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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 42912-2023

**Corrosion of metals and alloys - Test method for high temperature
corrosion testing of metallic materials by immersing in molten salt or
other liquids under static conditions**

金属和合金的腐蚀 金属材料在静态浸入熔盐或其他液体条件下的高温腐蚀试验方法

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Table of Contents

Foreword	3
1 Scope	5
2 Normative references	5
3 Terms and definitions	6
4 Test method	6
5 Testing of specimen surface and microstructure	13
6 Report	13
Annex A (informative) Technical differences between this document and ISO 17245:2015 and their reasons	16
Annex B (informative) Chemical and electrolytic procedures for removal of corrosion products	19
Bibliography	22

Foreword

This document was issued on 6 August 2023 by the State Administration for Market Regulation; Standardization Administration of the PRC and takes effect on 1 March 2024.

It is a GB/T standard: recommended rather than compulsory, but it is the text a Chinese reviewer applies when assessing a submission.

1 Scope

GB/T 42912-2023 covers how the corrosion resistance of a metal is assessed when it sits immersed in a static molten salt or other corrosive liquid at high temperature under a controlled gas atmosphere - the test method, which is the bulk of the document and takes in the principle, the specimens, at least three per material so that mass change results can be reproduced, the crucible and furnace arrangement, the exposure and its duration, and the removal and weighing that follow; the examination of the specimen surface and of the microstructure beneath it, which is where attack that a weight reading misses shows itself; and the report. Annex A explains where the document departs from ISO 17245:2015 and why, and Annex B gives chemical and electrolytic procedures for stripping corrosion products without eating the metal underneath. Molten salts carry heat well, which is why they are used in concentrating solar plants, heat treatment baths and salt-cooled reactors, and they dissolve the protective oxide that keeps an alloy intact, so a candidate alloy has to be tried in the melt rather than argued for. Written for alloy developers, thermal storage and heat treatment engineers, and corrosion laboratories.

This document specifies a test method for evaluating the corrosion resistance of metallic materials when they are immersed in static molten salts or other liquids under static conditions and exposed to high-temperature controlled gas environments.

This document uses two types of controlled gas environments: stagnant inert gas environment and flowing reactive gas environment.

This document is applicable to high-temperature corrosion tests of metallic materials under static immersion conditions in molten salt or other liquids.

This document does not apply to situations where there is relative motion between the specimen and the surrounding corrosive liquid.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 10123, Corrosion of metals and alloys -- Vocabulary (GB/T 10123-2022, ISO 8044:2020, IDT)

GB/T 16545-2015, Corrosion of metals and alloys -- Removal of corrosion products from corrosion test specimens (ISO 8407:2009, IDT)

GB/T 16701, Methods for measuring the thermoelectric force of noble metal and base metal thermocouple wires

GB/T 16839.1, Thermocouples -- Part 1: EMF specifications and tolerances

GB/T 41654, Corrosion of metals and alloys - Method for metallographic examination of samples after exposure to high-temperature corrosive environments (GB/T 41654-2022, ISO 26146:2012, IDT)

JJG 141, Verification Regulation of Working Noble Metal Thermocouples

3 Terms and definitions

For the purposes of this document, the terms and definitions defined in GB/T 10123 as well as the followings apply.

3.1 corrosive liquid

A powder mixture consisting of salts, ash and/or other solids that melts at the experimental temperature, or a liquid containing compounds that react with metals at high temperatures.

3.2 descaling

Before measuring the mass of the remaining metal, remove corrosion products and corrosion phases from the specimen surface.

4 Test method

4.1 Principle

The number of specimens for each material should be no less than 3, so as to ensure reproducibility of test results. These specimens can be used for measurement of mass changes, dimensional changes and/or observation of surface and/or cross-sectional changes.

4.2 Test materials

4.2.1 Specimen

The specimen shall be in the form of a rectangular plate, disc or cylinder. The surface area is not less than 300 mm². The thickness is not less than 1.5 mm.

If the specimen cannot be produced in accordance with the above specifications, other specimen shapes and sizes shall be determined by negotiation between the supplier and the purchaser.

The specimens shall be machined to remove the affected layer resulting from cutting.

The final surface of the specimen shall be polished using an abrasive with an average particle diameter of approximately 15 µm. P1200 abrasives that meet the requirements of GB/T 9258.3 can be used.

If the relevant parties require other surface grinding and polishing methods, the surface grinding and polishing conditions should be described.

The dimensions of the specimen should be measured at at-least 3 locations on the specimen before the exposure test. The accuracy of the measuring instrument is ± 0.02 mm.

Specimens that have been ultrasonically cleaned in isopropyl alcohol or ethanol should be dried in hot air or in a desiccator.

If the specimen absorbs a large amount of water vapor in the environment, it is recommended that the cleaned specimen be stored in a desiccator before weighing and exposure testing.

The mass of the specimen should be measured prior to exposure. At least two measurements shall be made on each specimen. The mass difference between the two weighings should not exceed 0.05 mg.

4.2.2 Corrosive substances

WARNING: When working with hazardous materials such as certain ashes and molten salts, all necessary safety measures should be taken.

The type of corrosive substance should be selected according to the test environment. Corrosive substances should be collected from sediments in actual equipment or formulated with reagent-grade chemicals.

Corrosive substances should be mixed evenly. If the melting range of the substance is not known, it should be measured in advance or determined based on the phase diagram to ensure that the liquid phase is the main compound of the corrosive substance.

4.3 Test device

4.3.1 Device design

The test device shall include a temperature regulating device capable of uniformly heating the specimen at a constant temperature. The heating device should be equipped with a test unit (closed system) that isolates the specimen from the outside air.

A schematic diagram of a horizontal closed test device is shown in Figure 1. Devices placed vertically can also be used. The complete heating furnace device design is shown in Figure 1 of GB/T 38430-2019.

sample chamber should be maintained above the dew point. Condensation can have serious effects on test results.

Gas flow meters should be used to monitor gas flow. The flow meter should be placed