Designation: ~~E1306 – 11~~ E1306 – 17

Standard Practice for Preparation of Metal and Alloy Samples for Chemical Analysis by Electric Arc Remelting[1]

This standard is issued under the fixed designation E1306; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the preparation of solid samples of reactive and refractory metals and alloys by electric arc remelting. The samples for melting may be in the form of chips, turnings, wires, ~~and sponge. Powdered metals need to be compacted before melting.~~sponge and powdered metals.

1.1.1 This practice is also suitable for preparation of solid samples of other metals, such as steels, stainless steels, tool steels, nickel, nickel alloys, cobalt, and cobalt ~~alloys by electric arc remelting.~~alloys.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* Specific hazard statements are given in Section 9.

1.3 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E135 Terminology Relating to Analytical Chemistry for Metals, Ores, and Related Materials

3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice, refer to Terminology E135.

4. Summary of Practice

4.1 ~~Metal chips, turnings, or wires~~ Various forms are melted into a button approximately 1¼ ~~in.~~inches in diameter and approximately ¼~~-in.~~ inches thick using an electric arc furnace. The action of the arc creates agitation and mixing of the molten metal which produces a homogeneous sample.

5. Significance and Use

5.1 This sampling practice is useful for converting ~~chips, turnings, and wires~~ material taken from ingots or other solid materials into a homogeneous solid sample suitable for direct excitation on ~~an~~ a spark atomic emission or X-ray fluorescence spectrometer. The resultant button may itself be chipped to provide specimens for test methods requiring solutions or chips.

5.2 This practice has been used extensively for the preparation of zirconium, zirconium alloy, titanium, and titanium alloy materials, and is applicable to other reactive, refractory, ferrous and nonferrous alloys, such as cobalt, cobalt alloys, niobium, nickel, nickel alloys, steels, stainless steels, tantalum, tool steels, and tungsten.

6. Interferences

6.1 ~~Test samples of known composition shall be used to determine if there is any~~ The user should carefully consider the impact of using remelted samples for analysis as remelted samples may be subject to selective volatilization or segregation of ~~the impurity~~

[1] This practice is under the jurisdiction of ASTM Committee E01 on Analytical Chemistry for Metals, Ores, and Related Materials and is the direct responsibility of Subcommittee E01.20 on Fundamental Practices.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

any elements. Elements known to volatilize are bismuth, cadmium, chlorine, lead, magnesium, sodium, tellurium, thallium, uranium, and zinc. Other elements that may change in content are the interstitial gases, oxygen, nitrogen, and hydrogen, plus carbon, which may be added ~~due to the graphite anode.~~ if a graphite anode is used. A tungsten anode may be substituted if carbon pickup is a concern. Tungsten contamination may occur if this electrode is used. Copper contamination also may be introduced from the melting crucible.

7. Apparatus

7.1 *Electric Arc ~~Remelt~~Remit Furnace*—This section describes the various components of an electric arc remelt furnace. Refer to Fig. 1 to see how each component is arranged. The number assigned to each component in the following description corresponds to the number in the schematic.

7.1.1 *Water-Cooled Upper Housing* (*1*), approximately ~~6-in.~~ 6 inches in diameter and 6¼ ~~in. high,~~ inches in height, and having a smooth, flat sealing surface.

7.1.2 *Rubber ~~Boot~~ Boot*—(*2*), shall cover the anode manipulator assembly to prevent electrical shock.

7.1.3 The top of the housing shall be fabricated from an electrical and thermal insulating material, such as Bakelite, and shall support the following items:

7.1.3.1 *Relief ~~Valve~~ Valve*—(*3*), to relieve excessive pressure during the melting process.

7.1.3.2 *Inlet ~~Fitting~~ Fitting*—(*4*), for argon.

7.1.3.3 *Outlet ~~Fitting~~ Fitting*—(*5*), for connecting to a vacuum pump.

7.1.4 *Water-Cooled Lower Housing* (*6*), approximately 5¾~~-in.~~ inches in diameter and 5½ ~~in. high~~ inches in height containing the copper melting crucible. Its upper surface shall be fitted with a neoprene O-ring to seal against the upper anode housing.

7.1.4.1 The lower housing shall be capable of being inverted for removal of the button after it has cooled.

7.1.5 ~~*Jack*~~ *Jack*—(*7*), to raise the lower housing against the upper anode housing, compressing the O-ring and sealing the crucible chamber.

7.2 *DC Electric ~~Welder~~ Welder*—(*8*), to provide an arc current of 400 A to ~~600~~800 A.

7.3 *Pressure ~~Regulator~~ Regulator*—(*9*), two-stage, for argon gas.

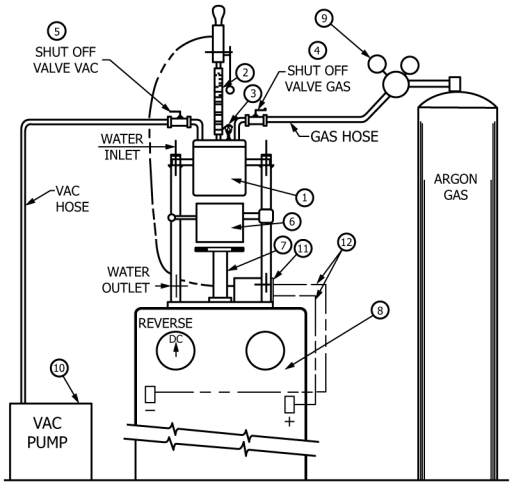
7.4 *Vacuum ~~Pump~~ Pump*—(*10*), having an initial pumping rate of 50 ~~L/min.~~L/min or more.

7.5 *Wire Brushes,* to clean the crucible.

7.6 *Tamping Rod,* suitable for packing the sample into the crucible.

7.7 *Foot Switch,* to provide low and high power settings (optional). If a foot switch is not available, the low to high power and the high to low power transition can be performed with the rheostat designed for adjusting the current.

7.8 *Control Panel* (*11*), containing the master power switch and rheostat for adjusting the current.



Legend:

(1) Anode Housing
(2) Rubber Boot
(3) Relief Valve
(4) Inlet Fittings for Argon
(5) Outlet Fitting for Vacuum
(6) Crucible Housing
(7) Jack
(8) DC Electrical Welder
(9) Pressure Regulator
(10) Vacuum Pump
(11) Control Panel
(12) Power Cable

FIG. 1 Schematic of Electric Arc Remelt Furnace