RESISTANCE TEMPERATURE DETECTOR (RTD)

Resistance temperature detector is a primary electrical transducer which is used to measure the change in the temperature. It is commonly known as resistance thermometer.The resistance thermometers are based on the principle that the resistance of the conductorchanges when ~he temperature changes. Basically the resistance thermometer determines the' change in the electrical resistance of the conductor subjected to the temperature changes.

The temperature sensing element used in this thermometer should exhibit a relatively large change in resistance for a given change in temperature. Also the sensing element should not undergo permanent change with use or age. Another desirable characteristic for the sensing element is the linear change in resistance with change in temperature. When the sensing element is smaller in size, less heat is required to raise its temperature. This is suitable for me~surement of rapid variations in temperature. Platinum, nickel, and copper are the metals most commonly used to measure temperature. The relationship between temperature and resistance of conductor is given by equation:

$$R_t = R_{ref} [1 + \alpha \Delta t]$$

where

R_t : Resistance of the conductor at temperature t°C,

R_{ref} : Resistance of the conductor at the reference temperature, usually 0°C,

α : Temperature coefficient of the resistance,

Δt : Difference between the temperature to be measured & reference temperature.

Almost all metallic conductors have a *positive temperature coefficient* so that their resistance increases with an increase in temperature. A high value of a is desirable in a temperature sensing element so that a substantial change in resistance occurs for a relatively small change in temperature. This change in resistance *[L* R] can be measured with a Wheatstone bridge, the output of which can be directly calibrated to indicate the temperature which caused the change is resistance.

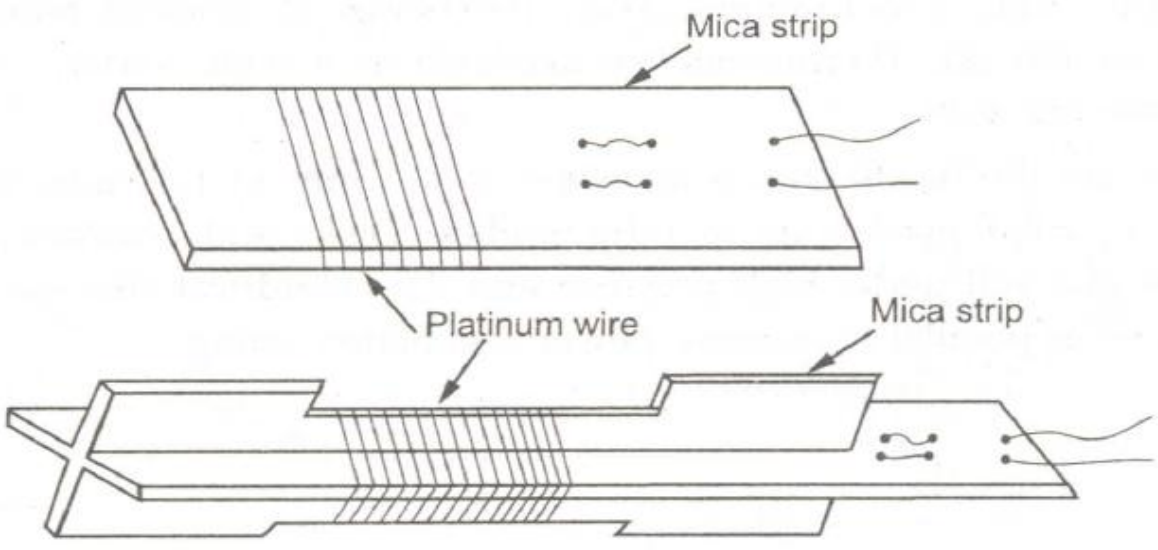
Most of the metals show an increase in resistivity with temperature, which is first linear and then increases in an accelerated fashion. The metals that exhibit good sensitivity and reproducibility for temperature measurement purposes are copper, nickel, and platinum. Among these, copper has the highest temperature coefficient with the most linear dependence. However, copper is generally not used due to certain practical problems. Because of its low resistivity, the size of the resistance element increases to get reasonable sensitivity. In the range below 400 K, a gold silver alloy can be used which has

the same characteristicb as platinum.

Construction of RTD:

The wire resistance thermometer usually consists of a coil wound on a mica or ceramic former, as shown in the Fig. The coil is wound in bifilar form so as to make it non-inductive. Such coils are available in different sizes and with different resistance values ranging from 10 ohms to 25,000 ohms.

To avoid corrosion of resistive element, usually elements are enclosed in a protective tube of pyrex glass, porcelain, quartz or nickel, depending on the range of temperature and the nature of the fluid whose temperature is to be measured. The tube is evacuated and sealed or filled with air or any other inert gas and kept around atmospheric pressure or in some cases at a higher pressure.



Source : http://elearningatria.files.wordpress.com/2013/10/ece-iii-electronic-instrumentation-10it35-notes.pdf