



## 3D Printing Spherical Tungsten Powder National Standard

GB/T 41338-2022 (Tungsten and tungsten alloy powder for additive manufacturing)

### 1. Range

This document specifies the technical requirements, test methods, inspection rules, marking, packaging, transportation, storage, accompanying documents and order form for tungsten and tungsten alloy powders for additive manufacturing.

This document applies to tungsten and tungsten alloy powders for additive manufacturing.

### 2. Normative References

The content in the following documents constitutes the essential provisions of this document through normative references in the text. Among them, for dated references, only the version corresponding to the date applies to this document; for undated references, the latest version (including all amendments) applies to this document.

GB/T1479. 1 Metal powders - Determination of bulk density - Part 1: Funnel method

GB/T1480 Metal powders - Determination of particle size by dry sieving

GB/T1482 Metal powders - Determination of fluidity - Standard funnel method (Hall flow meter)

GB/T4324 (all parts) Methods for chemical analysis of tungsten

GB/T5162 Metal powders - Determination of tap density

GB/T5314 powder for powder metallurgy - sampling method

GB/T14265 General Rules for Analytical Methods of Hydrogen, Oxygen, Nitrogen, Carbon and Sulfur in Metallic Materials

GB/T19077 Particle size distribution Laser diffraction method

GB/T 35351 Additive manufacturing Terminology

### 3. Terms and Definitions

The terms and definitions defined in GB/T 35351 apply to this document.

### 4. Technical Requirements

#### 4. 1 Chemical composition

The chemical composition of the product should meet the requirements in Table 1.

Grade	Chemical Content %											
	W	Mo	Ni	Fe	Al	Mg	Si	Ca	C	N	H	O
W-1*	≥ 99.96	≤ 0.005	≤ 0.03									
W-2*	≥ 99.93	≤ 0.010	≤ 0.020	≤ 0.10								
WMo	Balance	2.0~20.0	≤ 0.010	≤ 0.05								
WNiFe	Balance	≤ 0.010	1.0~9.0	1.0~9.0	≤ 0.010	≤ 0.010	≤ 0.010	≤ 0.010	≤ 0.010	≤ 0.010	—	≤ 0.05

\* W 含量为 100% 减去表中所示杂质 (不包含 C、N、H、O) 实测含量的总和。

W content is 100% minus impurity content shows in the table, (exclude C,N,H,O)

#### 4. 2 Granularity

The particle size of the product should meet the requirements in Table 2.

Grade	Category	Size μm	Size Composition	Size Distribution	Application
W-1 W-2	I	0~25	—	5.0 μm ≤ D <sub>10</sub> ≤ 10.0 μm 10.0 μm ≤ D <sub>50</sub> ≤ 20.0 μm 20.0 μm ≤ D <sub>90</sub> ≤ 30.0 μm	For laser melting process
W-1 W-2	II	15~53	>53 μm ≤ 5%	20.0 μm ≤ D <sub>50</sub> ≤ 45.0 μm	
WMo WNiFe	III	45~106	≤45 μm ≤ 5%, >106 μm ≤ 5%	60.0 μm ≤ D <sub>50</sub> ≤ 85.0 μm	For Electron Beam Melting Process

Particle size can be customized upon discussion by both parties.

#### 4. 4 Tap density

The tap density of the product should meet the requirements in Table 4.

Category	Tap Density g/cm <sup>3</sup>		
	W-1, W-2	WMo	WNiFe
I	≥10.60	—	—
II	≥11.00	≥10.00	≥10.00
III	≥11.80	≥10.00	≥10.00

#### 4. 5 Liquidity

The fluidity of the product should meet the requirements in Table 5.



Category	Liquidity s/50 g		
	W-1, W-2	WMo	WNiFe
I	≤10.0	—	—
II	≤8.0	≤10.0	—
III	≤7.0	≤10.0	≤10.0

#### 4. 6 Appearance

The appearance of the product is gray, without visible inclusions.

#### 4. 7 Other

If the buyer has special requirements on the powder spherical rate and hollow powder rate, it shall be determined through consultation between the supplier and the buyer, and shall be indicated in the order form.

### 5. Test Method

#### 5. 1 Chemical composition

5. 1. 1 The analysis method of H content in the product shall be carried out according to the provisions of GB/T14265.

5. 1. 2 Mo, Ni, Fe, Al, Mg, Si, Ca, C, O, N content analysis methods according to GB/T4324 (all parts) required to proceed.

5. 1. 3 The analysis method of Mo content in WMo products shall be determined through negotiation between the supplier and the purchaser, and the analysis methods of other elements shall be in accordance with GB/T4324 (all parts points) according to the regulations.

5. 1. 4 The analysis method of Ni and Fe content in WNiFe products shall be determined through negotiation between the supplier and the purchaser, and the analysis method of other elements shall be in accordance with GB/T4324 (all parts points) provisions.

#### 5. 2 Granularity

The particle size composition of the product is determined according to the provisions of GB/T1480, and the particle size distribution of the product is determined according to the provisions of GB/T19077.

#### 5. 3 Bulk Density

The bulk density of the product is determined according to GB/T1479. 1 is carried out.

#### 5. 4 Tap Density

The tap density of the product is determined according to the provisions of GB/T5162.

#### 5. 5 Liquidity

The fluidity of the product is determined according to the provisions of GB/T1482.

#### 5. 6 Appearance Quality

The appearance quality of the product is inspected visually.

## 5. 7 Other

The test methods for product sphericity and hollow powder ratio shall be determined through consultation between the supplier and the purchaser.

## 6. Inspection Rules

### 6. 1 Inspection and Acceptance

6. 1. 1 The product shall be inspected by the supplier to ensure that the product quality complies with the provisions of this document and the order form, And fill in the accompanying documents.

6. 1. 2 The buyer can inspect the received products according to the provisions of this document and the order form,

If the test results are consistent with the provisions of this document and the purchase order

In case of discrepancy, it should be raised to the supplier within 45 days from the date of receipt of the product, and the supplier and the buyer should negotiate to resolve it. If arbitration is required, arbitration sampling is at the demand side, it is jointly carried out by both the supply and demand sides.

### 6. 2 Batches

The products should be submitted for acceptance in batches, and each batch of products is composed of the same production process, the same raw material, the same brand, and the same category of products.

### 6. 3 Inspection Items and Sampling

The inspection items and sampling of the product shall comply with the provisions in Table 6.

Inspection Items	Sampling	Sampling	Regulation	Regulation
Chemical Content	As per GB/T 5314	One share per batch	4.1	5.1
Particle Size			4.2	5.2
Apparent Density			4.3	5.3
Tap Density			4.4	5.4
Liquidity			4.5	5.5
Appearance	Per drum	Per drum	4.6	5.3

### 6. 4 Judgment of Test Results

6. 4. 1. When the chemical composition test results are unqualified, it is allowed to take another double number of samples (excluding the original test sample) to conduct a repeated test for the unqualified items. If any result of the repeated test is still unqualified, the batch shall be judged. The product is substandard.

6. 4. 2. If any of the test results of particle size, bulk density, tap density and fluidity fail to pass, it is allowed to take another double number of samples (excluding the original test sample) to carry out a repeated test for the unqualified items. If any result of repeated inspection is still unqualified, the batch of products shall be judged as unqualified.



6. 4. 3. If the result of the appearance quality inspection is unqualified, the bag/barrel product shall be judged as unqualified. 6. 4. 3. If the result of the appearance quality inspection is unqualified, the bag/barrel product shall be judged as unqualified.

## 7. Marking, Packaging, Transportation, Storage and Accompanying documents

### 7. 1 Sign

Each minimum packaging unit of the product should have a mark indicating:

- a) Supplier name;
- b) product name;
- c) grade;
- d) production batch number;
- e) granularity (category);
- f) net weight;
- g) the date of packing;
- h) the number of this document;
- i) Marks such as "moisture-proof" and "prevent inhalation".

### 7. 2 Packaging

Products can be packaged in plastic bags with double-layer vacuum plastic packaging, or in clean wooden boxes, plastic drums, and iron drums as container units, and vacuum-packed. During the packaging process, environmental conditions should be strictly controlled to avoid pollution. The quality of product packaging is divided into four specifications: 1kg, 2kg, 5kg, and 10kg, and can also be packaged according to the needs of the buyer.

### 7. 3 Transport

The product should be transported in a covered environment. During the transportation process, it should be protected from rain and moisture. It should not be violently bumped or mechanically squeezed. During the transportation process, it should be lightly loaded and unloaded.

### 7. 4 Storage

The product should be sealed and stored in a ventilated and dry place, away from fire sources, and should not be stored together with oxidants, acids, alkalis and other corrosive substances, and kept away from direct sunlight.

### 7. 5 Accompanying Documents

Each batch of products should be accompanied by accompanying documents, which should include supplier information, product information, document number, date of manufacture or date of packaging

In addition, it should also include:

- a) Product Quality Assurance Letter, the contents are as follows:
  - The main performance and technical parameters of the product;
  - Product characteristics (including characteristics of manufacturing process and raw materials);



- Responsibility for product quality;
  - The quality certification obtained by the product and the various analysis and inspection results printed by the technical supervision department of the supplier;
- b) Inspection reports in the process of product quality control and finished product inspection reports;
- c) Instructions for use of the product: correct handling, use, storage methods, etc.;
- d) other.

### 8. Contents of Order Form

The order form for ordering the products listed in this document shall at least include the following contents:

- a) product name;
- b) Brand and category;
- c) net weight;
- d) the number of this document;
- e) Other.