable, cost-effective – these are key concepts on today's sensor market. Modern electronic measuring signal processing places ever higher demands on the sensor signal. Long-term stability and reliability, even under critical operating conditions, are increasingly important requirements in temperature sensors. High purity and chemical resistance as well as the sensor's physical properties make platinum the ideal base material for use in temperature measurement resistors. Platinum temperature sensors fulfil these conditions optimally over many years in operation.

Since the invention and patenting of the first platinum resistance thermometer by Heraeus in 1908, the company has acquired a global reputation as a manufacturer of high-quality temperature sensors, and Heraeus Sensor-Nite today has a leading position on the temperature sensor market. The company develops and supplies platinum temperature sensors for numerous applications in industrial sectors such as automotive technology, household appliances, air-conditioning technology, medical and electro technology, communications, industrial plant and energy management.

Temperature is a physical quantity which can be reliably measured with economical components. Platinum temperature sensors are characterised by the fact that wide temperature ranges can be measured with great precision.

As platinum temperature sensors measure minimal temperature differences, they are also used for applications which do not involve the measurement of temperature itself, but derived variables. Platinum temperature sensors are, for example, used for the measurement of flow rates, voltage, wear and tear and levels or for the location of leaks. A further important application is the precise temperature recording of compensation of temperature influences, particularly in electronics.

Basic values

Platinum temperature sensors work on the principle of temperature-dependent change of the electrical platinum metal resi-

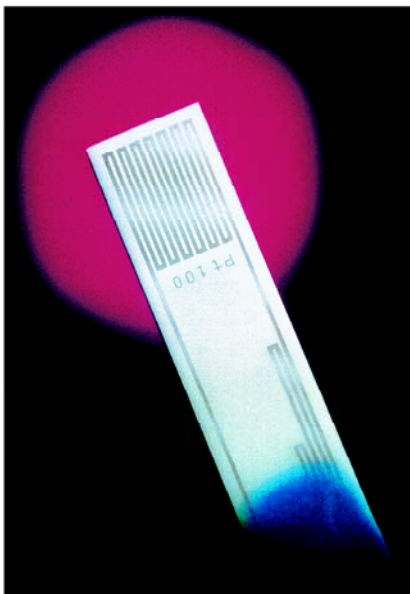


Figure 1: Typical Pt 100 platinum temperature sensor

stance. The relationship can be described by the following characteristic polynomial:

$$R_t = R_0 (1 + at + bt^2).$$

The constants are laid down in the international standards for platinum temperature sensors. b is so small that for most applications, a linear dependency between R_t and the temperature can be assumed.

Platinum temperature sensors with high nominal resistances have a higher sensitivity than those with lower nominal resistances as the gradient of the characteri-

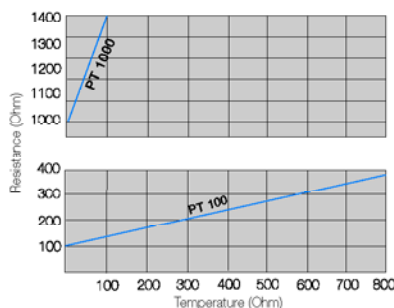


Figure 2: Characteristic curves of platinum temperature sensors

stic curve is directly proportional to R_0 . Depending on the materials and processes used in the manufacture of the platinum temperature sensors, minor specific deviations from the ideal constants and the optimal characteristic curve may occur. These deviations determine the working temperature range and the accuracy tolerance classifications for each type of platinum temperature sensor. Within these limits, platinum temperature sensors are fully interchangeable. The Heraeus Sensor-Nite product range is designed for a temperature range of -200°C to $+1000^{\circ}\text{C}$. The temperature coefficient (TCR or α) of platinum temperature sensors is positive and defined as:

$$\text{TCR} = (R_{100} - R_0) / (100 \cdot R_0).$$

It involves the gradient of the linear exposure of the characteristic polynomial between 0°C and 100°C . The DIN EN 60751 standard for platinum temperature sensors specifies a TCR of $0.00385/^{\circ}\text{C}$. This TCR value applies for all products described in this brochure.

Customer-specific sensors are also available with temperature coefficients of $0.00375/^{\circ}\text{C}$ as well as further TCR intermediate values, e.g. in accordance with the JIS standard.

Design

Platinum temperature measuring resistors comprise a sealed, structured platinum thin-film layer. Production takes place under clean room conditions with methods derived from the semi-conductor industry, such as vaporisation, photolithographic structuring and laser trimming. Stringent manufacturing and quality management methods guarantee Heraeus Sensor-Nite a leading position in the field of thin-film platinum temperature sensors.