



# **SNS COLLEGE OF TECHNOLOGY**

**An Autonomous Institution**  
**Coimbatore-35**



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## **DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING**

IYEAR/ II SEMESTER

### **23ECT101 Electrical Engineering and Instrumentation**

TOPIC – RTD

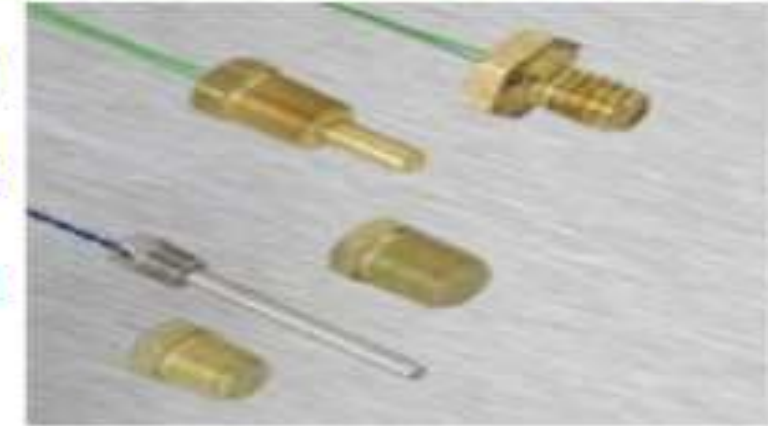


# RESISTANCE TEMPERATURE DETECTOR-RTD



## Resistance Temperature Detector- RTD

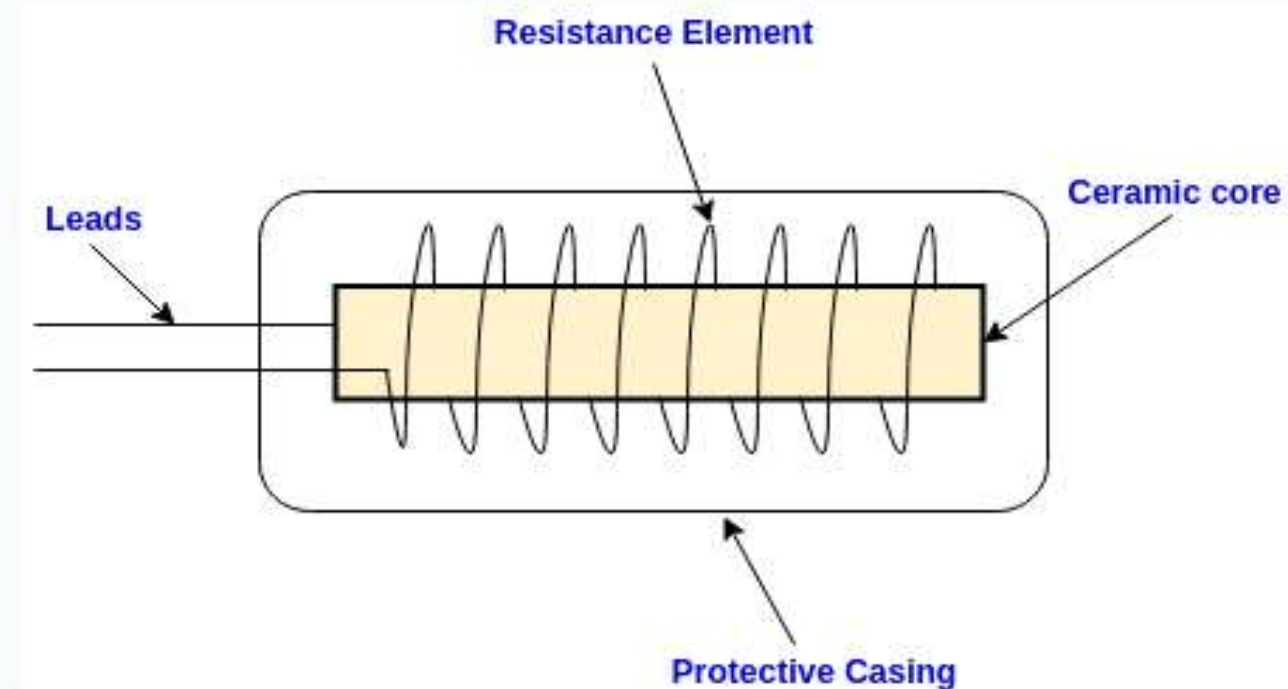
- RTD is a temperature sensitive resistor, It is a positive temperature coefficient device, which means that the resistance increases with temperature.
- This type of sensors is based on the observation that **different materials can have different resistive profiles at different temperatures.**
  - Properties are mainly **electrical** in nature.
- Industrial RTDs are very accurate: the accuracy can be as high as  $\pm 0.1^{\circ}\text{C}$ .
- The ultra high accurate version of RTD is known as **Standard Platinum Resistance Thermometers (SPRTs)** having accuracy at  **$\pm 0.0001^{\circ}\text{C}$ .**





## Construction of RTD

The resistance temperature detector is constructed by winding the resistance wire on a mica base. The wire is wound like a helical coil on the support to reduce the inductance effect. The terminals (Leads) are brought out of the pipe. The coil is protected by a stainless steel case. The structural view of a wire wound RTD is shown in the figure.



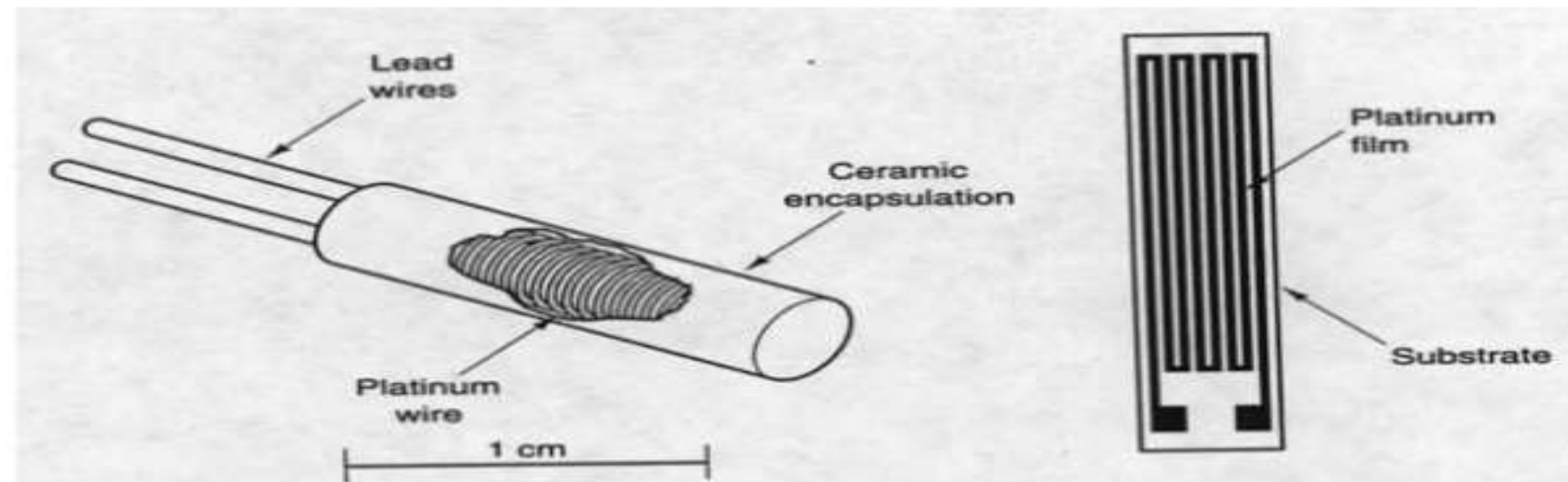
Copper, Nickel and Platinum are the most used RTD materials. These metals have positive temperature co-efficient and possess poor thermal sensitivity. Also, the resistance-temperature characteristics of these materials are approximately linear.

Another type of RTD is thin-film RTD that is constructed by depositing a thin layer of resistive material onto a ceramic substance.



## Thin-Film RTDs

- Thin-film RTD design is a newer technology and is gaining favor due to lower cost.
- It is designed to minimize strain on the platinum due to thermal expansion since strain also cause changes in resistance,  $R = \rho(L/A)$ .





## Working Principle of RTD

Resistance Temperature Detectors (RTD) operates on the principle that the resistance of a metal changes with changes in temperature.

The variation of resistance  $R$  with temperature  $t$  can be represented by the equation,

$$R_t = R_0(1 + \alpha \Delta t)$$

Where  $\alpha$  is the temperature co-efficient at  $t_0$  and  $R_0$  is the resistance at  $t_0$ .



## Advantages

- Can be operated in a wide temperature range.
- Good stability at high temperature.
- High accuracy.

## Dis-advantages

- Low sensitivity.
- More Expensive.
- Affected by shock or vibration.



# RTD Applications

- Air conditioning and refrigeration servicing
- Furnace servicing
- Foodservice processing
- Medical research
- Textile production