Australian/New Zealand Standard™

Methods for sampling and analysis of ambient air

Method 17: Determination of gaseous compounds in ambient air—Direct-reading cavity ring-down spectroscopy instrumental method

AS/NZS 3580.17:2016

PREFACE

This Standard was prepared by the joint Standards Australia/Standards New Zealand Committee EV-007, Methods for Examination of Air.

In preparing this Standard, sections of the Foreword and Clause 4 were reproduced with permission from the United States Environmental Protection Agency Handbook: *Optical Remote Sensing for Measurement and Monitoring of Emissions Flux* and Figure 1 is reproduced with permission from the Royal Society of Chemistry.

The objective of this Standard is to provide regulatory and testing bodies with a standard method for the determination of the concentrations of gaseous compounds in ambient air using instrumentation based on cavity ring-down spectroscopy.

FOREWORD

Most small molecules (e.g. nitrogen dioxide, ammonia, carbon dioxide, water, methane) have unique near-infrared absorption spectra consisting of sharp well resolved lines. Traditional absorption spectroscopy techniques measure the absolute change in light intensity after passing through a sample relative to the original intensity of the light. Cavity ring-down spectroscopy (CRDS) techniques measure the rate of decay of light intensity exiting from a high-finesse optical cavity. Using the rate of decay rather than the change in light intensity makes the CRDS technique less sensitive to fluctuations in light intensity or variations in ambient conditions (such as humidity). The reflectivity of the closed optical (or ring-down) cavity yields much longer effective sample path lengths for greater detection sensitivity. CRDS applications are most often used for measurements of weakly-absorbing or highly dilute atmospheric samples.

METHOD

1 SCOPE

This Standard sets out a method for determining gaseous compounds in ambient air using a direct-reading cavity ring-down spectroscopy instrument. This Standard also has application for instrumentation based on other cavity enhanced absorption spectrometric methods such as off-axis integrated cavity output spectroscopy. The method applies to the determination of gaseous compounds within the concentration ranges typically found in ambient air.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS/NZS
3580 Methods for sampling and analysis of ambient air
3580.1.1 Part 1.1: Guide to siting air monitoring equipment
3580.2.2 Part 2.2: Preparation of reference test atmospheres—Compressed gas method

ISO/IEC
Guide 98 Uncertainty of measurement
Guide 98-3:2008 Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)

California Environmental Protection Agency Air Resources Board
Standard Operating Procedures, Picarro G-1301 Methane, Carbon Dioxide, Water Vapor Analyzer

Environment Protection and Heritage Council
National Environment Protection (Ambient Air Quality) Measure, Technical Paper No. 5, Data Collection and Handling

United States Environmental Protection Agency
EPA Handbook: Optical Remote Sensing for Measurement and Monitoring of Emissions Flux

3 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

3.1 Drift

The percentage change in instrument response over a 24 h period of continuous unadjusted operation.

3.2 Full scale (FS)

The nominated maximum concentration for which an instrument has been calibrated.

3.3 Level 1 calibration

A simplified, two-point analyser calibration used when analyser linearity does not need to be checked or verified.

3.4 Level 2 calibration

A simple check of an analyser's response. These checks may be performed using non-certified test atmospheres (e.g. expired test cylinders).

3.5 Linearity

The deviation of an analyser's output from a best-fit line when subjected to varying test atmospheres.