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Semiconductor devices – Micro-electromechanical devices
Part 27: Bond strength test for glass frit bonded structures using micro-chevron-tests (MCT)

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SEMICONDUCTOR DEVICES – MICRO-ELECTROMECHANICAL DEVICES

Part 27: Bond strength test for glass frit bonded structures using micro-chevron-tests (MCT)

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International Standard IEC 62047-27 has been prepared by subcommittee 47F: Microelectromechanical systems, of IEC technical committee 47: Semiconductor devices.

The text of this standard is based on the following documents:

CDV	Report on voting
47F/230A/CDV	47F/259/RVC

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62047 series, published under the general title *Semiconductor devices – Micro-electromechanical 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 "http://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- withdrawn,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.

A bilingual version of this publication may be issued at a later date.

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INTRODUCTION

MEMS devices, e.g. for automotive applications, have to ensure lifecycles of up to 15 years or more. In order to guarantee functionality and reliability of the used interconnection technologies, qualified test methods are required for evaluating the quality and strength of the bonding interfaces. One of the preferred interconnection technologies for MEMS encapsulation is glass frit bonding, using an additional intermediate bond layer.

The micro-chevron-test is an experimental method to determine the fracture toughness of brittle materials or bond interfaces using specifically designed test chips (micro-chevron-samples) under defined load conditions. It was established for characterizing the strength of wafer bonds without additional intermediate bond layers. By analysis of test results from a series of tests at the Fraunhofer Institute for Mechanics of Materials and the Fraunhofer Institute for Electronic Nano Systems with different geometry and layout of the test-probes, the micro-chevron-test was established for the bonding reliability of glass frit bonded devices as well.

SEMICONDUCTOR DEVICES – MICRO-ELECTROMECHANICAL DEVICES

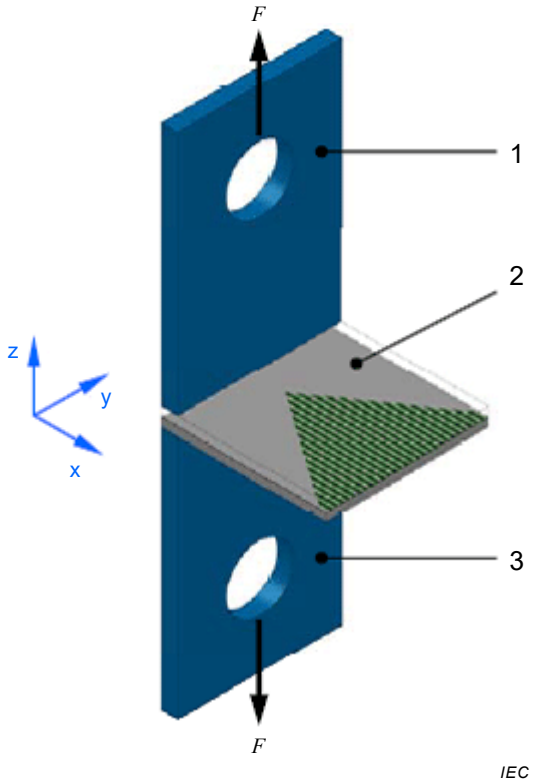
Part 27: Bond strength test for glass frit bonded structures using micro-chevron-tests (MCT)

1 Scope

This part of IEC 62047 specifies a method for assessing the bond strength of glass frit bonded structures using micro-chevron-tests (MCT). It describes suitable sample geometry and provides guidance for the design of deviating sample geometries.

The micro-chevron-test is an experimental method to determine the fracture toughness K_{IC} of brittle materials or bond interfaces using specifically designed test chips (micro-chevron-samples) under defined load conditions (crack opening mode I). Owing to its high precision and low variance, it is suitable for analysing the influence of different process parameters on bond strength as well as for quality assurance.

The exemplary setup of the micro-chevron-test is given in Figure 1.



Key

1 upper glued stud for application of tensile force

2 micro-chevron-test sample with patterned glass-frit-interface

3 lower glued stud for application of tensile force

F applied force

Figure 1 – Test setup of the micro-chevron-test

These operational instructions are applicable for symmetrically glass frit bonded silicon-silicon-stacks, i.e. the joint upper and lower chip of the chevron sample exhibit identical thickness and mechanical properties.

The method is suitable for test samples, which are either produced directly from individual chips in corresponding dimensions, or for integrated samples, which have been singled out from processed wafers using suitable methods.

This document determines preferential dimensions for samples as well as parameters for the test conditions. Deviating geometries can potentially influence the viability of the tests as well as the comparability of the results. On that score, all parameters are determined and documented accurately.

2 Normative references

There are no normative references in this document.