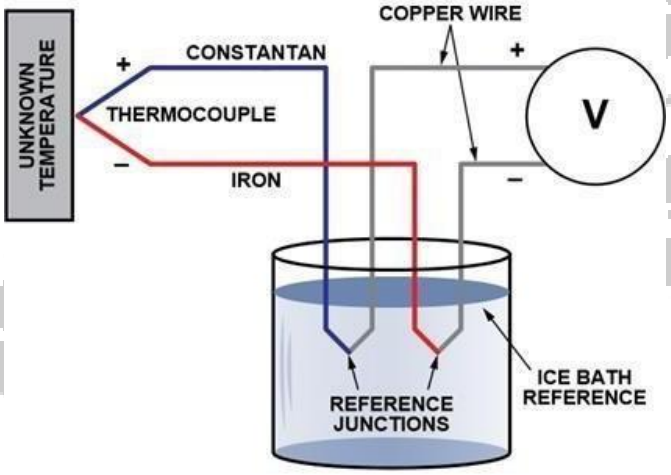
1.3 Thermal Detectors

- Photon transducers are generally not applicable in the infrared because photons in this region lack the energy to cause photoemission of electrons. Thus, thermal transducers or photoconductive transducers must be used.
- In thermal transducers, the radiation impinges on and is absorbed by a small blackbody and the temperature rise is measured.
- Respond to incident energy rate (average power)
- Sense the change in temperature that is produced by the absorption of incident radiation
- Relatively flat spectral response curves (determined by window and coating)

Thermocouple

- A thermocouple consists of a pair of junctions formed when two pieces of a metal such as copper are fused to each end of a dissimilar metal such as constantan and iron as shown in Figure.
- It is working based on seebeck effect.
- A voltage develops between the two junctions that varies with th difference in their temperatures.
- Thermocouples have high stability
- Since their output voltages are often on the order of microvolts, they require large amplification factors.Thermistor Bolometer



- A thermistor is a resistance thermometer, or a resistor whose resistance is dependent on temperature. The term is a combination of "thermal" and "resistor". It is made of metallic oxides, pressed into a bead, disk, or cylindrical shape and then encapsulated with an impermeable material such as epoxy or glass.
- There are two types of thermistors: Negative Temperature Coefficient (NTC) and Positive Temperature Coefficient (PTC). With an NTC thermistor, when the temperature increases, resistance decreases. Conversely, when temperature decreases, resistance increases. This type of thermistor is used the most.
- A PTC thermistor works a little differently. When temperature increases, the resistance increases, and when temperature decreases, resistance decreases. This type of thermistor is generally used as a fuse.
- Typically, a thermistor achieves high precision within a limited temperature range of about 50ºC around the target temperature. This range is dependent on the base resistance.

- A thin blackened tip allows the absorption of radiation, which heats the thermistor.
- The thermistor is normally placed in a bridge circuit with a reference thermistor that is not irradiated.
- The resistance can be measured by a null-comparison technique, or the out-of- balance voltage of the bridge can be monitored.

Pyroelectric Detector

- A pyroelectric detector is typically made from triglycine sulfate (TGS).
- When placed in an electrical field, a surface charge results from alignment of electric dipoles. When a pulse of incident radiation heats

the TGS, a change in surface charge results (pyroelectric effect), which is related to the incident radiant power.

- The output current is proportional to the rate of temperature change of the material dTldt
- The pyroelectric detector is fast (<1 ms response time) because only charge- reorientation limits the response speed for modulated inputs.