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INTERNATIONAL STANDARD

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

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

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

FDIS	Report on voting
47/2687/FDIS	47/2693/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.

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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.

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

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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.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
Gallium nitride
GaN
compound semiconductor crystal composed of gallium and nitrogen

3.2
substrate
material on which epitaxial layer is deposited

[SOURCE: IEC 63068-1:2019, 3.9, modified – "Homoepitaxial" has been replaced by "epitaxial".]

3.3
Silicon carbide
SiC
semiconductor crystal composed of silicon and carbon, which exhibits a large number of polytypes such as 4H and 6H

Note 1 to entry: A symbol like 4H gives the number of periodic stacking layers (2, 3, 4,...) and the crystal symmetry (H=hexagonal) of each polytype.

[SOURCE: IEC 63068-1:2019, 3.1, modified – Polytype of 3C has been deleted.]