

Vacuum Arc Melting Unit

Arc Melting is used for melting metals– typically to form alloys. Heating is via an electric arc struck between a tungsten electrode and metals placed in a depression (crucible) in the copper hearth. In vacuum arc melting the chamber is evacuated and then back filled with argon gas. Hence, melting is performed in argon atmosphere.

Basic Principle: A standard Tungsten Inert Gas (TIG) welding unit is used as a power source. Heat generated by the electric arc struck between the electrode and the metals serves to melt the metals placed in the crucible to form an alloy. Repeated melting is performed to improve the homogeneity of the alloy. Evacuation of the chamber avoids oxidation of the melt (Ar being an inert gas does not react with molten metal).

Features: The metals can be heated to a temperature in excess of 2000°C. A batch of five alloys can be made in a single evacuation, as there are five crucibles in the hearth (four small and one large). About 15g of metals can be melted in the small crucibles and about 80g in the larger crucible. There are three main parts to the system: power source (TIG– 600Amp), chiller and vacuum unit. The vacuum unit with rotary and diffusion pumps can attain a vacuum of 10^{-6} m bar. The cold circulation water from the chiller cools both the copper hearth and the electrodes. After elemental metals (or master alloy) are melted and solidified, it can be 'turned over' by a 'tweezer mechanism' without breaking the vacuum (and then re-melted). The melting → solidification → 'turn over' of sample → re-melting process is typically repeated three times to attain a better compositional homogeneity. Apart from the abovementioned hearth with five crucibles, an additional hearth has been provided with one crucible, which can suction cast the molten alloy, in the form of thin cylinders (typically 3mm diameter).



Fig. 1: Arc Melting Unit

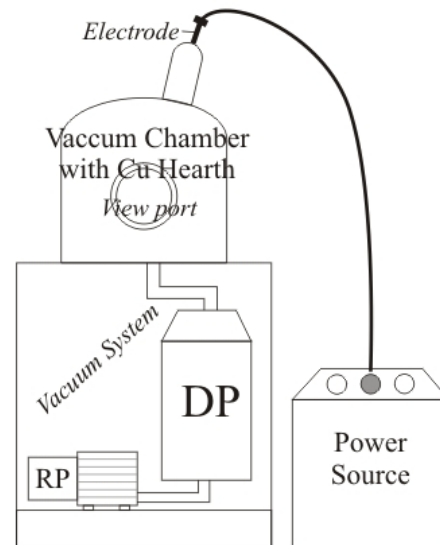


Fig. 2: Schematic of the arc melting system

Applications:

- (i) Melt elements to form an alloy using a high temperature arc.
- (ii) Remelt alloys to improve homogeneity.
- (iii) Suction cast the melt in a copper mold.

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