

ICS 77.120.99

CCS H 14



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

GB/T 16477.1-2024

Replacing GB/T 16477.1-2010

**Chemical analysis methods for silicon-based rare earth ferroalloy and
rare earth magnesium ferrosilicon alloy - Part 1: Determination of the
total rare earth content and of fifteen rare earth element contents**

稀土硅铁合金及镁硅铁合金化学分析方法 第1部分：稀土总量、十五个稀土元素
含量的测定

Issued on: April 25, 2024

Implemented on: April 25, 2024

**Issued by: State Administration for Market Regulation;
Standardization Administration of China**

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Foreword

This document is in accordance with the provisions of GB/T 1:1-2020 "Guidelines for standardization work Part 1: Structure and drafting rules for standardization documents" Drafting: This document is Part 1 of GB/T 16477 "Chemical analysis methods for rare earth ferrosilicon alloys and magnesium ferrosilicon alloys": GB/T 16477 has been The following parts have been published:

- Part 1: Determination of total rare earth content and content of fifteen rare earth elements;
- Part 2: Determination of calcium, magnesium and manganese content - Inductively coupled plasma optical emission spectrometry;
- Part 3: Determination of magnesium oxide content by inductively coupled plasma optical emission spectrometry;
- Part 4: Determination of silicon content;
- Part 5: Determination of titanium content - Inductively coupled plasma optical emission spectrometry: This document replaces GB/T 16477:1-2010 "Chemical analysis methods for rare earth ferrosilicon alloys and magnesium ferrosilicon alloys Part 1: Rare earth total Compared with GB/T 16477:1-2010, in addition to structural adjustments and editorial changes, the main technical changes are as follows:
 - a) Changed the determination range of total rare earth content in Method 1 from "0:50%~6:00%" to "0:50%~10:00%" (see Section 1 Chapter 1 of the:2010 edition);
 - b) Changed the determination range of total rare earth content in Method 2 from "2:00%~42:00%" to "10:00%~40:00%" (see Section 1 Chapter 10 of the:2010 edition);
 - c) Added fifteen rare earth element content determination ranges in Method 1 and Method 2 (see Chapter 1);

- d) The requirements for instrumentation, test procedures, determination, test data processing, and precision of Method 1 have been modified (see Chapter 4, 2010 Chapters 4, 6, 7 and 8 of the 2011 edition);
- e) The requirements for instrumentation, test procedures, determination, test data processing, and precision of Method 2 have been modified (see Chapter 5, 2010 Chapters 14, 15 and 16 of the 2011 edition);
- f) Quality assurance and control (see Chapter 9 and Chapter 17 of the 2010 edition) have been deleted. Please note that some of the contents of this document may involve patents: The issuing organization of this document does not assume the responsibility for identifying patents: This document was proposed and coordinated by the National Rare Earth Standardization Technical Committee (SAC/TC229): This document was drafted by: Ganzhou Nonferrous Metallurgy Research Institute Co., Ltd., Guohe General Testing Evaluation and Certification Co., Ltd., China Northern Rare Earth (Group) High-tech Co., Ltd., Qiandong Rare Earth Group Co., Ltd., Ganzhou Rare Earth Youli Technology Development Co., Ltd., Baotou Hong Bote Technology Co., Ltd., Youyan Rare Earth New Materials Co., Ltd., Baotou Huamei Rare Earth High-Tech Co., Ltd., Baotou Rare Earth Research Institute, Inner Mongolia Shengquan Keliyuan New Material Technology Co., Ltd: The main drafters of this document are: Xie Lu, Liu Hong, Li Ying, Zeng Xuehua, Hu Fangfei, Tian Jia, Dong Sanli, Xu Ning, Wen Bin, Hu Weizhong, Jiang Yuan, Li Minglai, Cui Chunyan, Xue Jianping, Luo Yansheng, Yu Yahui, Ma Hankun, Ai Fengge, Shi Xiang, Tian Zhirui, Wu Yingxin, Liu Pengyu, Zhu Ni, Sun Erfeng, Lü Nannan and Wang Xin: The previous versions of this document and the documents it replaces are as follows:

1 Scope

China's national method for determining how much rare earth is present in rare earth ferrosilicon and rare earth magnesium ferrosilicon alloy, and how that total divides among the fifteen individual rare earth elements. It is Part 1 of GB/T 16477 and covers the determination of the total rare earth content and the contents of the fifteen rare earth elements in these alloys. These alloys are the working nodularisers and inoculants of the iron foundry. Ductile iron is made by treating the melt with magnesium to turn the graphite from flakes into spheroids, and rare earths are added with it to neutralise the subversive elements - lead, bismuth, antimony, titanium - that would otherwise poison the spheroidising reaction and give a degenerate graphite structure. The dose is small and the window is narrow: too little rare earth and the treatment fails against a contaminated charge, too much and the iron carbides. So the foundry buys the alloy on its assay, and the assay has to be right. That is harder than it sounds, because the fifteen rare earths are chemically almost identical to each other, they sit in a matrix of iron, silicon and magnesium that interferes with most determinations, and the individual distribution matters as well as the total - cerium and lanthanum behave differently in the melt from the heavy elements. The method

therefore has to dissolve a difficult matrix without loss, separate the rare earth group from the iron and silicon, and then resolve the individual elements, with the tolerances stated so that a supplier's certificate and a customer's check analysis can be reconciled. Issued and in force since 25 April 2024, it replaces GB/T 16477.1-2010.

1 Determination of elements Quality score Determination of elements Quality score

Lanthanum 0:030~10:

00 Dysprosium 0:030~0:

50 Cerium 0:030~10:

00 Holmium 0:030~0:

50 Praseodymium 0:030~0:

50 Erbium 0:030~0:

50 Neodymium 0:030~0:

50 Thulium 0:030~0:

50 Samarium 0:030~0:

50 Ytterbium 0:030~0:

50 Europium 0:030~0:

50 Lutetium 0:030~0:

50 Gadolinium 0:030~0:

50 Yttrium 0:030~10:

2 Measurement range of method

2 Determination of elements Quality score Determination of elements Quality score

Lanthanum 0:050~40:

00 Dysprosium 0:050~2:

00 Cerium 0:050~40:

00 Holmium 0:050~2:

00 Praseodymium 0:050~2:

00 Erbium 0:050~2:

00 Neodymium 0:050~2:

00 Thulium 0:050~2:

00 Samarium 0:050~2:

00 Ytterbium 0:050~2:

00 Europium 0:050~2:

00 Lutetium 0:050~2:

00 Gadolinium 0:050~2:

00 Yttrium 0:050~40:

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