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

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**Ceramic ball bearings - Silicon nitride balls
(English Translation)**

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1 Scope

This document specifies the specifications and grades, technical requirements, inspection rules, as well as marking, packaging, transportation, storage of silicon nitride balls; describes the corresponding test methods.

This document is applicable to silicon nitride balls.

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. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 308.2 Rolling bearings - Balls - Part 2.Ceramic balls

GB/T 6569 Testing method for flexural strength of high performance ceramics

GB/T 10610 Geometrical product specifications (GPS) surface texture - Profile method - Rules and procedures for the assessment of surface texture

GB/T 10700 Test methods for elastic moduli of fine ceramics (advanced ceramics, advanced technical ceramics) - Bending method

GB/T 16534 Test method for Vickers hardness of high performance ceramics

GB/T 16535 Fine ceramics (advanced ceramics, advanced technical ceramics) - Test method for linear thermal expansion of monolithic ceramics by push-rod technique

GB/T 25995 Test methods for density and apparent porosity of fine ceramics

GB/T 34891 Rolling bearings - Parts made from high-carbon chromium bearing steels - Specifications for heat treatment

GB/T 41605 Silicon nitride materials for rolling bearing balls - Test method for fracture resistance at room temperature - Indentation fracture (IF) method

JC/T 2172 Aluminium titanate ceramic pipe for aluminium-melt feeding

3 Terms and definitions

The terms and definitions defined in GB/T 308.2, as well as the following terms and definitions, apply to this document.

3.1

Crack load ratio

The ratio -- of the crushing load value of a silicon nitride ball TO the standard crushing load value of a GCr15 steel ball of the same specification.

3.2

Preprocessed ball

A silicon nitride ball that has not undergone machining after sintering.

3.3

Fine ball

A silicon nitride ball that has undergone machining and possesses a specific dimensional precision.

3.4

Inclusion

A region within the silicon nitride ball that exhibits local non-uniformity in terms of phase and microstructure.

4.1 Ball specifications

The nominal diameters D_w of commonly used silicon nitride balls and their corresponding imperial sizes are shown in Table 1; nominal diameters for other specifications shall be determined through consultation between the supplier and the user.

Table 1 -- Nominal diameters of commonly used silicon nitride balls

4.2 Material grades

Silicon nitride balls are classified into three grades. I, II, III, based on flexural strength, hardness, fracture toughness, crack load ratio, microstructure.

4.3 Precision grades

Silicon nitride balls are classified into grades G3, G5, G10, G16, G20, G24, G28, G40, G60, G100, based on appearance, size tolerance, ball diameter variation, lot diameter variation, sphericity error, surface roughness; precision decreases sequentially from high to low.

5.1 Appearance quality

Table 5 -- Ball diameter variation, sphericity error, surface roughness

6.1 Appearance

Balls of grade G20 and higher precision shall be examined under a 20x stereomicroscope; balls of grades lower than G20 shall be visually inspected under fluorescent lighting.

6.2.1 Specimen preparation

Cut the silicon nitride ball to create a cross-section; grind, polish, ultrasonically clean the cross-section to prepare the test specimen. The specimen surface shall be free of scratches. The cross-section shall be ground and polished using one of the following two methods.

- a) First, grind the cross-section using diamond abrasive with a particle size of less than 50 μm ; then, polish using diamond or corundum abrasive with a particle size of less than 1 μm ;
- b) First, grind the cross-section using diamond abrasive with a particle size of less than 50 μm ; then, perform chemical polishing using cerium oxide, chromium oxide, or iron oxide.

6.2.2 Specimen observation

Observe inclusions and pores in the test specimen using an optical microscope at 100x or 200x magnification, to determine the number of inclusions per unit area; the final

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