Australian Standard®

Methods for the analysis of copper, lead, zinc, gold and silver ores

Part 1: Determination of gold (Fire assay—Flame AAS method)

This Australian Standard was prepared by Committee MN/5, Copper, Lead, Zinc, Gold and Silver Ores and Concentrates. It was approved on behalf f the Council of Standards Australia on 9 April 1991 and published on 10 June 1991.

The following interests are represented on Committee MN/5:

Australian Institute of Mining and Metallurgy

Australian Lead Development Association

Australian Mining Industry Council

CSIRO, Division of Mineral and Process Engineering

Royal Australian Chemical Institute

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PREFACE

This Standard was prepared by the Standards Australia Committee on Copper, Lead, Zinc, Gold and Silver Ores and Concentrates under the direction of the Minerals Standards Board as part of its program of standardizing methods for determination of elements of commercial interest in such materials.

The accurate determination of gold in ores is vital in the economic evaluation of new and existing ore bodies as the gold value can determine if an ore body is commercially viable. Hence it was considered important that a standard method for determination of gold in ores with precision data be prepared.

Fire assay collection remains an important method for determination of precious metals in non-ferrous ores and concentrates.

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Part 1: Determination of gold (Fire assay—Flame AAS method)

1 SCOPE This Standard sets out a fire assay collection and flame atomic absorption spectrometric finish method for the determination of gold content in copper, lead, zinc, gold and silver ores.

The method is applicable to the determination of gold contents from 0.1 g/t to 25 g/t in a range of gold bearing ores.

2 R**EFERENCED DOCUMENTS** The following documents are referred to in this Standard:

AS
1152 Test sieves

2134 Recommended practice for chemical analysis by atomic absorption spectrometry
2134.1 Part 1: Flame atomic absorption spectrometry

2162 Code of practice for the use of volumetric glassware

2816 Copper, lead and zinc sulphide concentrates — Determination of hygroscopic moisture in the analysis sample

2850 Chemical analysis — Interlaboratory test programs — For determining precision of analytical method(s) — Guide to the planning and conduct

3 PRINCIPLE Fire assaying for the determination of gold comprises a reducing fusion in which two phases, a complex liquid borosilicate slag and a liquid lead phase, are formed. The lead phase collects the precious metals and the gangue elements are separated into the slag. The great differences in relative density between the lead and the slag allow easy separation after solidification. The second stage involves cupellation (oxidizing fusion) with silver acting as a collector for gold: in this process lead is oxidized to lead oxide and absorbed into a porous vessel known as a cupel, leaving the precious metal bead separated for analysis by dissolution and flame atomic absorption spectrometry.

4 REAGENTS

4.1 General requirements Unless otherwise specified, all reagents shall be of a recognized analytical reagent grade and distilled or deionized water shall be used throughout.

4.2 Sodium carbonate — anhydrous

4.3 Litharge — assay reagent grade with gold content such as to conform with the total blank constraint of Appendix B.

4.4 Silica — precipitated grade.

4.5 Borax — fused anhydrous sodium tetraborate (borax glass powder).

4.6 Plain white flour

4.7 Lead foil — assay reagent grade with gold content such as to conform with the total blank constraint of Appendix B. Foil approximately 0.15 mm thick is suitable.

4.8 Silver wire — 99.99 percent silver.

4.9 Gold wire — 99.99 percent gold.

4.10 Hydrochloric acid — (ϱ_{20} 1160 kg/m^3 to 1190 kg/m^3).

4.11 Dilute nitric acid (170 mL/L) To 800 mL of water carefully add, with stirring, 170 mL of nitric acid (ϱ_{20} 1420 kg/m^3). Cool, dilute to 1 L with water and mix.

4.12 Dilute nitric acid (700 mL/L) To 200 mL water carefully add, with stirring, 700 mL of nitric acid (ϱ_{20} 1420 kg/m^3). Cool, dilute to 1 L with water and mix.

4.13 Aqua regia solution To 50 mL of nitric acid (ϱ_{20} 1420 kg/m^3) carefully add, with stirring, 150 mL of hydrochloric acid (4.10). Prepare freshly before use.

4.14 Ammonia solution To 250 mL of ammonia solution (ϱ_{20} 880 kg/m^3), carefully add, with stirring, 250 mL of water.