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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 14847-2025

Replacing GB/T 14847-2010

Test method for thickness of lightly doped silicon epitaxial layers on heavily doped silicon substrates - Infrared reflectance method

重掺杂衬底上轻掺杂硅外延层厚度的测试 红外反射法

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Standardization Administration of the PRC

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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 replaces GB/T 14847-2010 "Infrared Reflectance Measurement Method for Thickness of Lightly Doped Silicon Epitaxial Layer on Heavily Doped Substrate", and is consistent with... Compared with GB/T 14847-2010, apart from structural adjustments and editorial changes, the main technical changes are as follows:

a) The scope of application has been changed (see Chapter 1, Chapter 1 of the.2010 edition);

b) The methodology has been modified (see Chapter 4, Chapter 4 of the.2010 edition);

c) The interfering factors were changed (see Chapter 5, Chapter 5 of the.2010 edition);

d) Experimental conditions were increased (see Chapter 6);

e) Changes were made to the instruments and equipment (see Chapter 7, Chapter 6 of the.2010 edition);

f) The sample has been modified (see Chapter 8, Chapter 7 of the.2010 edition);

g) The experimental procedures have been changed (see Chapter 9, Chapter 8 in the.2010 edition);

h) The experimental data processing has been changed (see Chapter 10, Chapter 9 of the.2010 edition);

i) The precision has been changed (see Chapter 11, Chapter 10 in the.2010 edition);

j) The test report was amended (see Chapter 12, Chapter 11 of the.2010 edition). Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents. This document was prepared by the National Technical Committee on Standardization of Semiconductor Equipment and Materials (SAC/TC203) and the National Semiconductor Equipment and

Materials Standards Committee. It was jointly proposed and is under the jurisdiction of the Materials Subcommittee of the Chemical Technology Committee (SAC/TC203/SC2). This document was drafted by: Zhejiang Jinruihong Technology Co., Ltd., Nonferrous Metals Technology and Economic Research Institute Co., Ltd., and Nanjing Sheng Xin Semiconductor Materials Co., Ltd., China Electronics Crystal (Tianjin) Semiconductor Materials Co., Ltd., Shandong Youyan Ace Semiconductor Materials Co., Ltd. Xi'an Longwei Semiconductor Co., Ltd., Zhejiang University, Maxx Electronic Materials Co., Ltd., Bruker (Beijing) Technology Co., Ltd., Perkin Elmer Enterprise Management (Shanghai) Co., Ltd., Thermo Fisher Scientific (China) Co., Ltd., Shanghai Euler Semiconductor Equipment Co., Ltd. Qinghai Yuanping New Energy Technology Co., Ltd. The main drafters of this document are. Li Shenzhong, Zhang Haiying, Li Suqing, Xu Feng, Liang Xingbo, Jiang Yulong, Ge Hua, Li Mingda, Zhang Honghao, and Ma Linbao. Ma Xiangyang, Liu Lijuan, He Dongjiang, Zhao Yue, Fang Weiyu, Li Yunpeng, Zhuang Yujun, Han Yunxiao, Lei Haodong, Yuan Wenzhan. This document was first published in.1993, revised for the first time in.2010, and this is the second revision. Measurement of the thickness of a lightly doped silicon epitaxial layer on a heavily doped substrate Infrared reflection method

1 Scope

GB/T 14847-2025 is the Chinese national standard covering measuring epitaxial layer thickness without touching the wafer - the infrared interference fringes produced by the step in free carrier concentration at the interface, the spectral range and resolution, and the calculation from the fringe spacing. Issued on 31 October 2025, it has been in force since 1 May 2026, replacing GB/T 14847-2010.

This document describes a method for measuring the thickness of a lightly doped silicon epitaxial layer on a heavily doped substrate using infrared reflection. This document applies to silicon epitaxy with a thickness greater than 0.5 μm prepared on substrates with resistivity of 0.0006 Omega·cm to 0.025 Omega·cm. Layer thickness testing.

2 Normative references

The contents of the following documents, through normative references within the text, constitute essential provisions of this document. Dated citations are not included. For references to documents, only the version corresponding to that date applies to this document; for undated references, the latest version (including all amendments) applies. This document.

GB/T 6379.2-2004 Accuracy (Correctness and Precision) of Measurement Methods and Results - Part

2.Determining Standard Measurement Methods Basic methods of repeatability and reproducibility

GB/T 14264 Semiconductor Materials Terminology

GB/T 25915.1-2021 Cleanrooms and related controlled environments - Part

3 Terms and Definitions

The terms and definitions defined in GB/T 14264 and the following terms and definitions apply to this document.

3.1 refractive index The ratio of the sine of the incident angle to the sine of the refraction angle.

Note. The angle of incidence and angle of refraction refer to the angle between the surface normal and the infrared beam. For silicon materials with a resistivity greater than 0.1 Omega·cm, when the wavelength range is 6 μm~ At 40 μm, the ratio relative to air is 3.42, which is determined by Snel's law.

4.Method Principles Infrared incident light, upon contact with the surface of the epitaxial layer, penetrates the epitaxial layer and reaches the substrate, where it is reflected and refracted at the upper and lower interfaces of the epitaxial layer, respectively. The total reflected light is the superposition of these two reflected parts. Due to the wave nature of light, the phases of these two reflected parts may be constructive or interfering. The phase relationship is destructive, while the optical path difference between the two parts depends on the optical path difference. The optical path difference is determined by the epitaxial layer thickness, the optical constants of the epitaxial layer and the substrate, and the wavelet velocity of light. The incident angle of long- and infrared light on the epitaxial layer and the refractive index of the epitaxial layer determine the incident angle. When the optical path difference is an even multiple of half the wavelength, the two sets of reflected light are in phase, resulting in constructive interference, which means that the maximum value of the reflection spectrum is observed. Peak position; conversely, when the optical path difference is an odd multiple of half the wavelength, the two sets of reflected light are out of phase, resulting in destructive interference, i.e., exhibiting a minimum in the reflection spectrum. Value trough position. The interferogram was recorded by the instrument detector and converted into a reflectance spectrum, and the sample reflectance spectrum showed continuous maxima and minima of interference fringes. Spectral phenomena are determined based on the extreme wavenumbers of interference fringes in the reflection spectrum, the optical constants of the epitaxial layer and substrate, and the incident infrared beam on the sample. The thickness of the epitaxial layer can be calculated by using the angle.