~~Designation:E1306–07~~ Designation: E1306 – 11

Standard Practice for ~~Preparation of Metal and Alloy Samples by Electric Arc Remelting for the Determination of Chemical Composition~~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.

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.

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.

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 are melted into a button approximately 1¼ in. in diameter and approximately ¼-in. 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 taken from ingots or other solid materials into a homogeneous solid sample suitable for direct excitation on an ~~optical~~atomic emission or X-ray fluorescence spectrometer. The resultant button may itself be chipped to provide ~~samples~~specimens for ~~plasma emission, atomic absorption, and wet chemical analysis.~~ 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, ~~columbium (niobium),~~niobium, nickel, nickel alloys, 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 selective volatilization or segregation of the impurity elements. Elements known to volatilize are bismuth, cadmium, chlorine, lead, magnesium, sodium, tellurium, thallium,

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[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.

~~Current edition approved Jan. 15, 2007. Published January 2007. Originally approved in 1989. Last previous edition approved in 2004 as E1306–94(2004). DOI: 10.1520/E1306-07.~~

Current edition approved Nov. 1, 2011. Published December 2011. Originally approved in 1989. Last previous edition approved in 2007 as E1306 – 07. DOI: 10.1520/E1306-11.

[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.

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. 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 Furnace*—~~An apparatus suitable for this practice is shown schematically in~~ —This section describes the various components of an electric arc remelt furnace. Refer to Fig. 1 ~~. It shall be equipped as follows:~~ 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. diameter and 6¼ in. high, and having a smooth, flat sealing surface.

7.1.2 *Rubber 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* (*3*), to relieve excessive pressure during the melting process.

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

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

7.1.4 *Water-Cooled Lower Housing* (*6*), approximately 5¾-in. diameter and 5½ in. high 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 ~~*Hydraulic Jack*~~Jack (*7*), to raise the lower housing against the upper anode housing, compressing the O-ring and sealing the crucible chamber.

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

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

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

7.5 *Wire Brushes*, to clean the crucible.

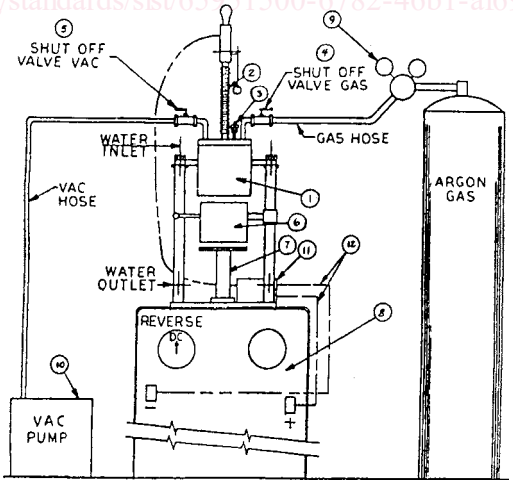
7.6 *Tamping Rod*, suitable for packing the sample into the crucible.

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.

8. Reagents and Materials

8.1 *Argon*, 99.99 %, gas or liquid.



Legend:

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

FIG. 1 Schematic of Electric Arc Remelt Furnace