

ICS 71.100.30

CCS Y 88



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

GB/T 20616-2026

Replacing GB/T 20616-2006

**Fireworks - Determination of bismuth content in pyrotechnic
composition**

烟花爆竹 烟火药中铋含量的测定

Issued on: February 27, 2026

Implemented on: June 1, 2026

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

Table of Contents

1.Scope	1
2 Normative References	1
3.Terms and Definitions	1
4.Principle	1
5.Reaction Formula	1
6.Reagent	2
7.Equipment and Tools	2
8.Sample Preparation	2
9.Analysis Steps	3
10 Result Calculation	3
11.Allowable difference	4

Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part

1.Structure and Drafting Rules of Standardization Documents". Drafting. This document supersedes GB/T 20616-2006 "Determination of Bismuth Content in Fireworks and Firecrackers Pyrotechnics" and is consistent with GB/T 20616-2006. Compared to previous versions, aside from structural adjustments and editorial changes, the main technical changes are as follows:

---The oven name and precision have been changed (see 7.1,

6.1 in the.2006 edition);

---The precision of the analytical balance has been changed (see 7.2,

6.2 in the.2006 edition);

---Added content on copper test sieves (see 7.5);

---The safety instructions have been revised (see 8.1, Chapter 7 of the.2006 edition);

---The method for preparing pyrotechnic sample has been modified (see 8.2, 7.1 of the.2006 edition);

---The temperature of the sample in the oven was changed (see 8.3,

7.2 in the.2006 edition);

---The description of the volume of test solution has been changed (see 9.5, 8.5 in the.2006 edition);

1 Scope

GB/T 20616-2026 is the Chinese national standard covering bismuth in a pyrotechnic mixture. Bismuth oxide replaced lead in the crackling compositions, and knowing how much is present is how a maker proves the lead is really gone. It fixes the reagents, the sample preparation, the procedure and the calculation. It replaces GB/T 20616-2006 and takes effect on 1 June 2026, one of the pyrotechnic analysis methods revised together. It was issued on 27 February 2026 and has been in force since 1 June 2026, replacing GB/T 20616-2006. The document is under the responsibility of the China National Light Industry Council. 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 a method for determining the bismuth content in fireworks and firecracker gunpowder. This document applies to the determination of bismuth content in fireworks and firecracker gunpowder.

2 Normative references

The contents of the following documents, through normative references within the text, constitute essential provisions of this document. Dated citations are not included. For references to documents, only the version corresponding to that date applies to this document; for undated references, the latest version (including all amendments) applies. This document.

GB/T 601 Preparation of Standard Titration Solutions for Chemical Reagents

GB/T 6682 Specifications and test methods for water used in analytical laboratories

GB/T 8170 Rules for rounding off numerical values and the representation and determination of limiting values

GB/T 41644 Test Methods for Fireworks and Firecrackers AQ4115 Technical Specification for Preventing Static Electricity Hazards in Fireworks and Firecrackers

3 Terms and Definitions

This document does not contain any terms or definitions that need to be defined.

4.Principles After pretreatment, the sample was fully dissolved in nitric acid and filtered. The pH of the solution was adjusted, and a precipitant was added to remove bismuth ions and

trimethylolpropionate from the solution. Ferric ions were separated from other components, and the total amount of bismuth and iron content were determined by disodium ethylenediaminetetraacetate (EDTA) complexometric titration. Measure the sample and then calculate the bismuth content. For iron determination, sulfosalicylic acid is used as an indicator, and EDTA standard titration solution is used at 60°C. Titrate at 70°C until the solution changes from red to light yellow and remains so for 30 seconds. Xylenol orange is used as an indicator solution when determining the total iron and bismuth content, and chloride solution is used... Titrate with zinc standard solution until the solution changes from yellow to orange.

5. Reaction Formula The reaction formula is as follows: $\text{Bi}_2\text{O}_3 \cdot 6\text{H}_2\text{O} = 2\text{Bi}^{3+} + 3\text{H}_2\text{O}$ $\text{Fe} + 4\text{HNO}_3(\text{dilute}) = \text{Fe}(\text{NO}_3)_3 + \text{NO} \uparrow + 2\text{H}_2\text{O}$ $\text{Cu}^{2+} + 2\text{OH}^- = \text{Cu}(\text{OH})_2 \downarrow$ $\text{Cu}(\text{OH})_2 + 4\text{NH}_3 = [\text{Cu}(\text{NH}_3)_4]^{2+} + 2\text{OH}^-$ $\text{Bi}^{3+} + 3\text{H}_2\text{Y}^{2-} = \text{BiY}^{3-} + 3\text{H}^+$