
काँसे के रासायनिक विश्लेषण — पद्धतियाँ
भाग 2 मैंगनीज ज्ञात करना — प्रकाशमिति पद्धति
(दूसरा पुनरीक्षण)

**Chemical Analysis of Bronzes —
Methods**
**Part 2 Determination of Manganese —
Photometric Method**
(*Second Revision*)

ICS 77.120.30

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FOREWORD

This Indian Standard (Part 2) (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Methods of Chemical analysis of Metals Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1967, covered determination of copper lead, tin, manganese, phosphorus, nickel, iron, silicon, aluminium, zinc and antimony in bronzes. Subsequently, the first revision was published in 1987 to bifurcate the standard into different parts which superseded IS 4027 : 1967.

This revision has been brought out to bring the standard in the latest style and format of the Indian Standards. This part is one of that series and covers the determination of manganese by photometric method. The other parts are as follows:

- Part 1 Determination of copper and lead by electrolytic method
- Part 3 Determination of phosphorus by volumetric method
- Part 4 Determination of nickel by photometric method
- Part 5 Determination of tin by iodimetric method
- Part 6 Determination of zinc by complexometric (EDTA) method
- Part 7 Determination of antimony by rhodamine B spectrophotometric method
- Part 8 Determination of iron
- Part 9 Determination of aluminium by atomic absorption spectrometric method
- Part 10 Determination of silicon
- Part 11 Determination of lead — Ethylenediamine tetraacetic acid (EDTA) — Titrimetric method

The methods of analysis prescribed in this standard may primarily serve as referee methods and may also be used by the laboratories for their day-to-day work. Due consideration has been given in the preparation of this standard to the facilities available in the country for such analysis.

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'.

Indian Standard

CHEMICAL ANALYSIS OF BRONZES — METHODS

PART 2 DETERMINATION OF MANGANESE — PHOTOMETRIC METHOD

(Second Revision)

1 SCOPE

This standard (Part 2) prescribes a method for determination of manganese in the range as specified in the relevant Indian Standards on bronzes.

2 REFERENCES

The standards given below contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of these standards:

<i>IS No.</i>	<i>Title</i>
IS 1070 : 2023	Reagent grade water — Specification (<i>fourth revision</i>)
IS 1817 : 1961	Methods of sampling non-ferrous metals for chemical analysis

3 SAMPLING

Samples shall be drawn and prepared in accordance with IS 1817.

4 QUALITY OF REAGENTS

Unless specified otherwise, analytical grade reagents and distilled water (*see* IS 1070) shall be employed in this test.

5 DETERMINATION OF MANGANESE BY THE PERIODATE — PHOTOMETRIC METHOD**5.1 Outline of the Method**

Manganese in an acid solution is oxidized to permanganate with potassium periodate. Photometric measurement is made at 520 nm.

5.2 Concentration Range

The recommended concentration range is from 0.1 mg to 2 mg of manganese in 100 ml of solution, using a cell depth of 1.000 cm.

5.3 Reagents**5.3.1 Hydrofluoric - Boric Acid Mixture**

Add 200 ml of hydrofluoric acid to 1 800 ml of a saturated solution of boric acid and mix. The mixture may be stored in a glass bottle.

5.3.2 Dilute Nitric Acid — 1 : 1 (v/v)**5.3.3 Phosphoric Acid — 85 percent****5.3.4 Potassium Periodate — solid**

5.3.5 Copper (Manganese Free) — copper containing under 0.001 percent of manganese

5.3.6 Standard Manganese Solution (1 ml = 0.10 mg of Mn)

Dissolve 0.100 g of high-purity manganese in 100 ml of dilute nitric acid (1 : 1) and boil to expel brown fumes. Cool, make up to 1 litre in a volumetric flask and mix.

5.4 Procedure

5.4.1 Transfer two 0.500 g portions of a sample in the form of fine drillings or sawings to 300 ml erlenmeyer flasks.

5.4.2 Add 15 ml of hydrofluoric-boric acid mixture, 15 ml of water, 15 ml of dilute nitric acid and 5 ml of phosphoric acid.

5.4.3 Allow dissolution to proceed without applying heat until reaction has nearly ceased. Heat to 80 °C to 90 °C until brown fumes have been expelled.

5.4.4 Add to first portion approximately 0.3 g of potassium periodate. Heat to boiling, boil gently for 2 min and then digest just below the boiling point for 20 min to develop full intensity of colour. Cool to room temperature, make up to 100 ml in a volumetric flask and mix.

5.4.5 Treat the second portion as in **5.4.4** without adding periodate.

5.4.6 Measure the absorbance of the first portion (after **5.4.4**) against the second portion (after **5.4.5**) at 520 nm.

5.4.7 Compute the manganese content from a calibration curve.

5.5 Calibration Curve

5.5.1 Transfer 0.500 g of manganese free copper into each of seven 300 ml erlenmeyer flasks and add 0 ml, 1.0 ml, 3.0 ml, 5.0 ml, 10.0 ml, 15.0 ml and 20.0 ml of manganese solution (1 ml = 0.1 mg of Mn).

5.5.2 Proceed as in **5.4.2** to **5.4.4**.

5.5.3 Measure absorbances of standards against reagent blank.

5.5.4 Plot absorbance values against mg of manganese per 100 ml of solution.

5.6 Calculation

$$\text{Manganese, percent} = \frac{A}{B} \times \frac{1}{10}$$

where

A = mg of manganese found in 100 ml of the final solution; and

B = g of sample represented in 100 ml of the final solution.

ANNEX A

(Foreword)

COMMITTEE COMPOSITION

Methods of Chemical Analysis of Metals Sectional Committee, MTD 34

<i>Organization</i>	<i>Representative(s)</i>
CSIR - National Metallurgical Laboratory, Jamshedpur	DR SANCHITA CHAKRAVARTY (<i>Chairperson</i>)
Bhabha Atomic Research Centre, Mumbai	MS SANJUKTA A. KUMAR SHRI M. V. RANA (<i>Alternate</i>)
CSIR - National Metallurgical Laboratory, Jamshedpur	DR ASHOK K. MOHANTY
Defence Metallurgical Research Laboratory, Ministry of Defence, Hyderabad	SHRI S. S. KALYAN KAMAL
Defence Research and Development Organization, Research Centre Imarat, Hyderabad	SHRI B. L. JATAV SHRIMATI SUNITA JAISWARA (<i>Alternate</i>)
Directorate General of Quality Assurance, Ministry of Defence, New Delhi	SHRI L. P. VARTE SHRI D. KARTIKEYAN (<i>Alternate</i>)
Arcelor Mittal Nippon Steel, Mumbai	SHRI MANOJ GUPTA SHRI KIRIT TAILOR (<i>Alternate</i>)
Geological Survey of India, New Delhi	DR MAHABIR SINGH
Hindalco Industries Limited, Mumbai	SHRI KRISHANU MAHAPATRA SHRI ASHUTOSH ACHARYA (<i>Alternate</i>)
Indian Metals and Ferro Alloys Limited, Bhubaneswar	SHRI DINESH KUMAR MOHANTY
JSW Steel Limited, Mumbai	SHRI SURESH L. RAJMANE SHRI D. KOTRABASAVARAJU (<i>Alternate I</i>) SHRI K. B. NAGASHANMUGAM (<i>Alternate II</i>)
Jawaharlal Nehru Aluminium Research Development and Design Centre, Nagpur	DR SURESH PUTTESHWAR DR UPENDRA SINGH (<i>Alternate</i>)
MSME Testing Center, New Delhi	SHRI D. D. GAJBHIYE SHRI GYARSI PRASAD (<i>Alternate</i>)
National Aluminium Company Limited, Bhubaneswar	SHRIMATI SUKLA NANDI SHRI DEBANANDA BHATTACHARYYA (<i>Alternate</i>)
National Test House, Kolkata	DR RAJEEV KUMAR UPADHYAY SHRI AKBAR H. (<i>Alternate</i>)
Shriram Institute for Industrial Research, Delhi	SHRI P. K. KAICHER SHRI B. GOVINDAN NAIR (<i>Alternate</i>)
Steel Authority of India Limited, Research & Development Centre for Iron & Steel, Ranchi	DR K. RAVI

IS 4027 (Part 2) : 2023

<i>Organization</i>	<i>Representative(s)</i>
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Tata Steel Limited, Kolkata	SHRI SHRENIVAS ASHRIT
BIS Directorate General	SHRI SANJIV MAINI, SCIENTIST 'F'/SENIOR DIRECTOR AND HEAD (METALLURGICAL ENGINEERING) [REPRESENTING DIRECTOR GENERAL (<i>Ex-officio</i>)]

Member Secretary
SHRI ASHISH PRABHAKAR WAKLE
SCIENTIST 'C'/DEPUTY DIRECTOR
(METALLURGICAL ENGINEERING), BIS

Bureau of Indian Standards

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Amendments Issued Since Publication

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