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

GB/T 43493.2-2023

**Semiconductor device - Non-destructive recognition criteria of defects
in silicon carbide homoepitaxial wafer for power devices - Part 2: Test
method for defects using optical inspection**

半导体器件 功率器件用碳化硅同质外延片缺陷的无损检测识别判据 第2部分：缺陷的光学检测方法

(English Translation)

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Table of Contents

Introduction
1 Scope
2 Normative references
3 Terms and Definitions
4 Optical detection methods
4.1 General
4.2 Principle
4.3 Testing requirements
4.4 Parameter setting
4.5 Test Step
4.6 Review
4.7 Precision
4.8 Test report
Appendix A (informative) Optical inspection images of defects
A:1 Overview
A:2 Microtubules
A:3 TSD
A:4 TED
A:5 BPD
A:6 Scratch marks
A:7 Stacking fault
A:8 Extended stacking fault
A:9 Compound stacking fault
A:10 Multi-type inclusions
A:11 Particle inclusions
A:12 Step cluster
Reference

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 based on GB/T 43493 "Non-destructive testing and identification criteria for defects in silicon carbide homogeneous epitaxial wafers for power devices of semiconductor devices" part 2: GB/T 43493 has released the following parts:

---Part 1: Defect classification;

---Part 2: Optical detection methods of defects;

---Part 3: Photoluminescence detection method of defects:

This document is equivalent to IEC 63068-2:2019 "Non-destructive testing of defects in silicon carbide homogeneous epitaxial wafers for power devices in semiconductor devices" Identification criteria Part 2: Optical detection methods of defects:

Please note that some content in this document may be subject to patents: The publication structure of this document assumes no responsibility for identifying patents:

This document is jointly developed by the National Semiconductor Equipment and Materials Standardization Technical Committee (SAC/TC203) and the National Semiconductor Equipment and Materials Standards it was jointly proposed and coordinated by the Materials Sub-Technical Committee of the Chemistry Technical Committee (SAC/TC203/SC2):

Introduction

Silicon carbide (SiC), as a semiconductor material, is widely used in new generation power semiconductor devices: Compared with silicon (Si), it has breakdown SiC-based power semiconductors have superior physical properties such as high electric field strength, high thermal conductivity, high saturated electron drift rate and low intrinsic carrier concentration:

Compared with silicon-based devices, bulk devices have faster switching speed, low loss, high blocking voltage and high temperature resistance:

SiC power semiconductor devices have not yet been fully applied, mainly due to issues such as high cost, low yield, and long-term reliability: One of the the serious problem is defects in SiC epitaxial materials: Despite efforts to reduce defects in SiC epitaxial wafers, commercial SiC epitaxial wafers are still There are a certain number of flaws: Therefore, it is necessary to establish an international standard for the quality assessment of SiC homoepitaxial wafers:

GB/T 43493 aims to provide classification and optical detection methods for various defects in 4H-SiC homoepitaxial wafers for high-power semiconductor devices and photoluminescence detection methods: Consists of three parts:

---Part 1: Defect classification: The purpose is to list and provide various types of defects in 4H-SiC homoepitaxial wafers for high-power semiconductor devices:

traps and their typical characteristics:

---Part 2: Optical detection methods of defects: The purpose is to give and provide 4H-SiC homoepitaxial materials for high power semiconductor devices Definition and guidance method for optical inspection of defects in wafers:

---Part 3: Photoluminescence detection method of defects: The purpose is to give and provide 4H-SiC homogeneous materials for high power semiconductor devices Definition and guidance for photoluminescence detection of defects in epitaxial wafers:

Semiconductor device Defects of silicon carbide homoepitaxial wafers for power devices Non-destructive testing identification criteria Part 2: Optical detection methods of defects

1 Scope

This document provides definitions and methods for optical inspection of defects on commercial silicon carbide (SiC) homoepitaxial wafer products: Mainly by giving Examples of optical images of these defects are provided to provide a basis for detection and classification of defects on SiC homoepitaxial wafers:

This document mainly discusses non-destructive characterization methods of defects, so destructive characterization such as wet corrosion is not included in the scope of this document:

2 Normative reference documents

This document has no normative references:

3 Terms and definitions

The following terms and definitions apply to this document:

The address of the terminology database maintained by ISO and IEC for standardization is as follows:

---ISO online browsing platform:availableat<https://www.iso.org/obp> 3.1 optical inspectionopticalinspection Optical imaging is used in optical image sensors to detect the morphology of wafers, and the wafer surface is scanned under non-contact testing methods to obtain Determine the characteristics of the defect, such as its size and shape:

optical imagingopticalimaging Technology that utilizes light source illumination, optical components, optical image sensors, and computer systems to capture, process, and analyze defect images:

lightingillumination Lighting used to observe defects and their surrounding conditions:

Defect information is obtained by observing the reflected light from the wafer surface:

directional lighting Illumination incident on the wafer from a specific direction:

scattered lightdiffusedlighting Illumination incident on the wafer from random directions: