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**Superalloys and intermetallic compounds - Designation and
chemical composition**

高温合金和金属间化合物 牌号及化学成分

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1 Scope

This document specifies the classification, designation naming rules and use, naming methods, representation methods, unified numerical designation coding rules, designations and their chemical compositions for superalloys and intermetallic compounds high temperature materials.

This document applies to the formulation and revision of product standards and technical agreements for wrought superalloys, (equiaxed-grain, directionally solidified columnar-grain, single-crystal) cast superalloys, additively manufactured superalloys, powder superalloys, dispersion-strengthened superalloys, welding-grade superalloys, and intermetallic compounds high temperature materials.

This document does not apply as the technical requirements for ordering products used alone as superalloys and intermetallic compounds high temperature materials.

2 Normative references

GB/T 17616

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 superalloy

Iron-, nickel-, chromium-, and cobalt-based alloy, which can operate for extended periods at temperatures above 600 °C and under certain stress conditions, and possesses excellent high-temperature strength, good resistance to oxidation and hot corrosion, as well as good fatigue performance and fracture toughness.

3.2 intermetallic compounds high temperature materials

Intermetallic compounds-based high-temperature materials which can maintain excellent performance under high-temperature conditions.

4.1 Classification of superalloys

According to the constituent elements of the matrix, it can be classified into four categories. iron-based (iron-nickel-based) superalloys, nickel-based superalloys, chromium-based superalloys, and cobalt-based superalloys. According to the main strengthening characteristics of alloys, it can be classified into solid-solution- strengthened superalloys and precipitation-hardened superalloys. According to the basic forming method or special application of alloys, it can be classified into wrought superalloys, equiaxed-grain cast superalloys, directionally solidified columnar-grain cast superalloys, single-crystal cast superalloys, powder metallurgy superalloys, dispersion-strengthened superalloys, additively manufactured superalloys, and welding-grade superalloys.

4.2 Classification of intermetallic compounds high temperature materials

According to the basic constituent elements of intermetallic compounds, it is classified into nickel-aluminum intermetallic compounds high temperature materials and titanium-aluminum intermetallic compounds high temperature materials.

5.1.1 For all superalloys and intermetallic compounds high temperature materials that

have undergone scientific research, trial production, and formal appraisal organized by the competent authority and have been transferred to mass production, as well as alloys or materials that have been formally approved for research and development, production, and have stable processes and supply by the country, the main production and research units shall submit a registration application for the material designation to the responsible unit of the standard.

5.1.2 Superalloys and intermetallic compounds high temperature materials in the

research and trial production stage should be named according to the designation naming method in this document.

5.2.1 Designation structure

The designations of superalloys and intermetallic compounds high temperature materials shall be represented by a combination of Chinese Pinyin letters and Arabic numerals, with the letters and numbers arranged without gaps. A general structure is shown in Figure 1.

5.2.2 Prefix

Determined based on the alloy's process or material properties, and is represented by the following one to three Chinese Pinyin letters.

- a) GH, a designation for wrought superalloy, using the Chinese pinyin letters "GH" as a prefix ("G" and "H" are the first letters of the pinyin for "super" and "alloy" respectively);
- b) K, a designation for equiaxed-grain cast superalloy, using the Chinese pinyin letter "K" as a prefix;
- c) DZ, a designation for directionally solidified columnar-grain cast superalloy, using the Chinese pinyin letters "DZ" as a prefix ("D" and "Z" are the first letters of the pinyin for "directionally" and "columnar" respectively);
- d) DD, a designation for single-crystal cast superalloy, using the Chinese pinyin letters "DD" as a prefix ("D" and "D" are the first letters of the pinyin for "directionally" and "single" respectively);
- e) HGH, a designation for welding-grade superalloy, using the Chinese pinyin letters "HGH" as a prefix ("H" before "GH" is the first letter of the pinyin for "welding");
- f) FGH, a designation for powder metallurgy superalloy, using the Chinese pinyin letters "FGH" as a prefix ("F" before "GH" is the first letter of the pinyin for "powder");
- g) MGH, a designation for dispersion-strengthened superalloy, using the Chinese pinyin letters "MGH" as a prefix ("M" before "GH" is the first letter of the pinyin for "dispersion");
- h) ZGH, a designation for additively manufactured superalloy, using the Chinese pinyin letters "ZGH" as a prefix ("Z" before "GH" is the first letter of the pinyin for "additively");
- i) JG, a designation for intermetallic compounds high temperature materials, using the Chinese pinyin letters "JG" as a prefix ("J" and "G" are the first letters of the pinyin for "metallic" and "high" respectively).

5.2.3 Classification code

5.2.3.1 The classification code shall be represented by one-digit Arabic numeral.

5.2.3.2 The classification codes for wrought superalloys, additively manufactured superalloys, and welding-grade superalloy wires are specified as follows.

- 1 - solid-solution-strengthened alloys with iron or iron-nickel (nickel content less than 50%) as the main element;
- 2 - precipitation-hardened alloys with iron or iron-nickel (nickel content less than 50%) as the main element;
- 3 - solid-solution-strengthened alloys with nickel as the main element;
- 4 - precipitation-hardened alloys with nickel as the main element;
- 5 - solid-solution-strengthened alloys with cobalt as the main element;
- 6 - precipitation-hardened alloys with cobalt as the main element;
- 7 - solid-solution-strengthened alloys with chromium as the main element;
- 8 - precipitation-hardened alloys with chromium as the main element.

Note 1. The first Arabic numeral in the designation of welding-grade superalloy wires does not indicate the type of strengthening; it simply follows the designation of wrought superalloys.

Note 2. The choice between odd and even classification codes is determined based on the main strengthening type used in the alloy.

5.2.3.3 The classification codes for cast superalloys, powder superalloys, and dispersion-strengthened superalloys are specified as follows.

- 2 - alloy with iron or iron-nickel (nickel content less than 50%) as the main element;
- 4 - alloy with nickel as the main element;
- 6 - alloy with cobalt as the main element;
- 8 - alloy with chromium as the main element.

5.2.3.4 The classification codes for intermetallic compounds high temperature materials

are specified as follows.

- 1 - titanium-aluminum intermetallic compounds high temperature materials;
- 4 - nickel-aluminum intermetallic compounds high temperature materials.

5.2.4 Serial number

Use a two- or three-digit Arabic numeral to represent different designations within the same material category.