

Translated English of Chinese Standard: GB/T4184-2021

www.ChineseStandard.net → Buy True-PDF → Auto-delivery.

Sales@ChineseStandard.net

GB

NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA

ICS 31.030

CCS L 90

GB/T 4184-2021

Replacing GB/T 4184-2002

Tungsten-rhenium Alloy Wires

钨铼合金丝

Issued on: December 31, 2021

Implemented on: July 1, 2022

Issued by: State Administration for Market Regulation;

Standardization Administration of the People's Republic of China.

Table of Contents

Foreword	3
1 Scope.....	5
2 Normative References.....	5
3 Terms and Definitions.....	5
4 Requirements	5
5 Test Methods	8
6 Inspection Rules.....	12
7 Packaging, Marking, Storage and Transportation.....	13
Appendix A (normative) Determination of Rhenium Content in Tungsten-rhenium Alloy - ICP Spectrometry	15
Appendix B (normative) Accuracy of Wire Winding Machine	18

Foreword

This document was drafted in accordance with the rules provided in GB/T 1.1-2020 *Directives for Standardization - Part 1: Rules for the Structure and Drafting of Standardizing Documents*.

This document serves as a replacement for GB/T 4184-2002 *Tungsten-rhenium Alloy Wires*. In comparison with GB/T 4184-2002, apart from structural adjustments and editorial modifications, the main technical changes are as follows:

- a) The “Normative References” is modified (see Chapter 2; Chapter 2 of Version 2002);
- b) The designation W-5Re is added, and the specific categories and allowable upper limits of impurity elements in tungsten-rhenium alloy wires are refined (see 4.1; 4.1 of Version 2002);
- c) The requirements for “high temperature properties” are added (see 4.4);
- d) The content of “linearity” is modified and the requirements for the diameter of the curved ring are enhanced (see 4.5; 4.6 of Version 2002);
- e) The content of “surface quality” is modified (see 4.6; 4.1 of Version 2002);
- f) The requirements for “electrical resistivity” are added (see 4.8);
- g) “Appraisal inspection” is added and general rules are specified (see 6.4);
- h) The requirements for the “minimum length”, “bending property” and “winding into a spool” of tungsten-rhenium alloy wires are deleted, and the relevant provisions in the “packaging, storage and transportation” part are modified (see 7.1; 4.2.2, 4.4 and 4.8 of Version 2002).

Please be noted that certain content of this document may involve patents. The institution issuing this document does not undertake the responsibility of identifying these patents.

This document was proposed by and shall be under the jurisdiction of National Technical Committee 203 on Semiconductor Equipment and Materials of Standardization Administration of China (SAC/TC 203).

The drafting organizations of this document: Chengdu Hongbo Industrial Co., Ltd.; China Electronics Standardization Institute.

The main drafters of this document: Li Jian, Wang Jinsong, Cao Kewei, Sun Hongyun, He Qingchun, Li Xiaojuan, Guan Qi.

The issuing of the previous versions:

---First issued in 1984 as GB/T 4184-1984 and first revised in 2002;

Tungsten-rhenium Alloy Wires

1 Scope

This document specifies the designations, requirements, test methods, inspection rules, packaging, marking, transportation and storage of tungsten-rhenium alloy wires.

This document is applicable to the production of tungsten-rhenium alloy wires for electric light source filaments, vacuum electron device hot wires, grid electrodes and supports.

2 Normative References

The contents of the following documents constitute indispensable clauses of this document through the normative references in the text. In terms of references with a specified date, only versions with a specified date are applicable to this document. In terms of references without a specified date, the latest version (including all the modifications) is applicable to this document.

GB/T 228.1 Metallic Materials - Tensile Testing - Part 1: Method of Test at Room Temperature

GB/T 4324 (all parts) Methods for Chemical Analysis of Tungsten

YS/T 502 Determination of Rhenium in Tungsten-Rhenium Alloy - Diacetyl Oxime Colorimetric Method

3 Terms and Definitions

This document does not have terms and definitions that need to be defined.

4 Requirements

4.1 Chemical Composition

In accordance with chemical composition, tungsten-rhenium alloy wires are divided into three designations: W-1Re, W-3Re and W-5Re. The chemical composition of tungsten-rhenium alloy wires shall comply with the provisions in Table 1.

	Electrical resistivity	4.8	5.8
--	------------------------	-----	-----

6.4.3 Disqualification judgment

If the sample under test passes the inspection of all items listed in Table 10, then, it is judged as qualified. If it fails in the inspection of one or more items, then, it is judged as disqualified.

6.5 Quality Conformity Inspection

6.5.1 Inspection items

The quality conformity inspection items shall be carried out in accordance with Table 10.

6.5.2 Inspection batch

Products of the same designation, same raw materials, same process, same production batch number and same production period are one inspection batch.

6.5.3 Sampling and qualification judgment

Group A and Group B are subject to 100% inspection and disqualified products are eliminated.

Group C inspection is carried out on one specimen randomly taken from each inspection batch. If one or more results fail to comply with the requirements, double sampling shall be performed in the inspection batch and the disqualified items shall be inspected. If one or more results still fail to comply with the requirements, then, the batch will be judged as disqualified.

6.6 Re-inspection

The demand-side shall conduct re-inspection in accordance with this document within three months from the date of receipt of the product. If the inspection result is inconsistent with the product certificate or product quality certificate, an appraisal or inspection shall be jointly carried out, or a third party recognized by both sides shall be entrusted to conduct an inspection. If it still fails to meet the requirements, then, it shall be deemed disqualified.

7 Packaging, Marking, Storage and Transportation

7.1 Packaging, Storage and Transportation

Tungsten-rhenium alloy wire with a diameter $\phi \leq 0.35$ mm shall be evenly rewound on the wire coil without local accumulation or the phenomenon of pressed wire being unable to be released. The exposed wire head needs to be fixed, the surface shall be sealed with flint-glazed paper, and then, loaded into a plastic cylinder. The material and specifications of the wire coil shall be determined by negotiation between the supply-side and the demand-side.

When winding tungsten-rhenium alloy wire with a diameter $\phi > 0.35$ mm, it shall be wound into a coil and tied with soft metal wire in 3 to 4 sites to prevent the wire from bouncing open

Appendix A

(normative)

Determination of Rhenium Content in Tungsten-rhenium Alloy - ICP Spectrometry

A.1 Overview

The method provided in this Appendix is for the determination of rhenium in tungsten-rhenium alloy. The mass fraction of rhenium ranges from 1% to 10%.

A.2 Method Summary

The specimens are decomposed by hydrogen peroxide and determined by inductively coupled plasma emission spectrometer.

A.3 Reagents

A.3.1 Nitric acid: (1 + 1) analytically pure.

A.3.2 Hydrogen peroxide: mass concentration c is 1.10 g/mL.

A.3.3 Hydrochloric acid: (1+1) guaranteed reagent.

A.3.4 Rhenium standard solution: weigh-take 1.0000 g of metallic rhenium powder ($\geq 99.99\%$) into a 150 mL beaker, add 20 mL of hydrochloric acid (see A.3.3) and 5 mL of nitric acid (see A.3.1), heat, until it is completely dissolved, cool to room temperature, transfer into a 1,000 mL volumetric flask, use deionized water to dilute it to the scale, and mix it well. The rhenium mass concentration c of this solution is 1,000 $\mu\text{g/mL}$.

A.3.5 Pure tungsten solution: weigh-take 5.0000 g of metallic tungsten powder ($\geq 99.99\%$) into a 150 mL beaker, in several times, dropwise add 30 mL of hydrogen peroxide (see A.3.2), heat at low temperature, until it is completely dissolved, add 10 mL of deionized water, boil, remove and cool to room temperature. Transfer it to a 1,000 mL volumetric flask, use deionized water to dilute it to the scale, and mix it well. The tungsten mass concentration c of this solution is 5,000 $\mu\text{g/mL}$.

A.4 Instruments

Inductively coupled plasma emission spectrometer.

A.5 Specimens

The specimens shall be prepared into a state that is easy to dissolve.

A.6 Analytical Steps

A.6.1 Number of determinations

Perform two independent determinations and take the average value.

A.6.2 Test portion

Weigh-take 0.1 g of specimen, accurate to 0.0001 g.

A.6.3 Blank test

Carry out a blank test along with the test portion.

A.6.4 Determination

A.6.4.1 Place the test portion (see A.6.2) in a 150 mL beaker, use an appropriate amount of deionized water to moisten it, dropwise add 6 mL of hydrogen peroxide (see A.3.2), heat at low temperature, until the test portion is completely dissolved, add 10 mL of deionized water, boil, remove and cool to room temperature. Transfer it to a 100 mL volumetric flask, use deionized water to dilute to the scale, and mix it well.

A.6.4.2 Draw a working curve: respectively pipette 0.00 mL, 1.00 mL, 3.00 mL, 5.00 mL, 8.00 mL and 10.00 mL of the rhenium standard solution (see A.3.4) into a set of 100 mL volumetric flasks, add 20.00 mL of the pure tungsten solution (see A.3.5), use deionized water to dilute it to the scale, and mix it well. Ignite the plasma, wait for the instrument to stabilize, and then, at a wavelength of 358.015 nm, in the sequence of increasing concentration, successively determine and draw the working curve.

A.6.4.3 Determine the solution (see A.6.4.1) at a wavelength of 358.015 nm and obtain the corresponding rhenium content based on the working curve.

A.7 Result Calculation

In accordance with Formula (A.1), calculate the mass fraction of rhenium:

$$w_{\text{Re}} = \frac{(c_1 - c_0) \times V \times 10^{-6}}{m} \times 100\% \quad \dots\dots\dots (A.1)$$

Where,

w_{Re} ---the mass fraction of rhenium element;

c_1 ---the mass concentration of the element under test in the specimen solution, expressed in (μg/mL);

c_0 ---the mass concentration of the element under test in the sample blank solution, expressed in (μg/mL);

V ---the volume of the solution under test, expressed in (mL);

m ---the mass of the specimen, expressed in (g).

This is an excerpt of the PDF (Some pages are marked off intentionally)

Full-copy PDF can be purchased from 1 of 2 websites:

1. <https://www.ChineseStandard.us>

- SEARCH the standard ID, such as GB 4943.1-2022.
- Select your country (currency), for example: USA (USD); Germany (Euro).
- Full-copy of PDF (text-editable, true-PDF) can be downloaded in 9 seconds.
- Tax invoice can be downloaded in 9 seconds.
- Receiving emails in 9 seconds (with download links).

2. <https://www.ChineseStandard.net>

- SEARCH the standard ID, such as GB 4943.1-2022.
- Add to cart. Only accept USD (other currencies - <https://www.ChineseStandard.us>).
- Full-copy of PDF (text-editable, true-PDF) can be downloaded in 9 seconds.
- Receiving emails in 9 seconds (with PDFs attached, invoice and download links).

Translated by: Field Test Asia Pte. Ltd. (Incorporated & taxed in Singapore. Tax ID: 201302277C)

About Us (Goodwill, Policies, Fair Trading...): <https://www.chinesestandard.net/AboutUs.aspx>

Contact: Wayne Zheng, Sales@ChineseStandard.net

Linkin: <https://www.linkedin.com/in/waynezhengwenrui/>

----- The End -----