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

GB/T 43604.1-2023

**Methods for chemical analysis of gallium-based liquid metals-Part
1:Determination of lead, cadmium, mercury and arsenic
contents-Inductively coupled plasma mass spectrometry**

镓基液态金属化学分析方法 第1部分：铅、镉、汞、砷含量的测定 电感耦合等离子体质谱法

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Foreword

This document complies with the provisions of GB/T 1:1-2020 "Standardization Work Guidelines Part 1: Structure and Drafting Rules of Standardization Documents" Drafting:

This document is Part 1 of GB/T 43604 "Chemical Analysis Methods for Gallium-Based Liquid Metals": GB/T 43604 has released the following part:

- Part 1: Determination of lead, cadmium, mercury and arsenic content by inductively coupled plasma mass spectrometry:

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This document is proposed by the China Nonferrous Metals Industry Association:

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Introduction

Gallium-based liquid metal is an emerging class of functional materials that is liquid at room temperature and has good fluidity, electrical conductivity, thermal conductivity, and biocompatibility:

It has the characteristics of safety, self-healing and safety and non-toxicity: Gallium-based liquid metal is used in chip cooling, heat transfer, printed electronics, medical health, soft robots, Sensors and actuators, anti-counterfeiting signs and other fields have great potential for development: GB/T 39859 "Gallium-based Liquid Metal" divides products according to melting temperature For Category 5: The chemical composition of a product has an important impact on the properties of the product: At the same time, harmful elements such as lead, cadmium, and mercury are clearly regulated in the RoHS directive:

Limited requirements: GB/T 43604 is intended to consist of two parts:

- Part 1: Determination of lead, cadmium, mercury and arsenic content by inductively coupled plasma mass spectrometry: The purpose is to establish that lead, cadmium, mercury, arsenic Content determination method:
- Part 2: Determination of hexavalent chromium content by spectrophotometry: The purpose is to establish a method for determining hexavalent chromium:

GB/T 43604 aims to establish gallium-based standards by specifying the scope of application, standardizing reagents, materials and equipment, and listing detailed test procedures:

Methods of chemical analysis of liquid metals: This document is part 1 of a series of methods for the determination of gallium bases using inductively coupled plasma mass spectrometry:

Mass fractions of lead, cadmium, mercury and arsenic in liquid metal:

Inductively coupled plasma mass spectrometry has the advantages of small interference, simultaneous determination of multiple elements, and low detection limit: It has been widely used in nonferrous metals and Determination of trace impurity elements in its compounds: The establishment of this document solves the problem of determination of lead, cadmium, mercury and arsenic in gallium-based liquid metal, and is helpful for promoting The production and trade of imported products are of great significance:

Gallium-based liquid metal chemical analysis method Part 1: Determination of lead, cadmium, mercury and arsenic content Inductively coupled plasma mass spectrometry

1 Scope

This document describes methods for the determination of lead, cadmium, mercury, and arsenic in gallium-based liquid metals:

This document is applicable to the determination of lead, cadmium, mercury and arsenic content in gallium-based liquid metal: Measuring range (mass fraction): 0:0001%~ 0:010%:

2 Normative reference documents

GB/T 6682

GB/T 8170

GB/T 17433

3 Terms and definitions

The terms and definitions defined in GB/T 17433 apply to this document:

4 Principles

The sample is decomposed with nitric acid and hydrochloric acid, directly measured with an inductively coupled plasma mass spectrometer, and the mass concentration of each element is calculated according to the working curve method:

Degree, the measurement results are expressed as mass fractions: The internal standard method was used to correct the influence of instrument drift and matrix effect on the determination:

5 Reagents or materials

Unless otherwise stated, only reagents confirmed to be of superior grade purity or above are used in the analysis:

5:1 Water, GB/T 6682, Level 1:

5:2 Hydrochloric acid ($\rho=1.19\text{g/mL}$):

5:3 Nitric acid ($\rho=1.42\text{g/mL}$):

5:4 Hydrogen peroxide ($\rho=1.1\text{g/mL}$):

5:5 Nitric acid-potassium dichromate solution: weigh 0.5g potassium dichromate and dissolve it in water, add 50mL nitric acid (5:3), and transfer it to 1000mL capacity bottle, dilute to volume with water and mix well:

5:6 Standard storage solutions: For lead, cadmium, mercury, arsenic, rhodium, and thallium, use single-element standard storage solutions with certificates within the validity period: The mass concentration is 100 $\mu\text{g/mL}$: It can also be prepared and used according to

the preparation methods in 5:7~5:12:

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