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Semiconductor devices – Part 5-13: Optoelectronic devices – Hydrogen sulphide corrosion test for LED packages

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CONTENTS

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IEC 60747-5-13 has been prepared by subcommittee 47E: Discrete semiconductor devices, of 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
47E/746/FDIS	47E/751/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 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.

A list of all parts in the IEC 60747 series, published under the general title *Semiconductor devices*, can be found on the IEC website.

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- withdrawn,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.

INTRODUCTION

This part of IEC 60747 provides the accelerated test method to assess effects of the tarnishing of silver and silver alloys used for LED packages due to hydrogen sulphide, because sulphide gas (H_2S) tarnishes silver used in LED packages and causes lumen degradation.

There are some existing environmental stress test standards, but they intend to test contacts and connections, not LED lumen degradation. IEC 60068-2-43 provides useful information to assess effects to the contact resistance for contacts and connections due to corrosion of silver and silver alloy. Because the criterion performance in IEC 60068-2-43 is contact resistance, it is not applicable to LED packages to determine effects to the luminous/radiant flux maintenance.

For LEDs, light output should be measured, but there is no such provision in existing standards. Therefore, this document has been drawn up.

This document provides the accelerated test method with mixture gas (H_2S & NO_2) test which has the following merits:

- the test method in this document can reproduce the real failure mode;
- the test method in this document works to reproduce the in-situ linear kinetics;
- the test method in this document can reduce the testing duration.

In all tests, the major criterion of performance will be the change in the luminous/radiant flux and/or electric characteristics (e.g. forward voltage and forward current) caused by sulphide corrosion.

This test may not be suitable as a general corrosion test, i.e. it may not predict the behaviour of flux and/or electric characteristics and connections in industrial atmospheres.

This document also contains an informative Annex A that gives information to predict luminous/radiant flux degradation due to the silver and silver alloy tarnishing in particular conditions from test results.

SEMICONDUCTOR DEVICES –

Part 5-13: Optoelectronic devices – Hydrogen sulphide corrosion test for LED packages

1 Scope

This part of IEC 60747 provides the accelerated test method to assess effects of the tarnishing of silver and silver alloys used for LED packages due to hydrogen sulphide. Particularly, this test method is intended to give information on silver and silver alloy tarnishing effects to the luminous/radiant flux maintenance of LED packages. Additionally, this test method can give information on electric performances of LED packages due to corrosion of silver and silver alloys.

The object of this test is to determine the influence of atmospheres containing hydrogen sulphide on parts of LED packages made of:

- silver or silver alloy;
- silver or silver alloy protected with another layer;
- other metals covered with silver or silver alloy.

Testing other degradations that are susceptible to affect luminous/radiant flux maintenance and/or electric performance (e.g. degradation of copper or silicone parts) is not the object of this test.

This document is applicable to LED packages for lighting applications only if referenced by an IEC SC 34A document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-1*, Environmental testing – Part 1: General and guidance*

IEC 60068-2-60:2015*, Environmental testing – Part 2-60: Tests – Test Ke: Flowing mixed gas corrosion test*

IEC 60747-5-6*, Semiconductor devices – Part 5-6: Optoelectronic devices – Light emitting diodes*

CIE 127*, Measurement of LEDs*