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Free-cutting copper alloy rod and bar

易切削铜合金棒

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Standardization Administration of the People's Republic of China.

Table of Contents

Free-cutting copper alloy rod and bar

1 Scope

This document specifies the requirements, test methods, inspection rules and marks, packaging, transportation, storage, quality certificate and contract (or purchase orders), etc. for free-cutting copper alloy rod and bar.

This Standard applies to free-cutting copper alloy rod and bar.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 228-2002, *Metallic materials - Tensile testing at ambient temperature*

GB/T 2828.1, *Sampling procedures for inspection by attributes - Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

GB/T 3310, *Ultrasonic testing method of copper and copper alloy bars*

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

GB/T 5231-2001, *Wrought copper and copper alloys chemical composition limits and forms of wrought products*

GB/T 6394, *Determination of estimating the average grain size of metal*

GB/T 8888, *Wrought heavy non-ferrous metal products - Packing, marking, transporting, storing and quality certificate*

GB/T 10119, *Determination of dezincification corrosion resistance of brass*

GB/T 10567.2, *Wrought copper and copper alloy - Detection of residual stress - Ammonia test*

GB/T 26303.2, *Measuring methods for dimensions and shapes of wrought copper and copper alloy - Part 2: Rod, wire and profile*

YS/T 336, *Methods of fracture test for tube and rod of copper and copper alloys, nickel and nickel alloys*

The cross-section shapes of the product are shown in Figure 1. Markings are indicated in the order of product name, designation, state, accuracy level, specification and standard number. Marking examples are as follows:

Example 1: Round rods and bars that are manufactured from HPb59-2, the supply state is Y_2, the accuracy level is high, the outside diameter is 20 mm and the length is 2000 mm, are marked as:

Round rod and bar HPb59-2 Y_2 high 20×2000 GB/T 26306-2010

Example 2: Square rods and bars that are manufactured from HBi59-1, the supply state is Y, the accuracy level is high, the side length is 20 mm and the length is 2000 mm, are marked as:

Square rod and bar HBi59-1 Y high 20×2000 GB/T 26306-2010

Example 3: Rectangular rods and bars that are manufactured from HSi75-3, the supply state is Y_2, the accuracy level is common, the height is 25 mm, the width is 40 mm and the length is 2000 mm, are marked as:

Rectangular rod and bar HSi75-3 Y_2 40×25×2000 GB/T 26306-2010

Example 4: Regular hexagonal rods and bars that are manufactured from QTe0.3, the supply state is Y, the accuracy level is high, the side-to-side distance is 10 mm and the length is 1000 mm, are marked as:

Regular hexagonal rod and bar QTe0.3 Y high 10×1000 GB/T 26306-2010

3.2 Chemical composition

The chemical composition of rods and bars whose designations are HPb59-1, HPb59-3, HPb60-2, HPb62-3, HPb63-3, QTe0.5, QSn4-4-4 shall meet the requirements for the corresponding designations in GB/T 5231. The chemical composition of other designations shall comply with the provisions in Table 2 (see Annex B for rod and bar designations and corresponding designations in American ASTM standards).

Annex A

(informative)

Testing method for cutting

A.1 Scope

This appendix specifies the test methods for cutting of copper and copper alloys.

This appendix is applicable to the testing of cutting of copper and copper alloys.

A.2 Principle

Take the cutting index of lead brass HPb62-3 (US C36000) as 100%. Do a comparative test with the specimen to be tested. Take the cutting force measured during the specimen cutting test or the cutting force calculated from current and voltage values as the main evaluation index.

A.3 Main equipment

Automatic lathe, cutting force dynamometer or EX power monitor, alloy tool, vernier caliper, ruler.

A.4 Specimen

A.4.1 Comparison specimen

For HPb62-3 (US C36000) alloy straight rod and bar with a length of 200 mm and a diameter of ϕ25 mm, the standard composition is: Cu 61.5%, Zn 35.5%, Pb 3.0% (the expanded uncertainty of each element is 0.06%).

A.4.2 Specimen to be tested

Make a specimen to be tested with the same state, straightness and shape as the comparison specimen.

A.5 Test methods and steps

There are two test methods. Follow Method One when using the cutting force dynamometer. Follow Method Two when using the EX battery monitor.

A.5.1 Method One

Put the comparison specimen HPb62-3 and the specimen to be tested on the same automatic lathe equipped with a cutting force dynamometer. Carry out the cutting

detection test according to the same test conditions (rotational speed of lathe spindle, cutting speed, alloy tool and its parameters, feed rate, cutting state, ambient temperature, etc.). At least three sets of average data of cutting force F (including axial force F_X, radial force F_Y and main cutting force F_Z) are collected for each specimen. Each set of test data collects more than 50 points.

Determine the cutting parameters: 1) Fine turning: the cutting amount is 0.5 mm; the rotating speed is 820 r/min; the cutting speed is 0.260 mm/r. 2) Rough turning: the cutting amount is 1 mm; the rotating speed is 610 r/min; the cutting speed is 0.260 mm/r (cutting parameters can be selected from fine turning or rough turning).

A.5.2 Method Two

A.5.2.1 Put the comparison specimen HPb62-3 and the specimen to be tested on the same automatic lathe equipped with EX power monitor. Carry out the cutting detection test according to the same test conditions (rotational speed of lathe spindle, cutting speed, alloy tool and its parameters, feed rate, cutting state, ambient temperature, etc.).

A.5.2.2 Test steps

A.5.2.2.1 Turn on the lathe. Perform idling. Record the no-load current from the EX power monitor for future use.

A.5.2.2.2 Determine the cutting parameters: 1) Fine turning: the cutting amount is 0.5 mm; the speed is 820 r/min; the cutting speed is 0.260 mm/r. 2) Rough turning: the cutting amount is 1 mm; the rotating speed is 610 r/min; the cutting speed is 0.260 mm/r (cutting parameters are selected from fine turning or rough turning).

A.5.2.2.3 Conduct the cutting test. For each specimen, record the data of three-phase current I_a, I_b, I_c and three-phase voltage U_a, U_b, U_c at the same time point. Collect at least ten sets of data.

A.5.2.3 Calculation method

The power consumed in the cutting process is called cutting power P_m. The cutting power is the sum of the power consumed by the axial force F_x, the radial force F_y and the main cutting force F_z. Since there is no displacement in the F_y direction, no power is consumed, so the formula (A.1) is obtained:

$$P_m = (F_z \cdot v + F_x \cdot n_w \cdot f/1\,000) \times 10^{-3} \qquad \cdots\cdots\cdots\cdots\cdots\cdots (A.1)$$

Where,

P_m - Cutting power, in kilowatts (kW);

F_z - Main cutting force, in Newtons (N);

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