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PEOPLE'S REPUBLIC OF CHINA**

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**Micro-electromechanical system(MEMS) technology -
Four-point bending test method for interfacial adhesion energy
of layered MEMS materials**

微机电系统（MEMS）技术 层状MEMS材料界面黏附能四点弯曲试验方法
(English Translation)

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Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part 1: Structure and drafting rules for standardization documents" Drafting is required.

This document is equivalent to IEC 62047-31:2019 "Semiconductor devices - Microelectromechanical devices - Part 31: Layered MEMS materials interface Four-point bending test method for surface bonding energy.

The following minimal editorial changes were made to this document.

To coordinate with the existing standards, the name of the standard is changed to

"Microelectromechanical Systems (MEMS) Technology - Layered MEMS Material Interface Adhesion Four-point bending test method";

To show the original state of the test piece, Figure 1a) is added as a schematic diagram of the test piece with prefabricated cracks before the test, and a pressure roller is added.

and description of the support rollers.

1 Scope

This paper describes a four-point bending measurement method based on fracture mechanics concepts, using pure bending forces acting on layered MEMS materials.

The critical bending moment of the weakest interface steady-state cracking is used to measure the interface adhesion energy.

This document applies to MEMS devices that deposit thin film layers on semiconductor substrates. The total thickness of the thin film layer should be less than the supporting substrate (usually silicon 1/100 of the thickness of the wafer).

2 Normative references

This document has no normative references.

3.1 Terms and Definitions

The following terms and definitions apply to this document.

3.1.1

Energy release rate

The strain energy per unit surface area released during crack growth.

NOTE: The energy release rate is considered to be the crack driving force and is expressed in joules per square meter (J/m²).

3.1.2

interfacial adhesion energy the energy release rate when the interface crack starts to grow and expands steadily along the interface.

Note: Also known as critical energy release rate, its unit is joule per square meter (J/m²).

3.2 Symbols and names

The shape and symbol of the test piece are shown in Figure 1 and Table 1 respectively. The overall shape of the test piece is similar to a sandwich cantilever beam.

A prefabricated crack or a notch for crack initiation. After crack initiation, the crack extends

along the weakest interface in the layered material system.