THERMOCOUPLES

When two dissimilar metal wires are joined at the ends and are kept at different temperature TR and TS, a continuous thermoelectric current flow owing to the Seebeck effect as shown in Fig. 5.31a. If the wires are cut, an open-circuit Seebeck voltage is measured which is proportional to the temperature difference.

If TR is constant, the Seeback voltage is proportional to Ts. The associated Peltier effect is the increase or decrease of the junction temperature when an external current flows in the thermocouple (TC) wires. Reference 77 gives a description of these effects and their interrelationships.

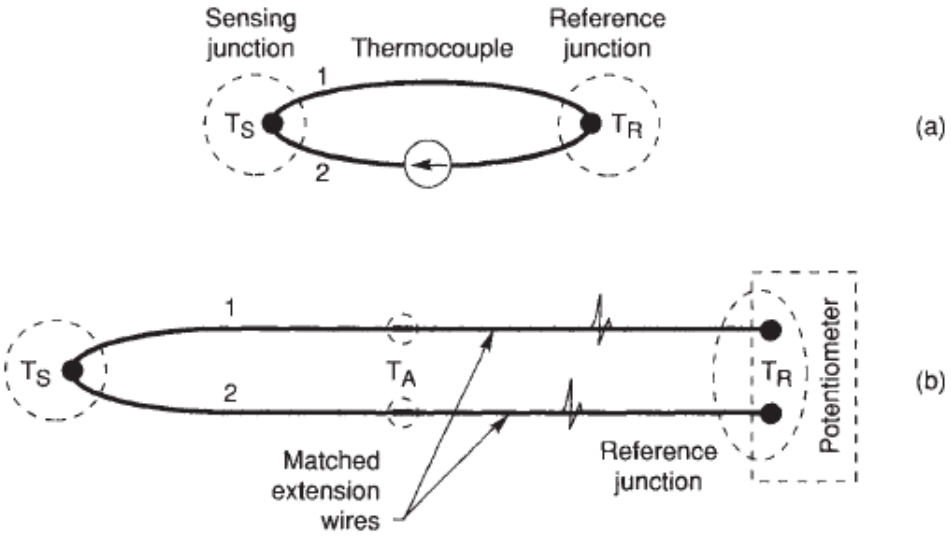

Figure 5.31 Thermocouples. (a) Seebeck effect. (b) Measurement setup for remote sensing.

Figure 5.31b shows an arrangement when the measuring equipment is remote from the sensing TC. Matched extension TC wires are used and the reference junctions are formed at the measuring equipment. The reference junctions must be kept at a constant temperature, mostly at ambient room temperature TA.

This requirement can also be satisfied by electronically providing a reference voltage compensation.

Thermocouples used in industry are made from several combinations of metals.

Type	Composition	Temp. range max, °C	Environment (bare wire)	Output, mV at 500°C
B	Platinum—30% rhodium vs. platinum–6% rhodium	0–1700	Oxidizing or inert; don't insert in metal tubes; used in glass industry	1.241
E	Nickel-chromium (Chromel) vs. copper-nickel (Constantan)	−200–900	Oxidizing or inert; limited use in vacuum or reducing	36.99
J	Iron vs. copper-nickel	0–750	Reducing, vacuum, inert; limited use in oxidizing at high temp.	27.388
K	Nickel-chromium (Chromel) vs. nickel-aluminum (Alumel)	−200–1250	Clean oxidizing and inert; use in vacuum or reducing; wide temp. range	20.64
R	Platinum–13% rhodium vs. platinum	0–1450	Oxidizing or inert; don't insert in metal tubes	4.71
S	Platinum–10% rhodium vs. platinum	0–1450	Same as R type	4.234
T	Copper vs. copper-nickel (Constantan)	−200–350	Mild oxidizing, vacuum or inert; low temp. or cryogenic applications	20.869 mV at 400°C

Table summarizes the properties of TCs that are commonly used, and a complete set of thermocouple reference tables is given in Ref. 76. The basic measuring instrument used with these thermocouples is the potentiometer, but direct-reading, analog, and digital meters of many kinds are also available from manufacturers.

Source: http://mediatoget.blogspot.in/2012/07/thermocouples.html