

ICS 77.160
CCS H 72



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 38384-2019

Spherical molybdenum powder

球形钼粉

Issued on: December 31, 2019

Implemented on: November 1, 2020

**Issued by: State Administration for Market Regulation;
Standardization Administration of the PRC**

Table of Contents

- 1 Scope
- 2 Normative references
- 3 Technical requirements
 - 3.1 Chemical composition
 - 3.2 Particle size
 - 3.3 Apparent density
 - 3.4 Flowability
 - 3.5 Sphericity
 - 3.6 Appearance quality
- 4 Test methods
 - 4.1 Determination of the chemical composition
 - 4.2 Determination of the particle size
 - 4.3 Determination of the apparent density
 - 4.4 Determination of the flowability
 - 4.5 Determination of the sphericity
 - 4.6 Appearance quality
- 5 Inspection rules
 - 5.1 Inspection and acceptance
 - 5.2 Formation of lots
 - 5.3 Inspection items and sampling
 - 5.4 Judgement of the inspection results
- 6 Marking, packaging, transport, storage and quality certificate
 - 6.1 Marking
 - 6.2 Packaging
 - 6.3 Transport
 - 6.4 Storage
 - 6.5 Quality certificate
- 7 Content of the order form (or contract)

Foreword

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

This standard was proposed by the China Nonferrous Metals Industry Association and is under the jurisdiction of the National Technical Committee on Nonferrous Metals Standardization (SAC/TC 243).

The standard was issued on 31 December 2019 by the State Administration for Market Regulation and the Standardization Administration of the People's Republic of China, and has been in force since 1 November 2020.

1 Scope

China's national standard for the spherical molybdenum powder produced by plasma spheroidization. Molybdenum powder as it comes from the hydrogen reduction of the oxide is angular and irregular, which is perfectly good when it is going to be pressed and sintered and useless for the processes this product serves: a powder-bed printer spreads a layer a few tens of microns thick and melts a track through it, and a powder that will not flow evenly leaves voids that no amount of laser power will close. Passing the irregular particles through a plasma melts them in flight and surface tension pulls each one round, which for a metal that melts at 2623 degrees C is an expensive thing to do - so the buyer needs a specification that states what was bought. This standard sets it: molybdenum at 99.95 per cent or better with named ceilings on iron, nickel, silicon, tungsten, carbon and oxygen; two particle size classes covering 20 to 45 microns and above 45 to 150 microns; an apparent density between 4.0 and 6.0 grams per cubic centimetre; a Hall flow between 10 and 20 seconds per 50 grams; and a sphericity of at least 85 per cent. Oxygen is the figure to watch, because it is picked up during spheroidization and carried straight into the finished part. Every property is tied to an existing national test method, and the inspection clause says what is sampled from each lot, what happens when a result fails, and how a disagreement between supplier and buyer is arbitrated within 45 days of delivery. The remaining clauses cover packing in sealed foam-lined drums of 25 or 50 kg net, storage in a dry and ventilated place free of acid and alkali vapour for no more than three months, and the quality certificate and order-form content that must travel with the material.

This standard specifies the technical requirements, the test methods, the inspection rules, the packaging, marking, storage and transport, and the content of the quality certificate and of the order form (or contract) for spherical molybdenum powder.

This standard applies to spherical molybdenum powder produced by plasma spheroidization technology.

2 Normative references

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

GB/T 1479.1 Metallic powders - Determination of apparent density - Part 1: Funnel method

GB/T 1480 Metallic powders - Determination of particle size by dry sieving

GB/T 1482 Metallic powders - Determination of flowability by means of a calibrated funnel (Hall flowmeter)

GB/T 4325 (all parts) Methods for chemical analysis of molybdenum

GB/T 5314 Powders for powder metallurgical purposes - Sampling

GB/T 8170 Rules of rounding off for numerical values and expression and judgement of limiting values

YS/T 1297 Method for the determination of the sphericity of titanium and titanium alloy powders

3.1 Chemical composition

The chemical composition of the product shall comply with Table 1. For grade PMo-1 the molybdenum content, as a mass fraction, shall be not less than 99.95 per cent, and the impurity content, as a mass fraction, shall be not greater than: iron 0.0050 per cent, nickel 0.0020 per cent, silicon 0.0020 per cent, tungsten 0.020 per cent, carbon 0.0080 per cent and oxygen 0.0800 per cent.

NOTE to Table 1: the molybdenum content is calculated by difference from the impurities, the gaseous elements such as carbon and oxygen being excluded.

3.2 Particle size

The particle size of the product shall comply with Table 2. Class I covers the range 20 micrometres to 45 micrometres and class II the range above 45 micrometres up to 150 micrometres.

NOTE to Table 2: the total quantity of product falling outside the specified particle size range shall be not greater than 5 per cent of the mass of the lot.

3.3 Apparent density

The apparent density of the product shall be from 4.0 g/cm³ to 6.0 g/cm³.

3.4 Flowability

The flowability of the product shall be from 10 s per 50 g to 20 s per 50 g.

3.5 Sphericity

The sphericity of the product shall be not less than 85 per cent.

3.6 Appearance quality

The product shall be a dark grey powder, loose and free from lumps, and free from impurities visible to the naked eye.

4.1 Determination of the chemical composition

The chemical composition of the product shall be determined in accordance with GB/T 4325.

4.2 Determination of the particle size

The particle size of the product shall be determined in accordance with GB/T 1480.

4.3 Determination of the apparent density

The apparent density of the product shall be determined in accordance with GB/T 1479.1.

4.4 Determination of the flowability

The flowability of the product shall be determined in accordance with GB/T 1482.

4.5 Determination of the sphericity

The sphericity of the product shall be determined in accordance with YS/T 1297.

4.6 Appearance quality

The appearance quality of the product shall be inspected visually.

5.1 Inspection and acceptance

5.1.1 The product shall be inspected by the quality inspection department of the supplier, it shall comply with this standard (or with the order contract), and a quality certificate shall be filled in.

5.1.2 The purchaser shall inspect the product received in accordance with the provisions of this standard. Where the result of that inspection does not agree with the provisions of this standard (or of the order contract), the purchaser shall raise the matter with the supplier within 45 days of receiving the product, or within the time laid down in the sales contract, and it shall be settled by negotiation between the two parties. Where arbitration is required, the arbitration material shall be not less than 60 per cent of that lot of product, the arbitration sample shall be taken jointly by the two parties at the place where the goods are stored, and the arbitration body shall be agreed jointly by the two parties.