Australian Standard®

Recommended practice for atomic emission spectrometric analysis

Part 2: Inductively coupled plasma excitation

STANDARDS AUSTRALIA

This Australian Standard was prepared by Committee CH/16, Spectroscopy. It was approved on behalf of the Council of Standards Australia on 26 June 1990 and published on 12 November 1990.

The following interests are represented on Committee CH/16:

Bureau of Steel Manufacturers

Confederation of Australian Industry

CSIRO, Division of Fuel Technology

CSIRO, Division of Mineral Chemistry

Department of Defence

Government Chemical Laboratories, Qld

National Association of Testing Authorities, Australia

Additional interests participating in preparation of Standard:

Aluminium smelters

Rural Water Commission

State Electricity Commission, Vic.

Steel producers

This Standard was issued in draft form for comment as DR 89192.

AS 3641.2—1990

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First published as AS 3641.2—1990.

PUBLISHED BY STANDARDS AUSTRALIA
(STANDARDS ASSOCIATION OF AUSTRALIA)
STANDARDS HOUSE, 80 ARTHUR ST, NORTH SYDNEY NSW
ISBN 0 7262 6460 1

PREFACE

This Standard was prepared by the Standards Australia Committee on Spectroscopy under the direction of the Chemical Standards Board.

This Standard is Part 2 of the AS 3641 series on recommended practice for atomic emission spectrometry and describes recommended procedures for the setting up and operation of inductively coupled plasma (ICP) instruments for use in chemical methods of analysis. The recommendations in this Standard are intended to apply to Australian Standard methods for ICP analysis. In the preparation of this Standard cognizance was taken of the following documents:

International Organization for Standardization, ISO/TC 147/SC 2/WG 32 N2, Miles, Douglas L. and Sharp, Barry L., *Inductively coupled plasma spectrometry.*

American Society for Testing and Materials, ASTM E 743, *Standard guide for spectrochemical laboratory quality assurance*, Philadelphia, USA, 1985.

Report by the Analytical Methods Committee. Evaluation of analytical instrumentation, Part III Polychromators for use in emission spectrometry with ICP sources, *Royal Society of Chemistry, Analytical Proceedings*. April, 1986, Vol. 23.

SARLIT, M.L. Verification of sequential ICP-AES instrument function. *International Organization for Legal Metrology,* September 1987.

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SECTION 1 SCOPE AND GENERAL

1.1 SCOPE This Standard sets out recommendations for instrumentation and operating procedures in the application of the inductively coupled plasma excitation to chemical analysis by atomic emission spectrometry.

NOTE: This Standard is intended to be read in conjunction with the instrument manufacturer's recommendations.

1.2 REFERENCED DOCUMENTS The following documents are referred to in this Standard:

AS

2243 Safety in laboratories
2243.2 Part 2: Chemical aspects
2243.5 Part 5: Non-ionizing radiations

2772 Radiofrequency radiation
2772.2 Principles and methods of measurement—300 kHz to 100 GHz

2883 Analysis of metals—Procedures for the setting up, calibration and standardization of atomic emission spectrometers using arc/spark discharge

2929 Test methods—Guide to the format, style and content

3641 Recommended practice for atomic emission spectrometric analysis
3641.1 Part 1: Principles and techniques

ASTM

E 135 Terminology relating to emission spectroscopy

BS

5703 Guide to data analysis and quality control using cusum techniques

1.3 DEFINITIONS For the purpose of this Standard, the definitions in AS 2883 and ASTM E 135 apply.

1.4 PRINCIPLE OF THE TECHNIQUE When atoms or ions of elements are excited in an inductively coupled plasma (see Figure 1), they emit electromagnetic radiation in the form of spectra. The characteristic spectrum of each element, which is determined primarily by the electronic configuration of the atom, consists of a number of wavelengths which correspond to the emission of electromagnetic radiation arising from the transition of electrons in various excited states to lower energy states. The intensity of the electromagnetic radiation which is emitted at a characteristic wavelength is proportional to the concentration of the element in the sample. The intensity is measured using an appropriate spectrometer and photo-detecting system.

1.5 SAFETY PRECAUTIONS

1.5.1 General The general safety precautions listed in AS 2243 should be followed to minimize safety hazards.

1.5.2 Ultraviolet radiation Most ICP instruments contain a safety interlocking system which prevents ignition of the source when the ultraviolet-absorbing shield is not in position. It is essential that the interlock is not overridden.

1.5.3 Fume hoods It is strongly recommended that an efficient mechanical ventilation system be installed to exhaust toxic fumes and ozone issuing from the torch. It should be heat and corrosion resistant. The intake of the exhaust system should be placed directly above the torch. The position of the intake and the exhaust capacity of the system should be in accordance with the manufacturer's specification, as an incorrect position can cause torch instability. It is also recommended that the exhaust from the RF generator be vented away from the instrument, i.e. through the fume hood.