This is a preview - click here to buy the full publication

IEC 63229

Edition 1.0 2021-02

PRE-RELEASE VERSION (FDIS)

Semiconductor devices – Classification of defects in gallium nitride epitaxial film on silicon carbide substrate

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 31.080.99

Warning! Make sure that you obtained this publication from an authorized distributor.

® Registered trademark of the International Electrotechnical Commission

This is a preview - click here to buy the full publication

47/2687/FDIS

FINAL DRAFT INTERNATIONAL STANDARD (FDIS)

PROJECT NUMBER:	
IEC 63229 ED1	
DATE OF CIRCULATION: 2021-02-05	CLOSING DATE FOR VOTING: 2021-03-19
SUPERSEDES DOCUMENTS: 47/2621/CDV, 47/2672/RVC	

IEC TC 47 : SEMICONDUCTOR DEVICES			
SECRETARIAT: Korea, Republic of		SECRETARY: Mr Cheolung Cha	
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 91,TC 104		HORIZONTAL STANDARD: ☐	
FUNCTIONS CONCERNED:			
☐ EMC	☐ ENVIRONMENT	☒ QUALITY ASSURANCE	☐ SAFETY
☐ SUBMITTED FOR CENELEC PARALLEL VOTING		☒ NOT SUBMITTED FOR CENELEC PARALLEL VOTING	

This document is a draft distributed for approval. It may not be referred to as an International Standard until published as such.

In addition to their evaluation as being acceptable for industrial, technological, commercial and user purposes, Final Draft International Standards may on occasion have to be considered in the light of their potential to become standards to which reference may be made in national regulations.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

TITLE:

Semiconductor devices – Classification of defects in gallium nitride epitaxial film on silicon carbide substrate

PROPOSED STABILITY DATE: 2025

NOTE FROM TC/SC OFFICERS:

Copyright © 2021 International Electrotechnical Commission, IEC. All rights reserved. It is permitted to download this electronic file, to make a copy and to print out the content for the sole purpose of preparing National Committee positions. You may not copy or "mirror" the file or printed version of the document, or any part of it, for any other purpose without permission in writing from IEC.

This is a preview - click here to buy the full publication

CONTENTS

FOREWORD 3
INTRODUCTION 5
1 Scope 6
2 Normative references 6
3 Terms and definitions 6
4 Classification of defects 9
4.1 General 9
4.2 Description of the defect classes 9
4.2.1 General 9
4.2.2 Vacancy 9
4.2.3 Interstitial 10
4.2.4 Substitutional defect 11
4.2.5 Point defect complex 12
4.2.6 Threading dislocation 13
4.2.7 Crack 14
4.2.8 Inclusion 15
4.2.9 Hillock 16
4.2.10 Pit 18
4.2.11 Scratch 20
4.2.12 Others 21

Figure 1 – Vacancy 10
Figure 2 – Interstitial 11
Figure 3 – Substitutional defect 12
Figure 4 – Point defect complex 13
Figure 5 – Threading dislocation 14
Figure 6 – Crack 15
Figure 7 – Inclusion 16
Figure 8 – Hillock 18
Figure 9 – Pit 20
Figure 10 – Scratch 21

Table 1 – Classification of defects in GaN epitaxial film on SiC substrate 9

This is a preview - click here to buy the full publication

INTERNATIONAL ELECTROTECHNICAL COMMISSION

____

SEMICONDUCTOR DEVICES – CLASSIFICATION OF DEFECTS IN GALLIUM NITRIDE EPITAXIAL FILM ON SILICON CARBIDE SUBSTRATE

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 63229 has been prepared by IEC technical committee 47: Semiconductor devices. It is an International Standard.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
47/XX/FDIS	47/XX/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This is a preview - click here to buy the full publication

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

This is a preview - click here to buy the full publication

INTRODUCTION

Gallium nitride (GaN) as a representative of the wide band gap semiconductors has outstanding properties, such as wide band gap, high critical electric field, high electron saturation drift velocity, and good resistance to corrosion and radiation. Owing to these properties, GaN can bring significant improvements to electronic devices, such as high-voltage, high-frequency, and high-power, which will be widely used in wireless communication base stations, radars, automotive electronics, aerospace, the nuclear industry, and military electronics.

To date, the development of GaN epitaxial film and related devices is hindered by high cost, low yield, and poor reliability. Among them, the defects in GaN epitaxial film, which closely related to device reliability, are especially serious.

There are various defects found in GaN epitaxial film on silicon carbide (SiC) substrate. In addition, global researchers have not established a uniform definition and classification criterion for defects in GaN epitaxial film yet. Thus, it is essential to establish a set of international standards for GaN epitaxial film on SiC substrate, which will benefit the development of GaN epitaxial film and related devices.

To define and classify defects in GaN epitaxial film on SiC substrate, a new international standard is proposed. The main contents of this document are listing and illustrating the definition and classification of defects in GaN epitaxial film on SiC substrate, providing reference for future GaN-related research and device manufacture.

This is a preview - click here to buy the full publication

SEMICONDUCTOR DEVICES – CLASSIFICATION OF DEFECTS IN GALLIUM NITRIDE EPITAXIAL FILM ON SILICON CARBIDE SUBSTRATE

1 Scope

This International Standard gives guidelines for the definition and classification of defects in GaN epitaxial film grown on SiC substrate. They are identified and described on the basis of examples, mainly by schematic illustrations, optical microscope images, and transmission electron microscope images for these defects. This document covers only defects in as-grown GaN epitaxial film on SiC substrate and does not include defects caused by subsequent processes.

2 Normative references

There are no normative references in this document.