INTERNATIONAL STANDARD 4538

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Metallic coatings — Thioacetamide corrosion test (TAA test)

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FOREWORD

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 4538 was developed by Technical Committee ISO/TC 107, *Metallic and other non-organic coatings*, and was circulated to the member bodies in November 1976.

It has been approved by the member bodies of the following countries :

Australia	Italy	South Africa, Rep. of
Bulgaria	Japan	Spain
Czechoslovakia	Mexico	Switzerland
France	Netherlands	Turkey
Germany	Philippines	United Kingdom
Hungary	Poland	U.S.A.
India	Portugal	U.S.S.R.
Israel	Romania	

No member body expressed disapproval of the document.

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0 INTRODUCTION

The type and number of test specimens, the exposure period required and the criteria of failure are not specified in this International Standard. Such details should be given in the appropriate coating or product specification.

1 SCOPE AND FIELD OF APPLICATION

1.1 This International Standard specifies the apparatus and the procedure for assessment of the resistance of metal surfaces to corrosion and tarnish in atmospheres containing volatile sulphides, carried out in accordance with coating or product specifications.

1.2 The method is applicable to the assessment of the efficacy of tarnish-preventing treatments applied to silver or copper and to the detection of discontinuities in precious metal coatings on these metals.

2 REFERENCE

ISO 1462, *Metallic coatings — Coatings other than those anodic to the basis metal — Accelerated corrosion tests — Method for evaluation of the results.*

3 PRINCIPLE

Exposure of test specimens to vapours emitted by thioacetamide in an atmosphere having a relative humidity of 75 %, maintained by the presence of a saturated solution of sodium acetate.

4 REAGENTS

Use only reagents of recognized analytical grade and only distilled water or water of equivalent purity.

4.1 Thioacetamide, powdered crystals.

WARNING : Thioacetamide is a carcinogen. All contact with human skin should be avoided.

4.2 Sodium acetate, saturated solution.

Dissolve 3 parts of sodium acetate trihydrate ($CH_3COONa.3H_2O$) in 1 part of water.

5 APPARATUS

5.1 Test chamber, comprising a container made of glass or suitable transparent plastics material, capable of being closed by a gas-tight cover. The actual dimensions of the test chamber are not specified but the requirements stated in this and subsequent clauses shall be met. Unless otherwise specified, the capacity of the test chamber shall be not less than 2 litres and not more than 20 litres.

All materials used in the construction of the test chamber shall be capable of resisting the action of volatile sulphides and shall not emit any gas or vapour likely to influence the corrosion of the materials under test.

5.2 Plate, made of inert non-metallic material, supported inside the test chamber to provide a level surface occupying 70 to 90 % of the cross-section of the chamber at least 10 mm and not more than 75 mm above the base of the chamber.

5.3 Simple framework, made of inert non-metallic material, placed inside the chamber to serve as a support for the moist paper (see 7.2) and as a means of suspension for test specimens (see 7.1).

5.4 Constant temperature enclosure or (if the test chamber cannot be accommodated in such an enclosure) **suitable cover or screen** capable of preventing any sudden temperature fluctuation or local temperature difference.

6 TEST SPECIMENS

6.1 Select the type and number of test specimens to be used according to the specification for the coating or products being tested. See also 7.4.

6.2 Any cleaning procedure applied to the test specimens before submitting them to the test shall be according to the relevant specification. In the absence of instructions for the preliminary cleaning, do not clean the test specimens in any way.

6.3 If the test specimens are cut from a larger coated article, carry out the cutting in such a way that the coating and any protective film applied to it are not damaged, especially in the area adjacent to the cut. Take care to avoid contamination by swarf during cutting. Unless otherwise specified, protect the cut edges adequately by coating them with a suitable medium that is stable under the conditions of the test, such as paint, varnish, wax or adhesive tape.

7 OPERATING PROCEDURE

7.1 The supports and suspensions for the test specimens shall be of inert non-metallic material. They shall not hinder the free circulation of the atmosphere around the test specimens. Unless otherwise specified, any angle of inclination of the test surfaces can be used. Usually, the best procedure is to suspend the test specimens from a frame standing on the base of the test chamber.

7.2 Cover at least 50 % of the side walls of the test chamber (5.1) with a thick absorbent paper soaked in the sodium acetate solution (4.2). Immerse the lower ends of the paper to a depth of at least 10 mm in the same solution covering the bottom of the test chamber completely. This solution shall always contain crystallized salt in excess, regardless of the conditions obtaining outside the test chamber. It is recommended that the upper part of the soaked paper be pressed against the wall of the chamber with the aid of the frame (5.3).

7.3 Sprinkle the horizontal plate (5.2) within the test chamber with a thin layer of a fine powder of the thioacetamide (4.1) to the extent of at least 50 mg per square decimetre of surface. Distribute powder as uniformly as possible over the whole surface of the plate.

7.4 Place the test specimens in position in such a way that they do not touch the paper soaked in the sodium acetate solution, the framework holding the paper in position or the thioacetamide on the horizontal plate.

Place them so that no part of any test specimen is within 20 mm of another test specimen or of the walls of the test chamber. The lowest part of the test specimens shall be not more than 40 mm and not less than 30 mm from the horizontal plate sprinkled with the thioacetamide, the uppermost part of the test specimens being not more than 300 mm from the plate.

7.5 Close the test chamber and maintain at $20 \pm 5\ ^{\circ}C$ (see 5.4). Take precautions against sudden changes or local differences of temperature.

7.6 Observe the appearance of the test specimens after 1 h, 2 h, 4 h, 8 h, 1 day, 2 days, 4 days, etc. Choose the test duration according to the type of sample or from the relevant specification. A duration of 2 weeks is rarely exceeded. The test chamber may be opened for the examination, but only for the minimum time necessary. Do not remove specimens from the test chamber.

7.7 Thioacetamide deteriorates slowly in humid air, although its appearance does not change much. At least once every 2 weeks, wash and dry the supporting plate and provide a fresh supply of thioacetamide. At the same time, ascertain that the sodium acetate solution has neither evaporated nor been diluted too much. If necessary, add water or sodium acetate crystals.

8 TREATMENT OF TEST SPECIMENS AFTER TEST

At the end of the test period, remove the test specimens from the test chamber into clean surroundings at ambient temperature for examination. Unless otherwise specified, do not carry out cleaning treatment before examination.

9 EVALUATION OF RESULTS

Many different criteria for evaluation of the results of the test may be applied. The intended use of the tested objects and the severity of requirements shall be taken into account. It is difficult to apply quantitative criteria such as change of mass or mechanical properties. Usually, the appropriate criteria will be given in the specification for the coating or product tested. For most routine applications of the test, only the following need to be considered :

a) the appearance after test;

b) the appearance after removing superficial non-adherent corrosion products;

c) the number and distribution of corrosion defects, i.e. coloured spots, pits, cracks, blisters, etc. These may conveniently be assessed by methods such as that specified in ISO 1462;

d) the time of inspection when the first signs of corrosion were observed.

10 TEST REPORT

10.1 The test report shall indicate the outcome of the test according to the criteria for evaluation of results prescribed for the test. Report the result obtained for each test specimen tested and, when appropriate, the average for a group of replicate test specimens. The test report may, if required, be accompanied by photographic records of the tested specimens.

10.2 The test report shall contain information about the conduct of the test. This information may vary according to the purposes of the test and to the directions prescribed

for it, but a general list of the details likely to be required is as follows :

a) the specification of the basis material tested;

b) the type of coating, with an indication of its surface finish;

c) the number of test specimens, of each coating or product subjected to the test;

d) the dimensions and shape of the test specimens and the nature and area of the surface tested;

e) the preparation of the test specimens, including any cleaning treatment applied and any protection given to edges or other special areas;

f) the method, if any, used to clean the test specimens after the test with, when appropriate, an indication of the loss of mass resulting from the cleaning operation;

g) the temperature readings within the exposure zone of the test chamber;

h) the exposure period for each cycle and the number of cycles;

i) an indication of the precautions taken to verify that all the requirements stated in this International Standard have been met;

j) the behaviour of any reference panels placed in the test chamber at the same time as the test specimens;

k) the results of all inspections.