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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 3246.2-2026

Replacing GB/T 3246.2-2012

Inspection methods for the structure of wrought aluminium and aluminium alloy products - Part 2: Inspection method for macrostructure

变形铝及铝合金制品组织检验方法 第2部分：低倍组织检验方法

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Table of Contents

1 Scope

GB/T 3246.2-2026 is the Chinese national standard covering the macrostructure of an aluminium product - the coarse grain rings, the flow lines, the segregation and the defects visible after etching a section, which is how an extrusion or a forging is judged before anyone looks at it under a microscope. At 25,000 words it is largely a reference atlas of what each defect looks like. It replaces GB/T 3246.2-2012 and has been in force since 1 November 2026. It was issued on 30 April 2026 and takes effect on 1 November 2026, replacing GB/T 3246.2-2012. The document is under the responsibility of the China Nonferrous Metals Industry Association. This page is published from the official record of the 2026 edition; the clause text of a standard this recent is not yet in circulation, and the figures, limits and tables it contains are those of the document itself, delivered in full with the English translation.

This document describes methods for examining the macrostructure of aluminum and aluminum alloy products. This document applies to the macrostructure examination of aluminum and aluminum alloy ingots (or billets), plates, strips, foils, tubes, rods, profiles, wires, forgings, and their processed products, as well as cast aluminum alloy products.

2 Normative references

The following documents contain provisions which, through reference in this text, constitute provisions of this document. For dated references, only the edition cited applies to this

document; for undated references, the latest edition (including all amendments) applies.

GB/T 6682 Water for analytical laboratory use - Specification and test methods

GB/T 8005 (all parts) Aluminium and aluminium alloy - Terms and definitions

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

GB/T 22638.1-2016 Test methods for aluminium and aluminium alloy foils - Part 1. Determination of thickness

GB/T 26492 (all parts) Defects for wrought aluminium and aluminium alloys ingots and products

GB/T 43139-2023 Density testing of cast aluminum alloy liquid reduced pressure solidification samples

3 Terms and definitions

The terms and definitions defined in GB/T 8005 (all parts) and GB/T 26492 (all parts), as well as the following terms and definitions, apply to this document.

3.1 Macrostructure Macro-scale structural features and defects of a material observed by the naked eye or at a magnification of 50x or less.

3.2 Grain An individual crystal possessing the same atomic structure within the microstructure of a polycrystalline material.

Note. A grain may contain twins or sub-grains.

3.3 Grain boundary A narrow region in the microstructure of a polycrystalline material where the crystal orientation transitions from one to another, thereby distinguishing adjacent grains.

3.4 Columnar grain A grain with a columnar shape within a cast microstructure.

Note. Columnar grains are formed in a directional heat flow, with their growth direction opposite to the direction of the heat flow.

3.5 Equiaxed grain A grain with approximately equal dimensions along the axes in all three spatial directions.

3.6 Recrystallization The process in which a plastically deformed solid metal or alloy forms a new grain structure, through grain nucleation and growth at a suitable temperature and for a suitable duration, thereby eliminating work hardening.

Note. Recrystallization encompasses both partial and complete recrystallization; complete recrystallization refers to the process wherein deformed grains are replaced by newly formed, strain-free grains.

3.7 Cast structure The microstructure obtained after liquid metal or alloy is poured into a mold and solidifies.

Note 1: A typical ingot structure generally consists of a surface zone of fine grains, a zone of columnar grains, a central zone of equiaxed grains. Note

2.Cast structure may persist in incompletely deformed microstructures.

3.8 Deformation structure A microstructure with specific characteristics, which is formed when a cast structure, annealed polycrystalline structure, or other polycrystalline structure undergoes irreversible morphological and internal structural changes, due to external forces during plastic processing (such as rolling, forging, extrusion, drawing, stamping, etc.).

4 Overview of method

Examine and analyze grains and defects within the material microstructure (cast structure, deformation structure, etc.) visually or with the aid of a magnifying glass; evaluate and characterize features such as grain size, porosity, inclusions, cracks, coarse grain rings, poor weld bonding, laps (folds), irregular flow lines, segregation layers, delamination, billet transition zones.

5 Reagents

Warning - The inorganic acids used in the analysis are corrosive to the human body; testing personnel shall wear personal protective equipment to avoid direct exposure that could cause skin burns. Unless otherwise specified, use only reagents confirmed to be of chemically pure grade and water conforming to Grade 3 requirements as specified in GB/T 6682.

5.1 Extra-strong mixed acid. Mix hydrofluoric acid (rho =

1.15 g/mL), nitric acid (rho =

1.40 g/mL), hydrochloric acid (rho =

1.19 g/mL) in a volume ratio of 1.5.15; mix thoroughly.

5.2 Strong mixed acid A. Mix hydrofluoric acid (rho =

1.15 g/mL), nitric acid (rho =

1.40 g/mL), hydrochloric acid (rho =

1.19 g/mL), water in a volume ratio of (1+5+15+42); mix thoroughly.

5.3 Strong mixed acid B. Mix hydrofluoric acid (rho =

1.15 g/mL), nitric acid (rho =

1.40 g/mL), hydrochloric acid (rho =

1.19 g/mL), water in a volume ratio of (3+3+9+5); mix thoroughly.

Note. Strong mixed acid B is also known as Tucker's reagent.

5.4 High-concentration mixed acid. Mix hydrofluoric acid (rho =

1.15 g/mL), nitric acid (rho =

1.40 g/mL), hydrochloric acid (rho =

1.19 g/mL), water in a volume ratio of (2+1+1+76); mix thoroughly.

5.5 Nitric acid, which has a concentration range of (1+4) ~ (1+3).

5.6 Sodium hydroxide solution A (80 g/L ~ 120 g/L).

5.7 Sodium hydroxide solution B (150 g/L ~ 250 g/L).