

Thermoelectric Series:

The arrangement of different metals in the form of series from which any two metals can be used for used to form a thermocouple is known as thermoelectric series.

Sb, As, Fe, Cd, Zn, Ag, Au, Mo, Sn, Pb, Hg, Mn, Cu, Pt, Co, Ni, Bi

Antimony, Arsenic, Iron, Cadmium, Zinc, Silver, Gold, Molybdenum, Tin Lead, Mercury, Manganese, Copper, Platinum, Cobalt, Nickel, Bismuth.

The first member of thermoelectric series is antimony (Sb) and last member is bismuth (Bi)

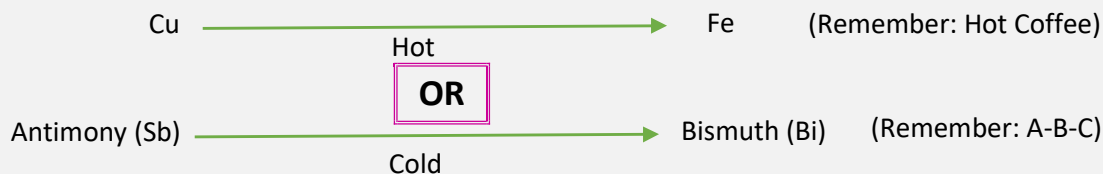
Note that: The order of metals in the series could be reversed. i.e., Bismuth could be the first member and Antimony could be the last member.

Bi, Ni, Co, Pt, Cu, Mn, Hg, Pb, Sn, Mo, Au, Ag, Zn, Cd, Fe, As, Sb

Significance of Thermoelectric series:

1. It helps in predicting the **direction of current** in a thermocouple. The direction of current is from metal coming first in the series to a metal coming later on in the series through cold junction. In above series, in the couple Antimony (Sb) Bismuth (Bi), the current will pass from Antimony to Bismuth at cold junction.

If the above thermoelectric series is in reverse order i.e., **Bi, Ni, Co, Pt, Cu, Mn, Hg, Pb, Sn, Mo, Au, Ag, Zn, Cd, Fe, As, Sb**, the direction of current is from metal coming first in the series to a metal coming later on in the series through hot junction.



2. The **more separated** the metals are in the series, the **greater** will be the value of **thermo-emf** generated. [Due to this fact, **Sb-Bi** thermocouple is more preferred as compared to other thermocouples. Because Sb-Bi thermocouple produces maximum thermo-emf for a given difference in temperature of the two junctions.]

Note:

1. The thermoelectric effect obeys the law of conservation of energy, In Seebeck Effect, Heat energy absorbed by the hot junction is converted into electric energy.
2. EMF generated in a thermocouple is the order of millivolts (mV).
3. Seebeck effect may be used as thermoelectric generator

Application of thermoelectric effect:

1. For detection of thermal radiation (Thermopile)
 2. For the measurement of temperature (thermoelectric thermometer)
 3. For the construction of thermoelectric generator.
- The thermo emf of lead is almost zero, therefore it is used as reference metal in thermoelectricity.
- The seebeck emf is very small so is not used for commercial purposes. It is only used in measurement of low temperature (for experimental purposes).

Application of thermocouple:

1. It measures amount of incident light or infrared rays
2. It monitors temperature of metals in steel, iron, aluminium industries.
3. It is used to measure temperature of a body

Advantage: It has fast thermal response.

Disadvantage: The emf developed is very low and so it has low accuracy.