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Replacing GB/T 3952-2008

Copper drawing stock for electrical purpose

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Table of contents

Foreword.....	3
1 Scope	5
2 Normative references	5
3 Requirements	5
4 Test method	11
5 Inspection rules	12
6 Marking, packaging, transport, storage and quality certificate.....	14
7 Order (or contract) content	15
Appendix A (Informative) Copper drawing stock for electrical purposes - Determination of the amount of copper powder - Dry brushing method.....	16
Appendix B (Informative) Test method for annealing performance of copper drawing stocks	18
Appendix C (Informative) Test method for oxide film of copper drawing stock	19

Foreword

This standard is drafted in accordance with the rules given in GB/T 1.1-2009.

This standard replaces GB/T 3952-2008 “Copper drawing stocks for electrical purposes”. As compared with GB/T 3952-2008, the main technical changes of this standard are as follows:

- In the normative references, DELETE GB/T 238 “Metallic materials - Wire - Reverse bend test”; ADD YS/T 464 “Methods for analytical of copper cathode - The optical emission spectrometry” and GB/T 23606 “Copper-hydrogen embrittlement test method”.
- MODIFY the content requirements of the impurity element Bi in the designations T2 and TU2, changing its mass fraction from 0.0006% to 0.0005%.
- MODIFY the requirements of the total amount of impurities in the designation T3, changing it from 0.05% to 0.06%.
- DEFINE the gauge distance for the elongation test sample at 200mm.
- UNIFY the gauge distance for the sample of copper powder amount and twist off test into 250mm.
- ADD the surface oxide film indicator requirements of the copper drawing stocks; ADD the oxide film determination method, as shown in Appendix C.
- CHANGE the sampling amount for the chemical composition, electrical performance, copper powder amount, and hydrogen embrittlement from every 15 rolls or 30 t into every 15 rolls or 60 ton.
- MODIFY the hydrogen embrittlement test method of the oxygen-free copper drawing blanks, changing from the Appendix B hydrogen embrittlement test method of the oxygen-free copper drawing blanks into GB/T 23606 hydrogen embrittlement test method.

This standard was proposed by China Nonferrous Metals Industry Association.

The standard shall be under the jurisdiction of the National Nonferrous Metals Standardization Technical Committee (SAC/TC 243).

The responsible drafting organizations of this standard: Jiangxi Copper Co., Ltd., Yunnan Copper Co., Ltd., Jiangsu Jiangrun Copper Co., Ltd., Tongling Nonferrous Metals Group Holdings Tongguan Electric Co., Ltd.

Copper drawing stock for electrical purpose

1 Scope

This standard specifies the requirements, test methods, inspection rules, marking, packaging, transport, storage, quality certificates, and orders (or contracts) contents of the copper drawing stock for electrical purposes.

This standard applies to the circular cross-section copper wire stock having a diameter of 6.0 mm ~ 35.0 mm, which is used for further drawing to produce wire materials OR for other copper conductors for electrical purposes.

2 Normative references

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) are applicable to this Standard.

GB/T 230.1 Metallic materials - Rockwell hardness test - Part 1: Test methods (scale A, B, C, D, E, F, G, H, K, N, T)

GB/T 3048.2 Test methods for electrical properties of electric cables and wires - Part 2: Test of electrical resistivity of metallic materials

GB/T 4909.2 Test methods for bare wires - Part 2: Measurement of dimensions

GB/T 4909.3 Test methods for bare wires - Part 3: Tensile test

GB/T 4909.4 Test method for bare wires - Part 4: Torsion test

GB/T 5121 (all parts) Methods for chemical analysis of copper and copper alloys

GB/T 23606 Copper-hydrogen embrittlement test method

YS/T 464 Methods for analytical of copper cathode - The optical emission spectrometry

3 Requirements

3.1 Product classification

3.1.1 Designation, status, specifications

If the user has the annealing performance requirement for the copper drawing stock of T3 designation AND indicated in the contract, it may make the annealing performance test with reference to the methods in Appendix B, AND indicate the annealing performance of this batch of products in the supply quality certificates. [If the measured Rockwell hardness (grade F) is less than 60 HRF, it will be deemed as full annealing; if it is 60 HRF ~ 70 HRF, it will be deemed as medium annealing; AND if it is greater than 70 HRF, it will be deemed as low annealing].

4 Test method

4.1 Chemical composition

The chemical composition analysis method of copper drawing stocks may follow the requirements of GB/T 5121 (all parts) or YS/T 464. The arbitration analysis method shall be in accordance with GB/T 5121 (all parts).

4.2 Dimensional measurement

The method of measuring the size of copper drawing stock shall be in accordance with the provisions of GB/T 4909.2.

4.3 Surface quality

The surface quality of copper drawing stocks is visually inspected AND the surface oxide film test is carried out with reference to Appendix C.

4.4 mechanical properties

The tensile test of copper drawing stock at room temperature shall be carried out in accordance with GB/T 4909.3, AND the sample will use the gauge distance of 200 mm.

4.5 Torsional performance

The twist off test shall be carried out in accordance with the provisions of GB/T 4909.4. The gauge length of the sample is 250 mm AND the torsional speed is 30 r/min (the speed deviation is within $\pm 10\%$).

4.6 Electrical performance

4.6.1 The test methods for the resistivity of copper drawing stock shall be in accordance with the requirements of GB/T 3048.2.

4.6.2 It shall prepare sample for the resistivity test using the following methods: CLEAN and PROCESS the sample to such an extent as having a diameter of 2 mm; REMOVE oil stain; MAKE it subjected to annealing in the 500 °C ~ 550 °C protective atmosphere for 30 min; then in the same protective atmosphere, COOL it down quickly OR quickly TRANSFER it from air into water for cooling purposes.

5.5.1 When the chemical composition and electrical performance are disqualified, the corresponding batch is deemed as disqualified. When the mechanical properties, torsional performance, surface quality and dimensional deviation are disqualified, the corresponding roll is deemed as disqualified.

5.5.2 When the amount of copper powder, hydrogen embrittlement and annealing performance are not in accordance with this standard or the order (or contract), a double number of samples shall be taken from this batch of products (including the roll of product which is disqualified in the original inspection) for repeated test. If the repeated test results are all qualified, this batch of products complies with the requirements of the contract; if there is still disqualified sample in the repeated test results, this batch of products is disqualified OR it will be subjected inspection roll by roll, AND only those qualified are batched and supplied.

6 Marking, packaging, transport, storage and quality certificate

6.1 Marking

The each roll of qualified copper drawing stock shall be attached with the label indicating the following information:

- a) Name of the manufacturer;
- b) Product trademark;
- c) Product designation, status, specifications;
- d) Net weight;
- e) Lot number;
- f) Production date.

6.2 Packaging

6.2.1 Copper drawing stocks shall be wrapped in a roll AND tied well.

6.2.2 It shall have the measures to prevent moisture, contamination, and mechanical damage.

6.2.3 It is allowed for both parties to specify the packaging method through negotiation.

6.3 Transport, storage

In the storage, handling and transport process, it shall pay attention to protect the copper drawing stock from mechanical damage AND to prevent copper drawing stock from dampen or erosion from corrosive material.

Appendix A

(Informative)

Copper drawing stock for electrical purposes - Determination of the amount of copper powder - Dry brushing method

A.1 Scope

This Appendix specifies the method for determining the amount of copper powder on the surface of copper drawing stock which is processed by continuous casting and rolling for electrical purposes.

This appendix is only applicable to the determination of the amount of copper powder on the surface of copper drawing stock of $\Phi 8$ mm which is processed by continuous casting and rolling.

A.2 Sample preparation

A.2.1 CUT a section of copper drawing stock sample of 300 mm ~ 350 mm length which had passed the surface quality inspection; gently STRAIGHTEN it; USE anhydrous ethanol or other organic solvents to clean the surface of the protective wax coating and residual emulsification liquid on the surface of the clean copper drawing stock; USE a transparent tape to wrap the both ends of the sample at a length of 25 mm ~ 50 mm; MAKE the copper drawing stock spacing between the two tapes at 250 mm.

A.2.2 USE a balance to weigh the copper drawing stock sample at both ends of which are wrapped with tape, and MAKE record (in the unit of grams, accurate to 4 digits after the decimal point).

A.3 Test

A.3.1 INSERT the sample into the torsional testing machine. The clamping parts of the two chucks are the two ends wrapped with a transparent tape. MAKE the sample be subjected to 10/10 torsion forward and backward, with the torsional speed set at 30 r/min (with the speed deviation between $\pm 10\%$); after this, USE soft brush to gently brush the sample, in order to thoroughly clean the powder sample within the spacing of the sample.

A.3.2 It shall avoid the sample which is taken from the testing machine from being contaminated; if it finds that the tape is stripped, it shall take the tape from the chuck, AND the copper powder on the tape shall be retained.

A.3.3 If there is any difficulty in weighing the copper drawing stock, it may also place a clean porcelain plate slightly longer than 250 mm below the chuck of the torsional test machine, so that the copper powders falling off in the torsional test all fall into the clean porcelain plate; after finishing torsion, USE

Appendix B

(Informative)

Test method for annealing performance of copper drawing stocks

B.1 Scope

This Appendix specifies the test method for the annealing performance of copper drawing stock.

This appendix applies to the inspection of the annealing performance of copper drawing stock.

B.2 Sample preparation

B.2.1 From the same batch of copper drawing stock product, CUT the blank sample of appropriate length which had passed the inspection as specified in 3.4.2 from the ends of every 60 ton of roll.

B.2.2 Cold ROLL the sample into a flat section on a cold rolling mill, at a thickness of 30% of the diameter of the original drawing stock; AND it is not required for edge rolling.

B.2.3 PLACE the flat sample after cold rolling into a thermostatic bath; HEAT it at a temperature of $275\text{ °C} \pm 1\text{ °C}$ for 15 min; and then quickly PLACE it in water at ambient temperature for water quenching [it may also use other temperature and time in accordance with the order (or contract)].

B.3 Hardness test

B.3.1 The Rockwell hardness test method of the sample after the heat treatment shall be in accordance with the provisions of GB/T 230.1.

B.3.2 The scale for the Rockwell hardness uses the F scale [steel ball having a pressure head of "1/6" (1.5875 mm), the total test force of 588.4 N, measuring hardness range of 60 HRF ~ 100 HRF].

B.3.3 The test shall be carried out along the center line of the annealed sample AND the average value shall be calculated in accordance with the number of tests as specified in the standard.

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