Designation: E1835 – 14 (Reapproved 2022)

Standard Test Method for Analysis of Nickel Alloys by Flame Atomic Absorption Spectrometry[1]

This standard is issued under the fixed designation E1835; 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 test method covers analysis of nickel alloys by flame atomic absorption spectrometry (FAAS) for the following elements:

Element	Compostiton Range, %
Aluminum	0.2 to 4.0
Chromium	0.01 to 4.0
Cobalt	0.01 to 4.0
Copper	0.01 to 4.0
Iron	0.1 to 4.0
Manganese	0.1 to 4.0
Silicon	0.2 to 1.0
Vanadium	0.05 to 1.0

1.2 The composition ranges of these elements can be expanded by the use of appropriate standards.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* For specific hazards associated with the use of this test method, see Practices E50 and the warning statements included in this test method.

1.5 *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]

D1193 Specification for Reagent Water

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E50 Practices for Apparatus, Reagents, and Safety Considerations for Chemical Analysis of Metals, Ores, and Related Materials

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

E882 Guide for Accountability and Quality Control in the Chemical Analysis Laboratory

E1601 Practice for Conducting an Interlaboratory Study to Evaluate the Performance of an Analytical Method

E1812 Practice for Optimization of Flame Atomic Absorption Spectrometric Equipment (Withdrawn 2004)[3]

2.2 *ISO Standards:*[4]

ISO 5725:1986 Precision of Test Methods—Determination of Repeatability and Reproducibility for a Standard Test Method by Inter-laboratory Tests

ISO 7530 Parts 1 through 9—Nickel Alloys—Flame Atomic Absorption Spectrometric Analysis

3. Terminology

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

4. Summary of Test Method

4.1 The sample is dissolved in a mixture of HCl and HNO_3. The solution is aspirated into an appropriate flame of an atomic absorption spectrometer. The absorbance of the resonant line

[1] This test method is under the jurisdiction of ASTM Committee E01 on Analytical Chemistry for Metals, Ores, and Related Materials and is the direct responsibility of Subcommittee E01.08 on Ni and Co and High Temperature Alloys.

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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.

[3] The last approved version of this historical standard is referenced on www.astm.org.

[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

TABLE 1 Nominal Compositions of Test Samples, %

Test Material	Al	Co	Cr	Cu	Fe	Mn	Mo	Nb	Ni	Si	Ti	V	Zr
825	0.2	0.07	21	1.6	30	0.7	...	...	Bal	0.4	1.1	...	...
902	0.4	0.05	5	0.04	48	0.4	...	...	Bal	0.35	2.5	...	...
3920	0.15	2	19	0.1	3	0.3	...	...	Bal	0.6	2.3	...	...
3927	0.1	1	20	0.05	44	0.4	...	...	Bal	0.8	0.6	...	...
7013	1.5	17	20	0.2	0.2	0.05	...	...	Bal	0.7	2.4	...	...
7049	1	0.01	15	0.15	7	0.8	...	...	Bal	0.3	2.3	...	...
925	0.3	0.2	21	...	27	...	3	0.4	Bal	...	2	0.05	0.05
NPK31	0.5	14	20	...	1	...	4.5	5	Bal	...	2	0.3	...
IN100	5.5	15	10	...	<0.5	...	3	...	Bal	...	5	1	...

energy from the spectrum of the analyte is measured and compared with that of calibration solutions.

5. Significance and Use

5.1 This test method is used for the analysis of nickel alloy samples by FAAS to check compliance with compositional specifications. It is assumed that all who use the procedure will be trained analysts capable of performing common laboratory procedures skillfully and safely. It is expected that the work will be performed in a properly equipped laboratory and that proper waste disposal procedures will be followed. Appropriate quality control practices must be followed such as those described in Guide E882.

5.2 *Interlaboratory Studies (ILS)*[5, 6]—International interlaboratory studies were conducted by ISO/TC 155/SC4, Analysis of nickel alloys. Results were evaluated in accordance with ISO 5725:1986 and restated to conform to Practice E1601. The method was published as ISO 7530, Parts 1 through 9. The published ISO statistics are summarized separately for each analyte to correspond with Practice E1601.

5.3 In this test method, some matrix modifiers are specified. However, other additives have come into common use since the original publication of this test method. These may be equally or more effective but have not been tested. It is the responsibility of the user to validate the use of such additives or the use of different dilutions, or both.

6. Apparatus

6.1 *Flame Atomic Absorption Spectrometer,* equipped with an appropriate background corrector, a signal output device (such as a video display screen (VDS), a digital computer, a printer or strip chart recorder, and an optional autosampler.

6.2 *Radiation Source*—Hollow cathode lamp or electrodeless discharge lamp for the analyte(s).

7. Reagents

7.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society where such specifications are available.[7] Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination. The reagents should be free of or contain minimal amounts (<0.1 µg/g) of the analyte of interest.

7.2 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean reagent water conforming to Type I or II of Specification D1193. Type III or IV may be used if they effect no measurable change in the blank or sample.

7.3 *Calibration Solutions*—Prepared for the individual analytes.

7.4 *Matrix Modifiers and Ionization Buffers*—Prepared for the individual analytes, where required.

8. Sampling and Sample Preparation

8.1 Sampling and sample preparation shall be performed by normal procedures agreed upon between the parties, or, in the event of a dispute, in accordance with the relevant standard if one is available.

8.2 The sampling procedure shall not involve any steps or procedures that can result in the loss of any analyte in the sample.

NOTE 1—Arc melting of the sample or induction melting of the sample under vacuum can result in significant loss of several elements that have a low vapor pressure. Arc melting of the sample should be performed only after careful consideration of all elements to be determined on the melted sample. Induction melting should be performed only in a complete or partial inert atmosphere.

8.3 The laboratory sample is normally in the form of turnings, millings, or drillings and no further mechanical preparation is necessary.

8.4 If it is suspected that the laboratory sample is contaminated with oil or grease from the milling or drilling operation, it shall be cleaned by washing it with high purity acetone, or other appropriate solvent, and dried in air.

8.5 If brazed alloy tools have been used in the preparation of the sample, it shall be further cleaned by pickling in dilute HNO_3 for a few minutes. The sample shall then be washed

[5] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report : RR:E01-1018.

[6] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report : RR:E01-1019.

[7] *Reagent Chemicals, American Chemical Society Specifications*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.