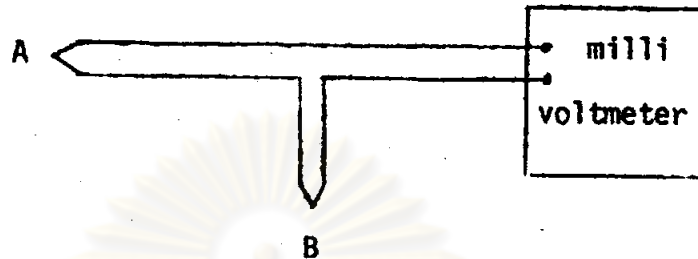


Appendix

Construction of A Chromel-Alumel Thermocouple

A thermocouple is a simple electric thermometer, consisting of a pair of electrical conductors joined together to produce a thermal e.m.f. when the two junctions are at different temperatures. The magnitude of the e.m.f. depends on the nature of the two metals at the junctions and the strains exerted on them at a given temperature. Materials are suitable for use in thermocouples only if, they develop a relative large e.m.f. which does not depart in an appreciable degree from the calibrated value as different samples of the materials are used. The substance must not change in composition or melt at the highest temperature. The e.m.f. of the thermocouple normally changes gradually with time.

A chromel-alumel thermocouple which consists of a positive chromel wire and a negative alumel wire is recommended for use in clean oxidizing atmospheres. The e.m.f. has been very well established in the range -200 to 1300°C . The two junctions are electrical weld (or spot weld) of the two chromel and alumel wires. The composition of the chromel-alumel (nickel chromium-nickel aluminium) is Ni 90%, Cr 10% - Ni 94%, Al 2% + Si, and Mn approximation. In measuring, the thermocouple should be connected in two junctions, junction A is the measuring junction, while referent junction B is at 0°C , in a mixture of crushed ice and distilled water. The e.m.f. of the chromel-alumel thermocouple



changes rather uniformly in the range -200°C to room temperature (as we have measured). In this temperature range, the e.m.f. as a function of temperature, can be given by the equation

$$E = At + Bt^2 + Ct^3 \quad -200^{\circ}\text{C} < t < 23^{\circ}\text{C}$$

where E is the e.m.f. when the referent junction is at 0°C and the measuring junction at a temperature t . The constant A , B , C are to be determined by measuring E at three different known temperature. This thermo-couple is very useful one for low temperature measurement.

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